ENCYCLOPÆDIA BRITANNICA.

EIGHTH EDITION.

THE

ENCYCLOPÆDIA BRITANNICA,

OR

DICTIONARY

OF

ARTS, SCIENCES, AND GENERAL LITERATURE.

EIGHTH EDITION.

WITH EXTENSIVE IMPROVEMENTS AND ADDITIONS;
AND NUMEROUS ENGRAVINGS.

VOLUME VIII.

ADAM AND CHARLES BLACK, EDINBURGH.
MDCCCLV.

EDINBURGH: PRINTED BY NEILL AND CO.

ENCYCLOPÆDIA BRITANNICA.

DIAMOND.

DIAMOND, *adamas* of the ancients, *almas* of Persia and *heera* of Hindustan, is the most brilliant of gems; and although known from the remotest times, if we may judge by the casual notice made of it in Scripture, it had in the earlier periods of history obtained little more than a name. Pliny states that it bore a price *above all things in the world*, and was known to very few except princes and crowned heads. His meagre remarks on this gem are even less satisfactory than those upon almost any other; which affords another reason to conclude that the diamond still remained in his time an object of great rarity. The localities quoted by Pliny appear to be quite erroneous; at least subsequent observations give us reason to think so.

Up to the commencement of the eighteenth century diamonds were wholly derived from India, where they were found in detached crystals, accompanied with grains of gold, amongst metallic sand washed down from surrounding mountains. In 1728 a similar territory, loaded with the two most valuable substances in nature, was discovered on the southern continent of the New World. When in pursuit of gold, crystals of diamond were often found; but the labourers being ignorant of their value, laid them aside as curiosities. A miner, who is said to have arrived in Brazil at this time, first directed attention towards them; and, without attempting to appropriate his discovery to his own aggrandizement, he led his comrades to turn their pursuit to the more engaging object. It soon, therefore, attracted the notice of the government, and the district was shortly afterwards taken possession of in name of the sovereign.

Hitherto the supply of diamonds was entirely confined to Hindustan and the island of Borneo; and, as might reasonably be expected, the opening of a new field, the extent of which was as yet wholly unknown, could not fail to affect the market. The discredit which was at first thrown upon the accounts from Brazil, as also on the purity and perfection of the stones, repressed the fears of the Asiatic dealers; and the increased demand after the purchase of the Pitt diamond, a circumstance which no doubt rendered that gem far more *recherché* at the gay and luxurious court of France, all tended to increase the demand, and keep it more upon an equilibrium with the increased supply than could possibly have been anticipated. At a subsequent period, no doubt, the revolution of France interfered with the value of jewels; but the surplus thus produced was soon absorbed by the wealth of Britain, and diamonds of the first water for a long time maintained their ground.

At the present day this perhaps cannot be said to hold good. As a commercial commodity, diamonds must have suffered depression like all others, and may, particularly those beyond the smallest sizes, perhaps be valued at from twenty-five to thirty per cent. under the prices which they bore in the times of Tavernier; although Mawe appears to have been anxious to inculcate a different doctrine. After his examination of the Brazilian district, he says there would be no difficulty in calculating the period requisite to work out the whole of the diamond ground in that country; and as many of the mines of Hindustan are considered as exhausted, the period must come sooner or later when diamonds will be no longer to be had.

In India, Golconda has always been cited as one of its principal repositories, although none was ever found in the immediate vicinity of that fortress, a circumstance traceable perhaps to the geological character of the neighbourhood, which is entirely syenitic. It may have arisen, however, from the fact, that the diamond mines of Raolconda and Ganee Purteeal were situated in the territory of the Kootub Shahee kings of Golconda. When that dynasty was overthrown, and their country occupied by the officers of the Mogul emperors, Golconda ceased to be the capital, and Hyderabad, which is only a few miles distant, became the occasional seat of the new government. The territory in which the mines are situated has since been ceded to the East India Company. It lies near Condapilly, on the northern bank of the Kistna, about fifty miles from the sea, and near the Pass of Bezoara, where the river appears at some period to have forced its way through a chain of hills, and to have emptied an extensive lake which had existed to the westward of them. All attempts to work them have been abandoned, as the produce has ceased to refund the expense of labour. The localities of the diamond in Hindustan are so various that it would be almost endless to enumerate them. Those on the Mahanuddy,

with those on the Kistna and at Mallavilly, north-west of Ellora, may be mentioned as probably the most productive of this gem. The island of Borneo is the only other eastern locality which can boast of its production. The diamond occurs at Pontiana, in that island, directly under the line, and at Benjarmassin, about three degrees south of the equator. Here it is said to be of a quality superior to that of the gems found in the other Indian localities; and to be distinguished in consequence by the name of *Landak*, the place where they are found. Here also the diamond occurs in alluvial soil, accompanied with gold. One diamond of 367 carats was found there upwards of a century ago, and is supposed to be now in the hands of the chief of Pontiana.

From Heyne's account of the working of diamond mines in Hindustan, it seems to afford a very miserable livelihood. He states that the diamond has hitherto been found only in alluvial soil, or in the most recent rocks; and that the stones are not scattered through the whole of these beds, but confined to one rather harder than the rest. The upper stratum, of eighteen inches, consists of sand, gravel, and loam; next there is a deposit of stiff black clay or mud, about four feet thick; and next the diamond bed, which is distinguished by a mixture of large rounded stones. It is from two to two and a half feet thick, closely cemented together with clay. Sometimes this stratum is covered with calcareous tufo. Here shallow pits are excavated, of a few feet in diameter, in such spots as the practice of the workman may induce him to select; he sinks to a depth of a few feet, and searches the bed which he considers most promising for his purposes; and if he meets with little encouragement, he shifts his situation and proceeds elsewhere. Thus a great deal of the country may be turned to waste and neglected, and, when it comes to be again wrought over more carefully, may give rise to the absurd fancy of regeneration.

The miners, M. Voysey (*Asiatic Researches*, vol. xv. p. 120) says, are of opinion all over India, that the chips and small rejected pieces of former searchers actually increase in size, and in process of time become large diamonds; and he finishes his paper by hoping that some future mineralogist would ascertain whether there were any foundation for the vulgar opinion of the continual growth of the diamond; particularly as he hoped at some future period to produce undeniable proof of the re-crystallization of amethyst, zeolite, and felspar, in alluvial soil. This ingenious writer did not live to bring forward his proofs; but had he been doomed to arrive at the age of the patriarchs of old, we are of opinion he would have been puzzled to produce them.

In Brazil, the diamond is more confined to one spot than in India. The district of Minas Geraes comprehends, as far as we yet know, the whole of the diamond grounds hitherto discovered in Brazil. There the workings appear to be carried on more systematically than in India. The operations at the Serra do Frio we have already noticed in the article Brazil (vol. v. p. 293). The Serra do Frio, or Cold Mountain, is a mountainous platform, having an elevation of from sixteen to eighteen hundred mètres. The district over which the diamonds are searched for extends about sixteen leagues from north to south, by about eight from east to west. It is situated twelve leagues north of Tějuco, on the river Tigitouhonha, which falls into the river San Francisco. By the decomposition of the granite and mica-slate, an agglomerate is formed, composed of rounded white quartz pebbles and light-coloured sand, to which the natives give the name of cascalaho; and it is in this substance that the diamonds are found, along with gold, which is sometimes crystallized. It is exactly similar to some of the samples of the diamond deposits of Hindustan sent to the Royal Society of Edinburgh by Mr Swinton, but differs considerably from others, where a conglomerated sandstone of considerable tenacity has in several instances been sent, as the matrix of the diamond.

From anything that has hitherto been ascertained, it does not appear that the diamond has ever yet been seen in a matrix which could be esteemed its original position. Heyne has given two coloured engravings of diamonds in the matrix, but they are in all probability only accidentally agglutinated in ferruginous matter, devoid of the character of rock. The Musnuddy, which joins the Mahanuddy, is mentioned as affording an indication which might lead to a favourable result in such an investigation. At its confluence with the Maund River, near Chunderpoor, and not farther down than Sonpoor, and only on the left bank of the river are diamonds found. Hence the Maund is the point at which the examination should commence; and if the country can be effectually penetrated, it would be well worthy the attention of some enterprising mineralogist.

We have few satisfactory geological accounts of any of the diamond countries; a slight sketch by Voysey, in the article above quoted, is the best that we can refer to. He particularly alludes to a range of hills called the Nalla Malla, or Blue Mountains, near Cummum, on the Gunlacummum river, which are composed of schistose rocks, of all varieties, from clay-slate to pure limestone, accompanied with quartz rock, sandstone, sandstone brescia, flinty slate, hornstone slate, and a tuffaceous limestone, containing imbedded, rounded, and angular masses of all these rocks. These are bounded on all sides by granite, which appears to pass under and form the base. The only rock of this formation on which the diamond is found is the sandstone brescia. "I have as yet," says he, "only visited the rich mines of Banaganpilly (lying in Heyne's map Long. 78. 4., Lat. 15. 4.), where the brescia is found under a compact sandstone rock, differing in no respect from that which is found under other parts of the main range. It is composed of a beautiful mixture of red and yellow jasper, quartz, calcedony, and hornstone, cemented together by a quartz paste. It passes into puddingstone, composed of rounded pebbles of quartz, &c., cemented by an argillo-calcareous earth, of a loose friable nature, in which the diamonds are most frequently found."

Heyne states, that in some of the mines in India the diamonds are found entirely broken or crushed, and only of value for pounding; but at the same time thinks it must be owing to carelessness. He mentions also that the diamonds of Cuddapah are carried to Madras to be used for the same purpose, and the price he quotes for a carat of stones fit for brilliants is only seven rupees.

In 1829, a number of small diamonds were discovered in the gold sands of the Ural Mountains, in a deposit very similar to that in Brazil, in a quartzose mica-slate, to which some have given the name of *Itacalumite;* and more lately a few have, it is said, been found in the gold washings of Georgia and N. Carolina, as well as in the Sierra Madre, S.W. of the city of Mexico.

The diamond, in its primitive form, is that of the equilateral octahedron. It passes into the dodecahedron and the cube, presenting modifications in each. The colourless diamond of the first water is the most valuable; but very fine diamonds sometimes present a deep red tinge, also yellow, orange, green, blue, and black. Those which have a slight tint of yellow are often remarkably brilliant, and are said to be of a superior hardness.

The value of diamonds is always calculated by the carat, which consists of four grains; but it must be remembered, that the diamond grain differs from the Troy grain, as it takes five of the former to weigh four of the latter, or more exactly one carat $=$ 3·174 gr. Troy.

In valuing diamonds, either rough or cut, the practice is to take the weight in carats, to square that weight, and then to multiply the product by such a rate of price as may cor-

respond to the state and quality of the stone; thus, if a natural crystal of diamond be clear, without flaws, and of a favourable shape, the price by which the square of its weight should be multiplied is L.2; so that if the stone weigh one carat, its value will be L.2, if two carats, $2 \times 2 = 4$, and $4 \times 2 = 8$, or a stone of two carats is worth L.8. A stone of ten carats, in the same way, will give $10 \times 10 = 100$, and $100 \times 2 =$ L.200, the value of a perfect rough diamond of this weight.

If the diamond has been worked into a brilliant of just proportions, the same rule is observed of squaring the weight in carats; but a much higher price is used as the multiplier of the product, as L.8 is considered to be the proper multiplier when the stone is perfect in water and shape. Thus a diamond of $5\frac{1}{2}$ carats gives $30\frac{1}{4}$ as its square, and this multiplied by 8 makes L.242 as its price. If the stone has been worked into the form which is termed a rose, L.6 is used as the multiplier; and if it be of the form termed table-cut, it is still lower.

Considerable modifications, however, must be made in these multipliers, according to the quality of the diamonds and the state of the market. If a brilliant be what is termed "off colour," that is, not absolutely colourless, or if it be in any other way imperfect in shape or purity, a corresponding diminution must be made in the multiplier. Thus a brilliant with a yellow or milky hue, or with a small speck or flaw, may not be multiplied by more than L.4, L.5, or L.6, according to the nature or extent of the imperfection. The state of the demand in the market must likewise have great influence. At present the demand for good brilliants of one carat and under is greater in proportion to the supply than for heavier stones, and such stones will therefore sometimes cost L.10 the carat; whilst there being fewer purchasers for the larger sizes, they may often be had in commerce at a lower rate than has been mentioned above.

The finest known diamonds are the following:—

That of the crown of France (Pitt diamond), weighing $136\frac{3}{4}$ carats, the value of which, taken according to the above rule, would be L.141,058. The dimensions of this fine stone are stated to be,

Length	1·2437 inches.
Breadth	1·177
Depth	·859

Weight in Troy grains, 434.

That of the Grand Duke of Tuscany (now Austrian) weighing $139\frac{1}{2}$ carats, valued as above at L.153,682.

That of the Emperor of Russia, weighing 195 carats. This diamond is rose cut.

The Koh-i-noor, weighing 186 carats, also rose cut.

That of the King of Portugal, weighing 1680 carats, being rough, not less than L.5,644,800.

It is consequently quite evident that this rule can obtain only among diamonds of moderate size; and, if it should establish something by which a price may be named, all else must be left to subsequent arrangement.

Of the remarkable diamonds we have enumerated, the first is that known by the name of the Regent or Pitt diamond. It was found at Pasteal, in the Golconda district. It was imported into this country by Mr Pitt, governor of Madras, who purchased it from a native for 48,000 pagodas, about L.20,400 at the exchange of the day; and after being offered to different crowned heads in Europe, was purchased by the regent of France in 1717 as a jewel for the crown. It was placed by Napoleon in the hilt of the sword of state, and, according to Brard, the price paid for it was 2,250,000 francs; Jeffreys calls it L.125,000, and other authors say L.130,000. Any of these, however, although by much the largest price ever paid for any jewel, is not equal to the rule of value. This is esteemed the finest and most perfect diamond known.

The second was purchased for a bit of rock-crystal, on a stall in the market-place of Florence, at the cost of a few pence: it is of a beautiful lemon-yellow colour, and is now in possession of the house of Austria. The diamond mentioned as the property of the Emperor of Russia ornaments the top of his sceptre. It is of the size of a pigeon's egg, and is said to have been the eye of an Indian idol pillaged by a deserter from the French service, who had the address to get himself installed as a priest in the service of the Malabar deity at Seringham, as narrated by Dutens. The Empress Catherine purchased it for L.90,000, together with an annuity of L.4000, and a title of Russian nobility.

The Koh-i-noor is described by Tavernier as an irregularly-shaped diamond, but cut and polished. It was found in the district of Golconda previous to the Christian era, and is said to have weighed 900 carats before cutting; but this appears a most enormous sacrifice. Of the Brazilian diamond some suspicions have been entertained. It has been insinuated that it is only a mass of very fine colourless topaz, and it is not likely that the king of Portugal will run the hazard of ascertaining the fact.

The supply of diamonds from Brazil, according to Baron d'Eschwege, during the eighty-four years from 1730 to 1814, was at the rate of 36,000 carats per annum: but the return from the registers of the administration of the diamond mines from 1800 to 1806 was only 19,000 carats. It is also added, that the revenue derived by government during the first period was only eighteen or nineteen francs the carat, whilst from forty to fifty were obtained during the last; a certain indication of a diminished supply. A singular circumstance is noticed with respect to the uniformity of the diamond ground of Do Frio. The same cubic mass of cascalho will yield, on washing, pretty nearly the same number of carats, in large or small diamonds, so that the superintendent can calculate on the probable produce of the washing.

Large stones do not abound in Brazil, but there are some of considerable dimensions. Mawe mentions one of 120 carats from the little rivulet D'Albaite; but they do not often exceed from eighteen to twenty.

The prices of diamonds quoted by Heyne, who visited with a scrutinizing eye the principal mines of Hindustan, differ from those laid down by the rule of Tavernier and Jeffreys. Without attempting to reconcile them, we shall quote the value which the Hindus put upon what they consider as the best, and denominate the Brahma diamond: it is sold by the manjalin, which is equal to two carats, and each carat at the price of ten pagodas.

One manjalin	10 Madras pagodas.
Two	24
Three	40
Four	80
Five	100
Six	150
Seven	250
Eight	400

He adds that these are the prices of stones free from speck, flaw, or crack. Cut stones are valued in a different way.

The most remarkable circumstance in the history of the diamond is to be found in the nature of its composition. This proud, this imperial ornament, which has ever occupied the summit of the diadem, this most brilliant of gems, and hardest of all known bodies, is, after all, but a morsel of charcoal, which has been made to yield to the rays of the sun, and dissolve into a noxious vapour. As early as 1607, Boetius de Boodt threw out the hint that diamond was inflammable. In 1673 Boyle discovered that when it was exposed to a great heat it was dissipated in acrid vapour. In 1694, the experiments of Boyle were confirmed by those of Cosmo III., Grand Duke of Tuscany, with his celebrated burning glass. About the same time, but whether before or not is uncertain, Sir Isaac Newton was led, from the great

refractive power of the diamond, to pronounce it "an unctuous substance coagulated." Lavoisier proved it to be composed of carbon, by throwing the sun's rays concentrated by a powerful lens upon a diamond inclosed in a vessel with oxygen gas; when the diamond and the oxygen disappeared, and carbonic acid was generated. Sir George Mackenzie repeated the experiments of Boyle in 1800; and, finally, when Sir Humphry Davy visited Florence in 1814, the experiment of the grand duke was performed again with the same lens; and mineralogists no longer hesitated to place the gem amongst inflammable bodies.

According to Ellicot, the specific gravity of Brazil diamonds is 3·513, and of India diamonds 3·519. The former is the mean of four, the latter of ten experiments.

Diamond cutting was little understood till 1476, when an artist of the name of Berghem, residing at Bruges, introduced the practice of using diamond powder for forming and polishing the facets. Holland, in consequence, long maintained a monopoly of this trade; and to this day the smaller diamonds are almost entirely manufactured for the European market at Amsterdam. The Pitt diamond was, however, cut and polished in London, as most of the larger sized stones continue to be. It is a very laborious and tedious operation. The grinding into the required form is entirely done by the hand. Two stones are cemented to the ends of tool handles, and rubbed with a powerful pressure against each other, a leaden model being first taken of the rough stone intended to be cut. The faces are thus determined. The two stones are then rubbed together over a little metal box having a double bottom, the upper one being loose and perforated with small holes, through which the diamond dust passes, and is carefully preserved. The desired form being thus obtained, the dust, mixed up with vegetable oil, is afterwards used in polishing the faces of the diamond on a common lapidary's wheel, and the brilliancy of the gem brought out. The period of constant work required to reduce a stone of between twenty-four and thirty carats to a regular form will extend to at least seven or eight months' constant work. The Pitt diamond was said to occupy two years. From the outline in Plate I., there was a great deal of extraneous matter to reduce, and that space of time may very likely have been required. When the mass to be removed is of such a size as to render it of importance to keep it entire, the piece is cut off by means of a steel wire, extended on a bow of cane or whalebone, anointed with diamond powder. This process is very commonly adopted in India. The diamond is sometimes also split by means of a chisel under a sharp stroke of a hammer; but this means requires great firmness of mind and dexterity of hand, for a valuable stone is sometimes destroyed by an unlucky blow.

The forms into which the diamond is cut are the brilliant, the rose, and the table. The first is composed of a principal face, which is called the table, surrounded by a fringe composed of a number of facets, which is all that is visible above the bezil when set. The proportion for the depth should be half the breadth of the stone, terminated with a small face, parallel to the table, and connected with the surface by elongated facets. As the octahedron is the most common natural form of the stone, and the brilliant cut is by far the most advantageous in point of effect, and as this is also generally the most economical form that can be adopted, it is preferred. The others are suggested by the shape of the mass.

The rose is entirely covered with facets on the surface, and is flat below. The table form is adopted in consequence of the shape of the mass, whether crystal or fragment, and produces the least effect. It is principally used in India, where the native jewellers cleave stones into plates, having often a large surface with little proportioned weight or brilliancy, except at the edges, which are ornamented by being cut into facets. The great diamond called the Koh-i-noor is rose cut. This celebrated gem was found, according to Hindu legend, in Southern India, in one of the mines of Golconda, situate near the left bank of the river Krishna. It resembles in shape the half of an egg, and is acknowledged to be of the first water. Its weight is 186 carats; a gravity in reference to which, under the ordinary mode of computation, a pecuniary value may be assigned to it of L.276,768. The fortunes of this magnificent jewel have been for the most part decided by the leading political events which have swayed the destinies of the country of its origin; its possessors having been almost without exception either the rulers or the conquerors of India. At the commencement of the Christian era, it appears to have been the property of the powerful rajah of Oojein, from whom it descended to his successors, the rajahs of Central India. Upon the subversion of the principality of Malwa by the Mohammedans in the early part of the fourteenth century, it became the prize of Ala-ud-din, the Patan sultan of Delhi. Baber, the founder of the Mogul dynasty, obtained the gem with his empire in 1526; and from him it was transmitted through a line of illustrious princes to Mohammed Shah, the great grandson of Aurungzebe. This prince in 1739 surrendered it to Nadir Shah, the Persian invader of India. According to popular tradition, Mohammed wore the diamond in his turban at his interview with Nadir, who, espying the jewel, proposed an exchange of turbans as a token of mutual regard and confidence. Nadir bestowed upon his prize the name of the Koh-i-noor or Mountain of Light. Upon the assassination of this monarch the gem fell into the hands of Ahmed Shah, the founder of the Abdali dynasty of Caubul. From this prince it descended to his successor Shah Shuja, who being expelled from his throne became, in 1813, the nominal guest, but substantially the prisoner of Runjeet Singh, the lion of the Punjaub. Runjeet resolved to set a price upon the liberty of his captive, and demanded from him the Koh-i-noor. After a considerable interval, during which remonstrance and artifice were fruitlessly employed, the Shah yielded a reluctant consent, and a day was fixed for its delivery to a new master. Accordingly on the 1st June Runjeet waited on the Shah with a few attendants, to receive the jewel. He was met by the exiled prince with much dignity, and both being seated, a pause and solemn silence ensued. which continued for nearly an hour. Runjeet then getting impatient, whispered to one of his attendants to remind the Shah of the object of the interview. No answer was returned, but the Shah made a signal to an eunuch who retired and brought in a small packet which he set down on the carpet at equal distance between the chiefs. Runjeet desired an attendant to open the packet, when the diamond was exhibited, and the ruler of the Punjaub retired with his prize. Runjeet was highly elated by the acquisition, and wore it as an armlet at public festivals. After his death it was preserved for a time to his successors, and was occasionally worn by Khurruk Singh and Sheer Singh; but in 1849, upon the abdication of Dhulep Singh, the Maharajah of the Punjaub, and the annexation of his dominions to the British empire, it was stipulated that the Koh-i-noor should be surrendered to the Queen of England. It was accordingly brought to this country by Lieutenant-Colonel Mackeson and Captain Ramsay, who deposited their charge in the hands of the chairman and deputy-chairman of the East India Company, by whom, in company with the president of the India board, the Koh-i-noor was presented to her Majesty on the 3d July 1850. Thus the unrivalled gem for which kings and emperors have contended, finds its resting-place with the sovereign of the most widely extended empire that ever existed—an empire stretching over countries in the east which the previous possessors of the Koh-i-noor never subdued, while in the west it embraces dominions to which, even in imagination, their views never extended.

The Koh-i-noor formed part of the treasures displayed at the Great Exhibition in London in 1851, since which time it has been recut with increased effect.

Much of the value of diamonds depends on the cutting of the stone. A late celebrated philosopher, who required a piece of diamond for philosophical purposes, found a large mass in the hands of a jeweller. It was of an awkward form, and presented a flaw which very greatly deteriorated its value, as, in consequence of the refraction and reflection which took place within the mass, the flaw seemed to occupy nearly the whole of the interior. The gentleman, however, was not afraid. He paid a large sum for the stone, directed the workman in cutting it, amputated the piece he wanted, separating the flaw, and sold the remainder back to the jeweller, after it had been properly cut and polished, for double the price he paid for it.

Hopes at one time were excited that a new diamond district had been discovered in Siberia by Baron Von Humboldt. He thought he had met with appearances in a territory belonging to Count Demidoff, analogous to that of Minas Geraes, and recommended a search for the gem. This has more lately been successful; and about fifty small diamonds have been obtained from the Ural district.

Explanation of the Plate, No. CCIII.—The three figures at the top, Nos. 1, 2, 3, are representations of the Regent or Pitt diamond, the Koh-i-noor, and the Grand Duke, of the full size and form. No. 4 presents the brilliant cut, looked at perpendicularly. No. 5, the same sidewise. Nos. 6 and 7 also represent the brilliant before it undergoes the process of re-cutting. Nos. 8 and 9 are the vertical and lateral appearances of the rose-cut diamond; and Nos. 10 and 11, that of the table-cut. The scale No. 12 exhibits the sizes of the set diamond within the bezil, together with the depth of the stone, and the number of carats a diamond of that size is likely to weigh. This estimate can only be an approximation to the exact weight; but the weight of a set stone may thus be very nearly ascertained. No. 13 is the figure of the octahedral diamond seen perpendicularly, with the table traced where the stone should be cut; and No. 14 is the same crystal, seen laterally, with the table and the opposite face also traced. By these figures it will be seen how much more advantageous it is to adopt the brilliant form than any other.

Diamonds have been imitated with great success by the French artists. To this composition, to which they give the name of *strass*, they not only communicate the adamantine lustre of the zircon, but succeed in giving it such a similitude to the real stone in all respects, hardness excepted, that it is nearly impossible for unpractised eyes to detect the difference. Recently quartz has been used with great effect to form the faces of factitious stones.

Diamond, *used by Glaziers*, an instrument of steel or iron, into the point of which a diamond is introduced and fixed by solder. The diamond must be so adjusted, that by applying the instrument in a particular position the angle of the crystal will come in contact with the glass. See Glass.

Diamond, in *Heraldry*, a term used for expressing the black colour in the achievements of peerage.

Guillim does not approve of blazoning the coats of peers by precious stones instead of metals and colours; but the English practice allows it. Morgan says the diamond is an emblem of fortitude.

Diamond *Harbour*, a port so called, situate on the Hooghly river, about 30 miles below Calcutta. Previous to the relinquishment of commerce by the East India Company, this was the spot where many of their ships unloaded and took in great part of their homeward bound cargoes. There are mooring chains for the accommodation of shipping and storehouses on shore; and in the adjacent villages, consisting of a few thatched houses with some petty shops, provisions may be purchased. But the place is very unhealthy, especially during the periodical rains in July, August, and September, owing to the exhalations from the swamps, and the heavy dews. A good road has been constructed between the harbour and the metropolis; and communication is also maintained between the two places by means of an electric telegraph. Lat. 22. 12.; Long. 88. 10.

Diamond *Island* is situated on the east side of the Bay of Bengal, 12 miles S. of Cape Negrais. It is about a mile and a half long, by one broad; low, covered with wood, and surrounded by shoals, which render it dangerous for boats to land. It has fresh water, and abounds with turtle. It belongs to the British, but is uninhabited. E. Long. 94. 19.; N. Lat. 15. 51.

DIAMPER, a town of Hindustan, province of Cochin, said to be inhabited chiefly by Christians. Here in 1599 a synod was held by the Portuguese archbishop and others, in the hopes of converting the Nestorians to the faith of the Roman Catholic Church, but without effect. N. Lat. 10. 2.; E. Long. 76. 29.

DIANA, in the mythology of Rome, a Latin deity, whose history and office bore so many points of resemblance to those of the Grecian Artemis, that she was latterly identified with that divinity. The worship of Diana, who seems to have been at first rather a local Latin goddess than one of the recognised deities of Rome, is first mentioned as celebrated by the lower classes of citizens in the reign of Servius Tullius. She was at that time regarded as the tutelary goddess of the slaves and plebeians; and her rites were yearly celebrated by these classes of the people on the anniversary of the day on which her temple was consecrated on the Aventine Hill. The name and attributes of Diana were derived from the Sabines, and became known to the Romans when that people was incorporated with the original plebeians of the Roman state. From them the worship of the goddess became gradually diffused among the knights and patricians; and as soon as it was known that a divinity in all respects corresponding to Diana had a high place in the Greek mythology, she was ranked by the Romans among the *dii majorum gentium*, and worshipped with the greatest honours.

As soon as the identity of Artemis and Diana was established, the Grecian myths regarding the birth, history, and functions of the goddess were universally adopted. According to these, Diana was the daughter of Jupiter and Latona, and the twin-sister of Apollo. She was born along with her brother on Mount Cynthus, in the isle of Delos, which up till this time had been a floating island, but was permanently fixed by Neptune in its present place in order that Latona might there find refuge from the persecutions of Juno, and give birth to her children in peace. By the Greeks and Romans Diana was worshipped under a variety of aspects. She was both a destroying and a preserving goddess. In the former capacity she was represented as a full-grown virgin, bearing, like Apollo, a bow and a quiver full of arrows with which she darted death and pestilence among those who offended her; as a preserving deity she watched over the sick, and assisted the unfortunate. Young girls and child-bearing women were believed to be under her especial protection. From this circumstance she was called by the Greeks *Ilithyia*, and by the Latins *Genitalis;* and as she herself was proof against the allurements of love, the priests and priestesses consecrated to her service were compelled to live in the strictest chastity. As Apollo was the god of the sun, Diana was in like manner believed to be the goddess of the moon, from which circumstance she was called by the Greeks *Selene*, and by the Romans *Lucina*. The last and most splendid of all the ceremonies in honour of Diana was the national festival instituted at Rome by Augustus, in compliance with the orders of the Sibylline books, in honour of which Horace composed his famous *Carmen Sæculare*. In this hymn Apollo and Diana are invoked together as the presiding deities of Rome; and the

various offices and functions of both deities, as understood at that time, are minutely described.

In her character as a huntress, Diana is most generally represented in Greek works of art as a tall and handsome virgin, with long hair floating down her neck—drawing an arrow from her quiver with her right hand, and with her left restraining a stag which is endeavouring to escape. As the goddess of the moon she is represented with a long robe reaching to her feet, while her forehead is adorned with the crescent of the moon.

Besides the general homage paid at Greece and Rome to Diana, as one of the dii consentes, there were certain places in which she was worshipped with peculiar rites, and vested with special functions. Of these the most important was Ephesus, where the temple of the goddess was so splendid as to be reckoned one of the wonders of the world. The Ephesian Diana differed considerably from the Greek in the nature of her office. She seems to have typified the reproductive and all-nourishing powers of nature. Hence her image was the figure of a female with many breasts; and the officiating ministers of her temple were eunuchs. Her head was adorned with a mural crown, and the lower part of the figure was covered with hieroglyphic symbols. The worship of Diana is said to have been instituted at Ephesus by the Amazons. Next in importance to the Ephesian was the Taurian Diana. The worship of this goddess was believed to have been at one time accompanied with bloody rites, such as sacrifices of human victims, &c. Her statue was brought from Tauris by Orestes, who on his way back to Sparta landed at Brauron in Attica, from which circumstance the goddess was called *Braurontia.* The image was thence removed to Sparta, where it was placed in an upright position in a temple specially consecrated for its reception; and the deity whom it symbolized was known as Artemis Orthia. It was before this statue that the ceremony of the public scourging of the Spartan youth was observed. (See DIAMASTIGOSIS.) Besides the Ephesian and the Taurian Diana there only remains to be mentioned the Arcadian, who was in an especial manner the patron of hunting and other sylvan sports. She is usually described as frequenting the glades of Taygetus, Mænalus, and the other wild mountains of Arcadia that abounded in game. Twenty nymphs accompanied her in the chase, and with sixty more she celebrated her nightly dances under the bright light of the moon. Her bow and arrows were the workmanship of Vulcan, and her hounds were the gift of Pan. Four stags with golden antlers drew her car. The name of Diana is associated with some of the most beautiful of the ancient myths. See ARTEMIS, ACTÆON, ENDYMION, NIOBE, ORION, &c.

DIANÆ ARBOR, or ARBOR LUNÆ, a name given by the old chemists to the beautiful arborescent form of silver, produced by dissolving it in nitric acid, and precipitating it by another metal.

DIANDRIA, in *Botany*, the second class in the Linnæan system, and comprehending, as its name imports, all genera with flowers possessing but two stamens.

DIANO, a town of Naples, province of Principato Citeriore, situated in a fertile valley at the foot of Mount Motulo, 46 miles S.E. of Salerno. Pop. 4500.

DIAPASON, in *Music*, a name given by the Greeks to the interval of the octave, and so called because the octave embraces all the sounds of the perfect system. It means also the compass of any voice or instrument. Makers of musical instruments have also a rule or scale called *diapason*, by which they regulate the size and the different parts of the instrument to be made. *Diapason* means also a particular stop in the organ.

DIAPENTE, the ancient Greek name for the musical interval of a fifth.

DIAPER, a kind of cloth on which are formed various figures, and which is chiefly used for table-linen.

DIAPHANOUS (διαφαίνω, *I shew through*) an appellation given to all transparent bodies, or such as transmit the rays of light; as glass, &c.

DIAPHONICS (δια and φωνή, the *voice*), the doctrine of refracted sounds.

DIAPHORESIS (διαφόρησις), in *Rhetoric*, is used to express hesitation or uncertainty in the speaker.

DIAPHORETICS (διαφορέω, *I carry through*), such medicines as promote perspiration.

DIAPHRAGM (*Diaphragma*), in *Anatomy*, the midriff, called by anatomists *septum transversum.* It is a strong muscular substance, separating the breast or thorax from the abdomen or lower venter, and serving as a partition between the abdominal and the thoracic viscera. (See ANATOMY, vol. iii., p. 39.) Plato, as Galen informs us, first called it *diaphragm*, from the verb διαφράττειν, *I separate.* Till his time it had been called φρένες, from a notion that an inflammation of this part produced frenzy, which is not more warranted by experience than another tradition, that a transverse section of the diaphragm with a sword causes the patient to die laughing. The term is used analogously to denote something that divides or separates; as, for instance, the plate which divides the cavity of certain shells into two parts, and so forth.

DIARBEKIR, a city of Asiatic Turkey, and capital of the pashalic of Diarbekir, situated on a mass of basaltic rock, which rises in an eminence on the western bank of the Tigris. N. Lat. 37. 55., E. Long. 39. 52. It is about three miles in circumference, of a nearly circular form, and is encompassed by a lofty thick wall of black stone. This wall, which is supposed to be a work of the Romans, is fortified by numerous round and square towers at irregular intervals. The whole is now in a ruinous condition. The town is also environed by a ditch, and has four gates leading to Mardin, to Asia Minor or Rumelia, to the mountains of Armenia and Kurdistan, and to the river. The citadel, standing about midway between the two last-mentioned gates, is thus in the north-east angle of the town, and commands both the valley of the Tigris below, and the town. It is surrounded by a wall, and is divided into many courts. It contains also the palace of the pasha, which is a commodious rather than a splendid building. In one of the stables are the remains of an old Christian building. The citadel is now almost completely in ruins. There is a fine view of the town from this height. The houses are built of black basalt in the lower stories, and of dark-coloured brick in the upper ones. This, with a succession of flat terraces, gives a sameness and gloominess of aspect to the town, which, however, is somewhat relieved by the view of the mosques, towers, and little garden-plots in different parts. Of the mosques seen from the citadel, there are fifteen with minarets, nine having circular shafts and galleries in the Mohammedan style, and the remaining six with square towers, after the manner of Christian churches. There are five other mosques with domes or cupolas only, and several smaller ones, making altogether twenty-five Mohammedan places of worship. Among the minarets of the mosques, some were observed by Mr Buckingham to be highly sculptured; and in several of the square towers were intermixed layers of red burnt brick, mixed with masonry of stone, after the manner of the Roman towers in the walls of Antioch. Amidst the ruins of the castle some fine arches of highly burnt bricks were also observed, which, from their form, as well as material, looked more like Roman than Saracenic work. The bazaars and baths contain brickwork of a similar kind, which Mr Buckingham thinks is decidedly Mohammedan. Broken columns of black marble are seen scattered in different quarters of the town; and among these are several Ionic capitals of Greek origin. Of the Christian churches, the Armenians have two, one of them large and richly decorated, and the other smaller, but more tastefully

adorned. The Catholics have one church, with a convent attached to it; the Syrians and the Greeks have also each a place of worship; and the Jews have a small synagogue for their service. There are upwards of twenty baths in the town, and about fifteen khans or caravanserais. The Khan Hassan Pasha is particularly fine; and in its lower court the corn-market is usually held.

Diarbekir was one of the most flourishing and wealthy cities of Asia, and formerly contained about 40,000 families. It had very extensive manufactures, and an active trade with Baghdad in Indian, and with Aleppo in European produce. The plain was cultivated in every part, and covered with villages; and within three miles of the gates were several villages, each containing from 400 to 500 houses. The number of houses or families in the city are now only about 8000 (of which 1500 are Armenian, 85 Catholic, 70 Greek, 50 Jewish, and 6300 Turkish). The trade with Baghdad is annihilated, and that with Aleppo is reduced to insignificance. There are but few merchants, and those not wealthy; the people have few means of occupation; and not a village remains in the plain. The climate, though excessively hot in summer, cannot be said to be unhealthy; and in winter the temperature is delightful. The situation of Diarbekir admirably adapts it for a great commercial city, and nothing appears necessary to revive its ancient importance but a removal of the causes which have occasioned its decline, namely insecurity to trade from the attacks of the Kurds. The Tigris is not used as a channel of transport so high up as Diarbekir; but rafts of timber are sometimes floated down from the mountains above the town.

From the circumstance of the walls and buildings of this city being constructed almost wholly of black stone, it is called by the Turks Kara Amid, or the Black Amid. Its ancient name was Amida; the name of Diarbekir is used chiefly by the Arabs, as the name of Amid is still used by the Turks in all their public writings. Amida was successively taken, retaken, and destroyed, in the ancient wars between the Persians and Romans. It was pillaged by Tamerlane in the year 1393; and was successively taken and retaken by the Persian kings, until it was conquered by Selim, the first sultan of the Osmanli Turks, in the year 1515. In 1605 it again fell under the power of Persia; but it was afterwards retaken by the Turks, under whose dominion it has since continued.

DIARTHROSIS, in *Anatomy*, a kind of articulation or juncture of the bones which affords room for a manifest motion. The word comes from διa, and ἄρθρον, *a joint*. It is opposed to *synarthrosis*, in which the articulation admits of no sensible motion.

DIARY (Lat. *diarium*, from *dies* a *day*), a journal or register of daily occurrences or observations.

DIASCHISMA, in *Music*, an interval equal to the half of a minor semitone, according to Boëthius.

DIASIA, in *Antiquity*, a great festival celebrated at Athens, immediately beyond the walls, in honour of Zeus (Jupiter). It took place towards the end of the month Anthesterion (February), and was accompanied by a great fair. All persons brought offerings, which consisted either of victims or of incense, according to the means of each individual.

DIASTASE. See Brewing, vol. v. p. 320; and Chemistry.

DIASTEMA, the name given by the Greeks to a simple musical interval, as distinguished from a compound one.

DIASTOLE, the dilatation of the heart, auricles, and arteries: opposed to *systole*, or contraction. See Anatomy.

Diastole, in *Grammar*, the extension of a syllable; or a figure by which a syllable naturally short is made long.

DIASTYLE. See Glossary to Architecture.

DIASYRMUS, in *Rhetoric*, a kind of hyperbole, being exaggeration of something that is low and ridiculous.

DIATESSARON, the Greek name for the musical interval of a fourth.

DIATHERMOUS, a term applied to such substances as suffer radiant heat to pass through them; such as transparent pieces of rock-salt, &c.

DIATHESIS, in *Medicine*, any particular state of constitution which predisposes to disease. Hence the terms inflammatory, putrid, gouty, diathesis, &c.

DIATONIC, in *Music*. See Music.

DIAZ, Bartolomeo, a Portuguese navigator, placed in 1486 at the head of a small squadron fitted out by John II., to make discoveries on the east coast of Africa. He sailed round the south point of that continent, to which he gave the name of *Cabo Tormentoso*, but was compelled to return on account of a mutiny on board his ships. The king altered the name of the cape to its present appellation, viz., the Cape of Good Hope. In 1500 Diaz sailed with Cabral to the West Indies.

DIBBLE, a pointed instrument used to make holes for planting young trees, slips, and seeds.

DIBDIN, Charles, a well-known writer of songs and musical composer, was born at Southampton in 1745, and was the youngest of a family of eighteen. His parents designing him for the church, he was sent to Winchester; but his love of music early diverted his thoughts from the clerical profession. After receiving some instruction from Kent, the organist of Winchester Cathedral, he went to London. His first dramatic pieces appeared on the stage of the Covent Garden Theatre, and in 1778 he became musical manager in that establishment. At this period his success on the stage was far from being commensurate with his ability as a composer. A series of mono-dramatic entertainments which he gave at his *Sans Souci*, brought his songs, music, and recitations more prominently into notice, and permanently established his fame as a lyric poet. On retiring from public life in 1805, he was rewarded by government with a pension of L.200 a-year, of which he was only for a time deprived under the administration of Lord Grenville. Dibdin died of paralysis in 1814. Besides his *Musical Tour*, his *Professional Life*, a *History of the Stage*, and several smaller works, he wrote upwards of 1400 songs and about 30 dramatical pieces.

Dibdin, *Thomas Frognall*, D.D., nephew of the preceding, a celebrated philologer and antiquarian, was born at Calcutta in 1775. He received his education at St John's College, Oxford, and afterwards entered on the study of law under Basil Montague. Abandoning the legal for the clerical profession, he took orders in 1804; and while holding various lectureships in the metropolis, he devoted himself with great ardour to literary pursuits. In 1824 he was appointed to the rectory of St Mary's, Bryanstone Square, an appointment which he held till his death in 1847. Dibdin's works are exceedingly voluminous. The most important are the *Bibliomania*, the *Biographical Decameron*, the *Biographical Antiquarian and Picturesque Tour*, *Reminiscences of a Literary Life*, and *Bibliotheca Spenseriana*.

DICASTES, in *Antiquity*, a judge, or rather a juror, at Athens.

DICE (plural of *die*), cubical pieces of bone or ivory, marked with dots on each of their faces, from one to six. They are used in various games of chance, by being thrown from a box.

DICÆARCHUS, a celebrated Peripatetic philosopher, historian, and geographer, was a native of Messana in Sicily. He was the contemporary of Theophrastus and Aristotle, and flourished towards the close of the fourth century B. C. The exact dates of his birth and death are unknown: the time of the latter event is approximately fixed by good authorities as the year 285 B. C. Nothing is known with certainty concerning the life of Dicæarchus except that he was a disciple of Aristotle, and a friend of Theophrastus, to

whom he dedicated the majority of his works. Of his writings, which comprised treatises on a great variety of subjects, none have descended to our day. Nothing but their titles and a few fragments survive. The most important of them was his *Life in Greece*, in which the moral, political, and social condition of the people was very fully discussed. Among the philosophical works of Dicæarchus may be mentioned the *Lesbiaci* in three books, in which the author endeavours to prove that the soul is mortal. This work is written in the form of a dialogue, and derived its name from the fact that the scene of the dialogue was laid at Lesbos. To it the author afterwards appended a supplement, likewise in three books, which he called *Corinthiaci.* The only complete edition of the fragments of Dicæarchus is that published at Darmstadt in 1841 by Max. Fuhr. An excellent dissertation on them will be found in Osann.

DICHOTOMY (διχοτομια, a division into two parts), in *Astronomy*, that phase of the moon in which it is bisected, or shows only half its disk. In this situation the moon is said to be in a quadrate aspect, or in its quadrature. The term is also used in botany to express a mode of branching by repeated bifurcation, as exemplified in the leaves of ferns.

DICOTYLEDONOUS, in *Botany*, a term applied to plants whose seeds have two lobes or cotyledons.

DICKER (probably from δεκα, *ten*), in our old writers, is used to denote the number or quantity of ten, particularly ten hides or skins, of which twenty made a last; and is sometimes applied to other things, as a dicker of gloves or ten pairs, a dicker of iron or ten bars, &c.

DICKINSON, Edmund (1624–1707), an English physician and chemist, was born at Appleby, Berkshire. He took his degrees at Merton College, Oxford; and in 1655 published his *Delphi Phœnicizantes*, a learned work, in which he attempted to prove that the Greeks borrowed the story of the Pythian Apollo, and all the legends with which the Delphic oracle was associated, from the Holy Scriptures. After practising at Oxford, Dickinson removed in 1684 to London, where he was appointed physician in ordinary to Charles II.; an office which he also held under James II. Dickinson was the author of a work entitled *Physica vetus et vera*, in which he endeavoured to construct a system of philosophy on principles collected from the Mosaic history.

DICTATOR, in *Antiquity*, the highest extraordinary magistrate of the Roman republic. The original name of this office was *magister populi*, by which appellation he was called in the sacred books down to the latest times of the commonwealth.

When the republican form of government was established at Rome, and the supreme executive vested in the two consuls, emergencies sometimes occurred in which it seemed that the safety of the state might advantageously be intrusted for the time to some one man, whose past life had gained for him the esteem and respect of the whole body of the citizens. The idea of this office was borrowed by the Romans from the constitution of some of the Latin towns which they had subdued. It lay with the senate to decide when the services of a dictator were necessary. The power of nominating a man to the office was by that body made over to one of the consuls. It is not exactly determined to which of these offices the nomination of a dictator properly appertained. Sometimes it was the consul who happened to have the fasces at the time; sometimes it was he who happened to be nearest the city; at other times the consuls themselves either drew lots or came to an agreement as to which of them should perform the duty. In any case the nomination of the consul was indispensable; and so important was it considered, that on one occasion when both the consuls refused to name a person for the dictatorship, the senate had recourse to the tribunes of the people, to whose influence the consuls were obliged to give way. On another occasion, when it was found impossible to communicate with the surviving consul, after the battle of the Thrasymenus, the senate and people were compelled to provide for the crisis by electing a pro-dictator.

As soon as the consul had fixed upon a properly qualified person, he took the auspices with much solemnity, and immediately afterwards issued his proclamation in due form. This latter ceremony required always to be performed some time between midnight and morning. As soon as the dictator was nominated, the *imperium* was conferred upon him, and the duties of his office were defined by a *lex curiata.* The insignia of his office were also immediately placed at his disposal. These were—first, the lictors, twenty-four in number, who bore the fasces and secures; second, the curule chair; and third, the toga prætexta.

The first dictator was appointed at Rome B.C. 501, nine years after the expulsion of the Tarquins. Who the first dictator was, is differently stated by different historians; but it is most probable that T. Lartius was the man, and that his nomination was rendered necessary by the prospect of a formidable war with the allied Latin states.

Dictators appointed, as T. Lartius was, to manage the foreign relations of the state, were said to be chosen *rei gerundæ causâ*, or *seditiones sedandæ causâ*; but it often happened that in matters of less importance than a foreign war, a dictator was appointed with nominal authority. This officer was generally selected in the absence of the consuls to perform some small ceremonies, which in strict propriety could only be gone through by one of the consuls. Thus a dictator was sometimes chosen to hold the comitia, to appoint holidays, to affix the *clavus annalis* in the temple of Jupiter, and to preside at trials.

As soon as the dictator was appointed, he was required to select a master of the horse (*magister equitum*), whose term of office was the same as his own. Should the master of horse die before the lapse of six months, it was necessary to appoint a successor. Like the dictator, to whom he was subject in all things, he received his commission by a *lex curiata*. In the absence of his principal, he was entitled to act independently, though he was always held responsible for any mismanagement that might occur under his command.

The power of the dictator was absolute; and so long as he remained in office no appeal was open against his mandates to any other authority in the state. He was nearly altogether independent of the senate. He could inflict much severer punishments than the consul without being liable, as these officers were, to have his sentence reversed by the assembly of the people. His power was as irresponsible as it was absolute. It is stated by Festus that an appeal could be made against the decrees of the dictator. This, however, seems to be a mistake on the part of that historian, for, in the only case which ever occurred to test that principle, the dictator (L. Papirius) denounced the appeal as incompetent to his accusers, from the tenure by which he held his office. In token of the absolute power of the dictators over the lives of their fellow-citizens, their lictors bore the axe in the midst of the fasces, even in their walks through the city—a mark of distinction which the consuls had formerly enjoyed, but which had been abolished in their case by the Valerian law.

Though the power of the dictators was thus great, it was, nevertheless, limited by certain indirect restrictions. The most important of these was, that the dictator had no control whatever over the public money, and had to content himself with such sums as were allowed him by the senate. He was not allowed to leave Italy; and could not appear on horseback in the city without the express permission of the people. The surest safeguard, however, against any treacherous designs on the part of the dictator was the shortness of the period during which he remained

 in office. This was never permitted to exceed six months: and if the crisis which had called for the election of a dictator passed over before the expiry of that period, it was expected that he would immediately resign.

When a dictator was appointed, all the ordinary magistrates ceased to be directly responsible to the governing authorities of the state, and took their orders directly from him. The only magistrates exempt from this necessity were the tribunes of the commons. The inferior officers, however, did not, as has been supposed, retire from office altogether. They merely obeyed the dictator so long as he continued in power, and on his resignation entered once more upon the untrammelled exercise of their authority.

It remains to be added that dictators were only appointed at Rome so long as Italy remained unsubdued. The last dictator appointed at Rome held office in B.C. 202: from that time the constitutional dictatorship disappears from Roman history.

DICTIONARY, in its original acceptation, is the arranging of all the words of a language according to the order of the alphabet, and annexing a definition or explanation to each word. When arts and sciences began to be improved and extended, the multiplicity of technical terms rendered it necessary to compile dictionaries, either of science in general, or of particular sciences, according to the views of the compiler.

DICTIONARY *of the English Language.* The design of every dictionary of language is to explain, in the most accurate manner, the meaning of every word; and to show the various ways in which it can be combined with others, in as far as this tends to alter or modify its meaning. The dictionary which does this in the most accurate manner is the most complete work of the kind; therefore the principal study of a lexicographer ought to be to discover the method which may seem best adapted for that purpose. Dr Johnson, with great labour, has collected the various meanings of every word, and quoted the authorities; but it would have been an improvement if he had given an accurate definition of the precise meaning of every word; pointed out the way in which it ought to be employed with the greatest propriety; showed the various deviations from the original meaning, which custom had so far established as to render allowable; and fixed the precise limits beyond which it could not be employed without becoming a vicious expression. With this view it would have been necessary to exhibit the nice distinctions which take place between words nearly synonymous, and without which many words can only be defined in such a manner that they must be considered as exactly synonymous. We omit making any quotations from Johnson in order to point out these defects; and shall content ourselves with giving a few examples, to show in what manner, according to our idea, a dictionary of the English language ought to be compiled.

IMMEDIATELY, *adv. of time.*

1. Instantly, without delay. Always employed to denote future time, and never past. Thus we may say, *I will come immediately;* but not *I am immediately come from such a place.* See PRESENTLY.
2. Without the intervention of any cause or event; as opposed to *mediately.*

PRESENTLY, *adv. of time.*

1. Instantly, without delay. Exactly synonymous with *immediately;* being never with propriety employed to denote any thing but future time.
2. Formerly it was employed to express present time. Thus, *The house presently possessed by such a one,* was often used, but this has now become a vicious expression; and we ought to say, *The house possessed at present.* It differs from *immediately* in this, that even in the most corrupt phrases it never can denote past time.

FORM, *subst.* The external appearance of any object, when considered only with reference to shape or figure. This term, therefore, in the literal sense, can only be applied to the objects of sight and touch, and is therefore nearly synonymous with *figure;* but these terms differ in some respects. *Form* may be employed to denote more rude and unfinished shapes; *figure,* those which are more perfect and regular. *Form* can never be employed without denoting matter, whereas *figure* may be employed in the abstract: thus we say a square or a triangular *figure,* but not a square or triangular *form.* And in the same manner we say the *figure* of a house; but we must denote the substance which forms that figure if we use the word *form;* as, *a cloud of the form of a house.* See FIGURE.

2. In contrast to irregularity or confusion. As beauty cannot exist without order, it is by a figure of speech employed to denote beauty, order, and the like.
3. As *form* respects only the external appearance of bodies, without regard to their internal qualities, it is, by a figure of speech, employed in contrast to these qualities to denote empty show, without essential qualities. In this sense it is often taken when applied to religious ceremonies, pageantry, and so forth.
4. As *form* is employed to denote the external appearance of bodies, so, in a figurative sense, it is applied to reasoning, denoting the particular mode or manner in which this is conducted; as, *the form of a syllogism,* &c.
5. In the same manner it is employed to denote the particular mode of procedure established in courts of law; as, *the forms of law, religion,* and the like.
6. *Form* is sometimes, although improperly, used to denote the different circumstances of the same body; as, *water in a fluid or a solid form.* But as this phrase regards the internal qualities rather than the external figure, it is improper, and ought to be, *water in a fluid or a solid state.*
7. But when bodies of different kinds are compared with one another, this term may be employed to denote other circumstances than shape or figure; for we may say, *a juice exuding from a tree in the form of wax or resin;* although, in this case, the consistence, colour, &c. and not the external arrangement of parts, constitutes the resemblance.
8. From the regular appearance of a number of persons arranged in one long seat, such persons so arranged are sometimes called a *form;* as, *a form of students,* &c. And,
9. By an easy transition the seat itself has also acquired that name.

GREAT, *adj.* A relative word, denoting largeness of quantity, number, &c., serving to augment the value of those terms with which it is combined, and opposed to *small* or *little.* The principal circumstances in which this word can be employed are the following:

1. When merely inanimate objects are considered with regard to quantity, *great* is with propriety employed to denote that the quantity is considerable: as, *a great mountain, great house,* and the like; and it is here contrasted with *small.* When *great* is thus employed, we have no other word which is exactly synonymous.
2. When inanimate objects are considered with regard to their extent, this term is sometimes employed, although with less propriety; as, *a great plain, a great*

field, and the like. In this sense it is nearly synonymous with *large;* and these terms were often used indiscriminately, but with some difference of meaning; for, as *large* is a term chiefly employed to denote extent of superficies, and as *great* more particularly regards the quantity of matter, therefore, when *large* is applied to any object which is not merely superficial, it denotes that it is the extent of surface which is there meant to be considered, without regard to the other dimensions; whereas, when the term *great* is employed, it has reference to the whole contents. If, therefore, we say *a large house*, or *a large river*, we express that the house, or the river, has a surface of great extent, without having any necessary connexion with the size in other respects. But if we say *a great house*, or *a great river*, it at once denotes that these objects have not only a large surface, but are also of great size in every respect.

3. *Great*, when applied to the human species, never denotes the size or largeness of body, but is applied solely to the qualities of the mind. Thus when we say that *Socrates was a great man*, we do not mean that he was a man of great size, but that he was a man who excelled in the endowments of the mind. The terms which denote largeness of size in the human body are *big, bulky, huge.*

4. *Great* is sometimes applied to the human species, as denoting high rank. In this case it is oftener used in the plural number than otherwise. Thus we say simply *the great*, meaning the whole body of men in high station, as opposed to the *mean*. It should seldom be employed in this sense, as it tends to confound dignity of rank with elevation of mind.

5. As this is a general term of augmentation, it may be joined with all nouns which denote *quantity, quality, number, excellence*, or *defects;* or such as imply *praise, blame, anger, contempt*, or any other affection of the mind.

6. It is employed to denote every step of ascending or descending consanguinity, as *great-grandfather, great-grandson*, and so on.

High, *adj.* Exalted in a perpendicular direction at a distance from the surface of the earth, and opposed to *low.*

1. *High* is a term altogether indefinite, and is employed to express the degree of elevation of any inanimate body. Thus we say *a high mountain, a high house, steeple, tower, pillar*, and the like. Nor is there any other word which can here be considered as synonymous; *lofty* being employed only to denote a very eminent degree of elevation.

2. To express the perpendicular elevation of vegetables either *high* or *tall* may be employed, as being in this case nearly synonymous. We may therefore say a *high* or *tall tree*, a *high* or *tall mast*, and so forth, but with this difference between these two expressions, that *tall* can be more properly applied to those which are much elevated and of small dimensions; and *high*, to such as are more bulky and of greater size.

3. The perpendicular height of man can never be expressed by the word *high, tall* being here the proper expression. And although *high* is sometimes used to express the height of other animals, yet it seems to be an improper expression. See Tall.

4. *High*, when applied to the human species, always refers to the mind, and denotes *haughtiness, stateliness, pride*, and when combined with expressions indicating energy of mind, it denotes that in a higher degree. In this sense it is opposed to *meanness, abjectness*, and *humility.*

5. As this is an indefinite term, tending to denote any thing which is elevated above us, it may be combined with almost every noun which admits of this elevation. Hence, as objects high above us are always out of our reach, it is in a metaphorical sense used to denote any thing which seems to be above the ordinary condition of mankind, or those qualities or endowments of mind which are not easily acquired; as, *dignity* or *elevation of sentiment, dignity of rank, acuteness in reasoning on difficult subjects, pride, haughtiness*, or any other quality which seems beyond the ordinary level of mankind; *dearness of price.*

6. In the same manner we apply this term to time, which having a metaphorical resemblance to a river flowing on with an unceasing current through all successive ages, any thing of remote antiquity is denoted by the term *high.*

7. Likewise to those degrees of latitude far removed from the line, where the pole becomes more elevated.

8. And also to some particular crimes, as being attended with peculiar degrees of guilt, as *high treason.*

Tall, *adj.*, signifies elevated to a considerable degree in a perpendicular direction: opposed to *low.*

1. This term is chiefly employed to express the height of man and other animals; and is applied to denote the height of the body only, without having any reference to the mind. When applied to man, no other word can be substituted in its stead; when applied to other animals, *high* is sometimes considered as nearly synonymous. See High.

2. It is likewise employed to denote the perpendicular height of vegetables, and in this case it is nearly synonymous with *high.* See High.

3. It can in no case be employed to express the height of merely inanimate objects, as we can never say a *tall steeple, tower*, or *pillar*, but a *high steeple*, &c. For the distinctions in these cases, see High.

Long, *adj.* A relative term, denoting the distance between the extremes of any body which is extended more in one of its geometrical dimensions than in another. It is opposed to *short.*

1. This term may be applied to all inanimate objects, of whatever kind, whose dimensions in one way exceed their dimensions in the other, and when not in an erect posture, whatever be the other circumstances attending them, whether it relates to superficies alone or to solid bodies, whether these be bounded or open, straight or crooked, flexible or rigid, or in any other circumstances whatever: thus we say *a long* or *short line, a long* or *short ridge, street, ditch, rope, chain, staff*, and the like. But it is to be observed, that although *long* is in the strict sense only opposed to *short*, yet as it expresses the extension of matter in one of its geometrical proportions, it is often contrasted by those words which express the other proportions when we mean only to describe the several proportions; as, *a table long and broad.* And as these several dimensions are expressed by different words, according to the various forms, modifications, and circumstances in which bodies are found, therefore it is in this sense contrasted by a great diversity of terms; as, *a long and broad* or *wide, narrow* or *strait, street* or *lane; a long and thick* or *small rope, chain, staff.* For the distinctions in these cases see Broad, Wide, &c.

2. Objects necessarily fixed in an erect position can never have this term applied to them, and therefore we cannot say *a long*, but a *high tower* or *steeple.* And for the same reason, while trees are growing and fixed in an erect position, we cannot apply this term to them; but when they are felled and laid upon the

ground, it is quite proper and necessary. Thus we do not say *a long*, but *a tall* or *high tree*, while it is growing; but we say *a long*, not *a tall log of wood;* and in the same manner we say *a tall mast* when it is fixed in the ship, but *a long mast* while it lies upon the beach. See TALL and HIGH.

3. Those vegetables which are of a tender, pliant nature, or so weak as not to be able to retain a fixed position, being considered as of a middle nature between erect and prostrate bodies, admit of either the terms *long, tall*, or *high;* as, *a long* or *tall rush* or *willow wand*, or *a long, tall*, or *high stalk of corn*. See HIGH and TALL.

4. The parts of vegetables, when considered as distinct from the whole, even when growing and erect, assume the term *long;* for we do not say *a tall*, but *a long shoot of a tree*, and *a tree with a long stem*, in preference to *a tree with a high stem*.

5. For the same reason, a staff and pole, even when fixed in a perpendicular direction, assume the word *long*, in preference to *tall* or *high*.

6. With regard to animals, the general rule is applied, without any exceptions; *tall*, and not *long*, being employed to denote the height of the human body when in an erect posture; and *long*, and not *tall*, to denote its length when in an incumbent situation. *Long* applied to all other animals which do not walk erect, always denotes their greatest length in a horizontal position from head to tail.

7. In a figurative sense, it denotes, with regard to time, any thing at a great distance from us.

8 As also, any thing that takes up much time before it is finished, as, *a long discourse, a protracted note in music*, and the like.

BROAD, *adj.*, denotes distance between the two nearest sides of a body whose geometrical dimensions are larger in one direction than in another. It has a reference to superficies only, and never to the solid contents, and is opposed to *narrow*.

1. *Broad*, in the strictest acceptation, is applied to denote those bodies only whose sides are altogether open and unconfined; as, *a broad table, a broad wheel*, &c. and in these cases it is invariably contrasted with *narrow;* nor is there any other word which in these cases can be considered as synonymous with it, or be used in its stead.

2. When any object is in some sort bounded on the sides, although not quite closed up, as a road, street, ditch, and the like, either *broad* or *wide* may be employed, but with some difference of signification; *broad* being most properly used for those which are more open, and *wide* for those which are more confined: nor can this term be ever applied to such objects as are closely bounded all around, as a house, a church, and the like, *wide* being here employed. For the more accurate distinctions in these cases see the article WIDE.

WIDE, *adj.* A term employed to denote relative extent in certain circumstances, and opposed to *narrow* and *strait*.

1. This term is in its proper sense applied only to denote the space contained within any body closed all round and on every side; as, a house, gate, or the like; and it differs from *broad* in this, that it never relates to the superficies of solid objects, but is employed to express the capaciousness of any body which contains vacant space; nor can capaciousness in this sense be expressed by any other word but *wide*.

2. As many bodies may be considered either with respect to their capaciousness or superficial extent, in all these cases either the term *broad* or *wide* may be used; as, *a broad* or *wide street* or *ditch*, &c.; but with a greater or less degree of propriety, according to the circumstances of the object, or the idea which we wish to convey. In a street where the houses are low and the boundaries open, or in a ditch of small depth and large superficies, as this largeness of superficies bears the principal proportion, *broad* would be more proper; but if the houses are of great height, or the ditch of great depth, and capaciousness is the principal property which affects the mind, we would naturally say *a wide street* or *ditch;* and the same may be said of all similar cases. But there are some cases in which both these terms are applied, with a greater difference of meaning; thus we say *a broad* or *a wide gate*. As the gate, however, is employed to denote either the aperture in the wall, or the matter which closes that aperture, these terms are each of them used to denote that particular quality to which they are generally applied; and as the opening itself can never be considered as a superficies, the term *wide*, in this case, denotes the distance between the sides of the aperture; whilst, on the contrary, *broad* denotes the extent of matter fitted to close that aperture; nor can these two terms be in any case substituted for one another.

3. As a figurative expression, it is used as a cant phrase for a mistake; as, *you are wide of the mark;* that is, not near the truth.

NARROW, *adj.* A relative term, denoting a proportional smallness of distance between the sides of the superficies of plain bodies, and opposed to *broad*.

1. As this is only applied to superficies, it is exactly contrasted by *broad*, and is applied in all cases where the term *broad* can be used (see BROAD); and in no other case but as a contrast to it, excepting the following.

2. It sometimes is employed to describe the smallness of space circumscribed between certain boundaries, as opposed to *wide*, and nearly synonymous with *straight;* thus we say *a wide* or *a narrow house, church*, and the like. For the necessary distinctions here, see the article STRAIT.

3. In a figurative sense it denotes *parsimony, poverty, confined sentiments*, and so forth.

STRAIT, *adj.* A relative term, denoting the extent of space in certain circumstances, and opposed to *wide*. See WIDE.

1. This term is employed, in its proper sense, to denote only space, as contained between surrounding bodies in such circumstances as to denote some degree of confinement, and is exactly opposed to *wide;* as, *a wide* or *a strait gate*, &c. See WIDE.

2. So necessary is it that the idea of confinement should be connected with this word, that in all those cases where the space contained is large, as in a church or house, we cannot express a smaller proportional width by this term. And as we have no other word to express space in these circumstances, we are obliged to force the word *narrow* from its natural signification, and make it express this. See NARROW.

3. In some particular cases, *narrow* or *strait* may be applied to the same object; as, *a narrow* or *a strait line;* but here *strait* is never employed except where an idea of confinement is suggested, and where it is exactly contrasted to *wide;* nor can *narrow* be employed except in such circumstances where *broad* would be a perfect contrast to it. Therefore these two terms may be always used in the same circumstances as those which contrast with them. For an account of these see WIDE.

4. The term *strait* is likewise in a peculiar manner used to denote the smallness of the internal diameter of those bodies which are fitted to receive or contain others, as any kind of bag, tube, body clothes, mortises, and others of the same kind; and in all these cases this term may be employed to denote the smallness of their lesser diameter, and never the term *narrow*. But in certain circumstances the word *tight* may be substituted for it. See TIGHT.

5. *Strait*, in a figurative sense, denotes any sort of confinement of sentiment or disposition.

TIGHT, *adj.* A term employed in certain circumstances to denote the internal capacity of particular bodies, and nearly synonymous with *strait*.

This term is confined entirely to denote the smallness of the internal dimensions of such objects as are formed to cover, or to receive or contain, other solid bodies, and can be employed in no other case. And although it agrees with *strait*, in always denoting confinement, and by being applicable to the same species of objects, yet it differs in the following respects: 1. If there be any difference of the diameter of the objects to which the term *strait* can be applied, it has always reference to the smaller; yet *tight* may be applied to any sort of confinement, whether it regards the length or breadth. 2. *Strait* can be applied to all bodies of capacity when of small diameter, without any sort of reference to the nature of the substance which it may be capable of containing. For we can say *a strait bag, a strait sleeve, a strait mortise, a strait gate*, and so on, whereas *tight* can only be applied to any body when it is considered as having reference to another body which is intended to be contained in it, and is pinched from want of room. Thus we say *the sleeve of a coat is too tight for the arm, the mortise is too tight for the tenon*, and so forth; but we cannot say *the bag* or *the gate is too tight*, because they are fitted to receive any sort of objects. And hence it happens that in many cases the dimensions of the same body may be expressed by *tight* or *strait*, when considered in different circumstances. Thus we may say, *this sleeve is too strait*, when we look at a coat lying on the table and consider its proportions; but it is not till we have tried it upon the arm which it is intended to cover, that we call it *tight*. And we may say, *a gate is too strait* or *too tight;* but in the first case we consider it as being too confined for admitting objects to pass through it; and in the next, as being too confined with respect to the "leaves" which are to shut the aperture not allowing them space to move with freedom.

These examples may serve to give some idea of the plan of an English dictionary composed upon philosophical principles. But, besides the circumstances above enumerated, there are many others which would require particular attention in the execution of a work of this kind. In the English language a great variety of terms occur which denote matter under certain general forms or circumstances, without regarding the minute diversities that may take place; as the word *cloth*, which denotes matter as manufactured into a particular form, including under it all the variety of stuffs manufactured in that particular way, of whatever materials, colour, texture, or fineness they may be. The same may be said of *wood, iron, yarn*, and a great variety of terms of the same nature, some of which cannot assume any plural; whilst others admit of it in all cases, and others, again, admit or refuse it according to the different circumstances in which they are considered.

In a dictionary, therefore, all this variety of cases ought to be clearly and distinctly pointed out under each particular article. This is the more necessary, as some of these words have others formed from them which might be readily mistaken for their plurals, although they have a very different signification; as *clothes*, which does not denote any number of pieces of different kinds of *cloth*, but *wearing apparel*. The following example will illustrate this head.

WOOD, *subst.* A solid substance of which the trunks and branches of trees consist.

1. This term is employed to denote the solid parts of vegetables of all kinds, in whatever form or circumstances they are found. Nor does it admit of a plural with propriety, unless in the circumstances after mentioned; for we say, *many different kinds of wood*, in preference to *many kinds of woods;* or we say, *oak, ash*, or *elm wood*, not *woods*.

2. But where we want to contrast wood of one quality or country with that of another, it admits of a plural; for we say, *white woods are in general softer than red;* or, *West Indian woods are in general of greater specific gravity than the European woods.* But unless where the colour, or some quality which distinguishes it from growing wood, is mentioned, this plural ought as much as possible to be avoided, as it always suggests an idea of growing wood.

3. *Wood* likewise denotes a number of trees growing near one another, being nearly synonymous with *forest*. See FOREST. In this sense it always admits of a plural; as, *Ye woods and wilds whose melancholy gloom*, &c.

A dictionary cannot be reckoned complete without explaining obsolete words; and if the terms of the several provincial dialects were likewise given, it would be of great utility. Nor would this occupy much space, because a number of these words need no other explanation than to mark along with them the words which had come in their place, when there happened to be one perfectly synonymous; and in those cases where the same idea could not be expressed in modern language without a periphrasis, it would be of use to explain them distinctly; so that, when a writer found himself at a loss for a term, and was obliged to search for one beyond the bounds of his own language, he might take one of these, if he found it expressive and energetic, in preference to another drawn from a foreign language. This would at least have one good effect; it would render our language more fixed and stable, not to say more accurate and precise, than by borrowing from foreign languages. The following examples may serve to give some idea of the manner of treating this part of the work.

MOE, or MO, *adj.* An obsolete term still employed in the Scotch dialect, and by them pronounced *mae*, denoting a greater number, and nearly synonymous with *more;* but it differs in this respect, that in the Scotch dialect, *mae* and *mair* (English *more*) are each employed in their distinct sphere, without encroaching upon one another, *mae* being employed to denote number, but never quantity or quality, and *mair* to denote quantity and quality, but never number; thus they say *mae*, not *mair, apples, men*, &c. and *mair*, not *mae, cloth, earth, courage*, &c. See MAIR. Both these terms are supplied by the word *more*, which in the English language is applied indiscriminately to denote quantity, quality, and number. See MORE.

As the English language is so exceedingly irregular in the pronunciation, the same letter in the same situation often assuming sounds totally different in different words, it is impossible to establish any general rules on this subject which do not admit of many exceptions; therefore a

dictionary is the best means of ascertaining and pointing out the proper pronunciations of words. For, if the writer first pointed out all the different sounds which the same letter could ever be made to express, and assigned to every particular sound which each letter could be made to assume, a particular mark, appropriated to denote that particular sound of the letter whenever it occurred, by placing these particular marks above the letters in the dictionary, the sound of each letter would be pointed out in all cases with the utmost certainty. It is impossible to illustrate this by examples, without first ascertaining all the sounds of each letter, which would lead into a discussion too long for this place.

We shall only further observe, that besides having the accented syllable of every word *properly* distinguished in a dictionary to assist in the pronunciation, the English language requires another essential improvement, namely, the use of accents to distinguish the meaning of *words* and *phrases*, which, although it is not so properly confined to a lexicographer, yet it is not quite without his sphere. Thus, the word *as* admits of two very different sounds, as well as different significations; for example, "Cicero was nearly *as* eloquent *as* Demosthenes;" in which the first *as* is pronounced *ass*, and the last is pronounced *az*. Now it often happens that, in reading, the particular way in which it ought to be understood is not pointed out by the context till after the word itself is pronounced, which has an equal chance at least of being pronounced wrong; whereas, if it were always accented when employed in the one sense, and not in the other, it would free the reader from this perplexity. There are other cases in which the proper use of accents in writing would be of great consequence; as at the beginning of a sentence when it is put as a question, or used ironically. But this does not so properly belong to the lexicographer as the grammarian.

The above examples, we hope, will be sufficient to give the reader some idea of the plan which we would propose, and will enable him to determine whether or not a dictionary, executed in this way, would convey to his mind a more perfect knowledge of the English language than those dictionaries which have hitherto been published. These examples are given rather with a view to show the manner in which a work of this kind may be conducted, than as perfect and unexceptionable explanations of the several articles there enumerated; and therefore we have not thought it necessary to produce any authorities, although we are sensible that they would be requisite in such a work.

The following is a list of the principal dictionaries in the various ancient and modern languages:—

Aegyptian.—Sharpe (Lond. 1837); Birch (Lond. 1838); J. F. R. Champollion (Paris 1841); Tattam (Lond.)
Aethiopian.—Wemmers (Rome 1638); Ludolf (Frankf. 1699).
Afghan.—Dorm (St Petersburg 1845).
Albanian.—Blanchus (Rome 1635); Kaballioti (Venice 1770); Xylander (Frankf. 1835).
Amharic.—Ludolf (Frankf. 1698); Bruce (Lond. 1805); C. W. Isenberg (Lond. 1841).
Anglo-Saxon.—Somner (Oxon. 1659); Benson (Oxon. 1701); Lye (Lond. 1772); Bosworth (Lond. 1838).
Angola.—De Cannecattim (Lisb. 1804).
Arabic.—Gieuharrius (Scutari 1802); Richardson and Johnson (Lond. 1829); Baretti (Calc. 1806); Freytag (Halae 1837); Ciadyrgy (Milan 1832); De Biberstein Kazimirski (Paris 1846).
Vulgar Arabic.—Germanus de Silesia (Rome 1639); Cañes (Madrid 1787).
Aramaic.—Buxtorf fil. (Basil 1648).
Armenian.—Aucher (Venise 1817); translated into English by Brand (Venice 1825).
Bengalee—Forster (Calc. 1802); W. Carey (Seramp. 1826); J. C. Marshman (Seramp. 1827); Ch. Haughton (Lond. 1833); Ram Comul Sen (Lond. 1835).
Biscayan.—Anonymous (Bayonne 1706); De Larrimandi (St Sebastian 1745).
Bohemian.—Tomsa (Prag. 1791); Jungman (Praze 1839).
Burman.—Hough (Seramp. 1825); Judson (Calc. 1826).
Chaldee.—Elias Levita (Col. Agr. 1560); Buxtorf (Argenton 1639); Landau (Prag. 1820).
Chinese.—Morrison (Macao 1823); Medhurst (Batav. 1842); Biot (Paris 1842); Callery (Macao 1845).
Cinghalese.—Clough (Colombo 1830); Callaway (Colombo 1821).
Cochin Chinese.—De Rhodes (Rome 1651); Taberd (Serampore 1838); Du Ponceau (Philad. 1838).
Coptic.—Kircher (Rom. 1644); Lacroze (Oxon. 1775); Parthey (Berlin 1844).
Danish.—Anonymous (Leipzig 1844).
Dutch.—Hexham & Manley (Rotterd. 1675); Werninck (Lond.)
English.—Phillips (Lond. 1678); Bailey (Lond. 1764); Johnson (Lond. 1755); Sheridan (Lond. 1789); Ash (Lond. 1795); Booth (Lond. 1835); Webster (Lond. 1842); Richardson (Lond. 1836).
Esquimaux.—Egede (Hafn. 1750); Fabricius (Copen. 1804).
Finnish.—Renvall (Aboae 1826).
French.—Dictionnaire de l'Académie Françoise; Boyer; Chambaud; Fleming and Tibbins; Spiers; Tarver.
Gaelic.—Macfarlane (Lond. 1815); Armstrong (Lond. 1825); Highland Society (Edin. 1828); M'Leod and Dewar (Glasgow 1831); M'Alpine (Edin. 1845).
Georgian.—Klaproth (Paris 1827).
German—Bailey (Jena 1823); Hilpert (Karlsr. 1839); Flügel (Leipzig 1838); Grieb (Lond. 1847).
Gothic.—Lye (Lond. 1772); Ulfilas (Leipzig 1843).
Greek.—Hesychius (Lug. Bat. 1746); Suidas; Hederich; Passow; Pape; Dunbar; Liddell and Scott.
Hawaii.—Andrews (Cahainaluna 1836).
Hebrew.—Buxtorf (Basil 1735); Cocceius by Schulz (Leip. 1777–95); Gesenius (Leip. 1846), Edited by Tregelles (Lond. 1846); Parkhurst (Lond. 1823); Robinson (Boston 1844); Lee (Lond. 1840); Fürst (Leip. 1842).
Hindee.—Rousseau (Lond. 1812); Adam (Calc. 1833).
Hindustanee.—Roberts (Lond. 1800); Taylor (Calc. 1808); Gilchrist by Roebuck (Lond. 1825); Shakspeare (Lond. 1834).
Irish.—Maccurtin (Paris 1732); Shaw (Lond. 1780); O'Reilly (Dublin 1822); O'Brien (Dublin 1832).
Icelandic.—Haldorsonius (Copen. 1814).
Italian.—Veneroni; De la Crusca; Baretti; Graglia; Meadows.
Japanese.—Medhurst (Batav. 1830); De Sibold (Lugd. Bat. 1835); Medhurst (Lond.)
Latin.—Forcellini and Facciolati; Scheller (Leip. 1805); Freund (Berlin 1845); Georges (Leip. 1843); Riddle (Lond. 1851); Andrews (Lond. 1852).
Lettish.—Steuder (Riga 1791).
Malay.—Anonymous (Amster. 1802); (Arnheim 1803).
New Holland.—Meyer (Adelaide 1843); Schürmann (Adelaide 1844).
New Zealand.—Kendal (Lond. 1820).
Norwegian.—Hallager (Copen. 1802); Hanson (Copen. 1840).
Oordoo.—Thompson (Lond. 1842.)
Persian.—Richardson and Johnson (Lond. 1829); Burhani Kati (Calc. 1818); Rousseau (Lond. 1802); Baretto (Calc. 1806); Ciadyrgy (Milan 1802); Samachscharius by Wetzstein (Leip. 1845).
Polish.—Schmidt (Breslau 1834); Troyanski (Berlin 1838); Czarnecki (Krotoshin 1843).
Portuguese.—Vieyra, ed. by Cunda (Lond. 1840); Wagener (Leip. 1812).
Provençal.—Raynouard (Paris 1843).
Rabbinic.—Buxtorf (Basil 1735); Otho (Altona 1757); Hornheim (Halle 1807); Landau (Prag. 1819–24).
Russian.—Schmidt (Breslau 1836); Reiff (St Petersburg 1836); Constantinon (Lond.)
Samaritan.—Castelli; Cellarius (Frankf. 1705); Otho (Frankf. 1735); Uhleman (Leipzig 1837).
Sanscrit.—Wilson (Calc. 1832); Yates (Calc. 1820); Haughton (Lond. 1833); Johnson (Lond.)
Scotch.—Brown (Edin. 1845); Jamieson (Edin. 1846).
Swedish.—Granberg (Orebro 1832).
Semitic.—Hottinger (Frankf. 1661); Castelli (Lond. 1669); Otho (Frankf. 1702).
Spanish.—Real Academia Española (Madrid 1844); Neumann and Baretti (Lond. 1823); Meadows (Lond. 1843).
Syriac.—Schaaf and Leusden (Lugd. Bat. 1717); Castelli by Michaelis (Göttingen 1788); Kirschius (Lipsiae 1836–41); Roediger (Hal. Sax. 1838).
Tamil.—Rottler (Lond.)
Telugu.—Campbell (Madras 1821); Morris (Madras 1835).
Tibetan.—Schroeter by Carey (Serampore 1826); Croma de Körös (Calc. 1834); Schmidt (St Petersburg 1841).

Turkish.—Ciadyrgy (Milan 1834); Kieffer (Paris 1837); De Haudjeri (Moscow 1842).

Welsh.—Owen (Lond. 1803); Lewis (Caermarthen 1805); Roberts (Lond. 1827); Pughe (Lond. 1832); Richards (Lond. 1839); Jones (Lond. 1840); Walter (Lond.)

See J. S. Vater's *Litteratur der Grammatiken, Lexica und Wörtersammlungen aller Sprachen der Erde;* zweite ausgabe von B. Jülg. Berlin 1847.

DICTYNNIA, in *Antiquity*, a festival with sacrifices celebrated at Cydonia in Crete and also at Sparta, in honour of Diana, surnamed Dictynnia; or, according to others, in honour of a nymph taken for her, who, having plunged into the sea to escape the passion of Minos, was caught in a fisherman's net (δίκτυον); whence the name.

DICTYS CRETENSIS, one of the early historians from whom the later Roman grammarians imagined that Homer derived materials for the Iliad and Odyssey. He is said to have followed Idomeneus, king of Crete, in the Trojan war; and the MS. of his work, written in Phœnician characters, was found in his tomb at Gnossus in the reign of Nero, and translated into Greek by order of that prince. A Latin version of the first five books has alone come down to us; but this work is generally regarded as a forgery. The best editions are those of Perizonius and Dederich.

DIDACTIC (διδασκω, *to teach*), signifies the manner of speaking or writing adapted to teach or explain the nature of things.

There are many words which are only used in the didactic and dogmatic way; and there are also many works, ancient and modern, both in prose and verse, written after this method; such as the Georgics of Virgil, Lucretius's poem *De Rerum Natura*, Pope's Essays on Criticism and on Man, &c.

DIDEROT, DENIS, a French writer and philosopher, was the son of a cutler, and born at Langrès in Champagne, in 1713. He received his early education among the Jesuits at the college of that order in his native town, and afterwards at the college D'Harcourt at Paris. At first he was destined for the church, one of his relatives having a canonry to bestow upon him. But he discovered little inclination for the ecclesiastical profession, and his father placed him with an attorney. It soon appeared, however, that he was more attached to a general and desultory pursuit of literature and science than disposed to submit to the drudgeries of the profession to which his father had destined him; and having neglected its duties, his allowance was withheld, and he was obliged to shift for himself. It is said he gave lessons in order to procure a subsistence; and also became a bookseller's hack, in which capacity, we are told, nothing came amiss to him, from an advertisement or a catalogue to a sermon. Certain it is, that the studies to which Diderot devoted his attention were extremely various. Physics, geometry, metaphysics, moral philosophy, and belles-lettres, were at different times the objects of his pursuit; and he even indulged in poetry and works of fiction. But he attached himself chiefly to the graver studies. He possessed great fluency and animation of language in conversation; and this accomplishment, with a decisive tone and manner, procured him both partizans and protectors. The species of reading to which he addicted himself, more various than profound, probably suggested to him those encyclopædic projects and labours which principally occupied his life, and by which he is chiefly remembered.

In the year 1745 he published *L'Essai sur le Merite et la Vertu*, 12mo, a work by which he obtained some reputation. The year following he published a piece entitled *Pensées Philosophiques*, and immediately acquired considerable celebrity. This work, though intrinsically of little merit, was highly commended by the partizans of the new philosophy, amongst whom he had enlisted himself. The same work was afterwards reprinted under the title of *Etrennes aux Esprits Forts;* it was very much read, and is supposed to have contributed greatly to the diffusion of those free-thinking opinions which had now become so prevalent in France. Soon after this period, Diderot, in conjunction with D'Alembert, concerted the plan of that vast undertaking, the *Dictionnaire Encyclopédique*. The professed object of this work was to form a magazine of every branch of human knowledge; it has been also alleged that it was intended by the authors and editors as an engine by means of which those established opinions, whether of a religious or political nature, which they were pleased to suppose had their origin in fraud and superstition, were to be subverted. The department of this work which was intrusted to Diderot was the description of arts and trades (*arts et métiers*). In fact, he was the principal architect of the edifice; and, besides the Prospectus, and the *Système des Connaissances Humaines*, which has been much commended for its classification, he contributed many articles in various departments of science. But his articles have been considered extremely verbose and diffuse; in many of them he is pedantically prodigal of metaphysical subtilties, and indulges in a pompous parade of scientific language. The first two volumes of the Dictionary appeared in the year 1751, and the first edition was completed and published in 1765, in 17 vols. fol. and 11 vols. of plates; but although Diderot was occupied in this laborious undertaking for a period of nearly twenty years, the recompense which he obtained for his labours is said to have been extremely small. He himself acknowledged the many defects of the work, not a few of which he attributed to the publisher Le Breton, who, he declared, often played editor himself, scratched out anything which he thought might compromise him, and filled up the chasms as he best could. Diderot's literary labours, however, were not confined to the Dictionary. Just before he commenced, and while engaged upon it, he composed numerous works, amongst which may be mentioned—(1.) *Lettres sur les Aveugles* (1749), "for the use of those who see." This work made a good deal of noise, and, in consequence of some of the sentiments it contained, gave offence to the government, for which reason the author was detained in confinement during several months at Vincennes. (2.) *Lettres sur les Sourds et Muets*, 2 vols. 12mo, 1751. (3.) The *Sixth Sense*, which was published in 1752. (4.) *Pensées sur l'interpretation de la Nature*, which appeared in 1754. These, which by no means exhaust the list, are similar works, and may be ranked in the same class. Like all his philosophic writings, they are (besides graver defects) often chargeable with the double fault of obscure thoughts expressed in a declamatory style.—His moral character was considerably affected by the publication of *Bijoux Indiscrets*, in two vols. 12mo, which is a collection of licentious tales; and it was little compensation that his two prose comedies, entitled *Le Fils Naturel*, 1757, and *Le Père de Famille*, 1758, comparatively uninteresting as dramatic pieces, exhibit a more correct morality. He also published a pamphlet on Public Education, which contains some useful hints, but at the same time proposes many things utterly absurd and impracticable. To the works now mentioned we may add an eulogy on Richardson, which is full of admiring enthusiasm. An Essay on the Life and Writings of Seneca the Philosopher was his last production, and was published in 1779. For a fuller and tolerably impartial account of these and his other writings, we must refer the reader to the *Biographie Universelle*.

The character of Diderot suffered considerably from some defamatory attacks which he had made on his former friend Rousseau, who had quarrelled with the French philosophers, and had separated himself from their school. From the *Confessions* of the philosopher of Geneva, it would appear that they expected of him some anecdotes which would not have redounded much to their honour. In one of his letters Rousseau, speaking of Diderot, says, "Although

born with a good heart and an open disposition, he had an unfortunate propensity to misinterpret the words and actions of his friends, and the most ingenuous explanations only supplied his subtle imagination with new interpretations against them." Rousseau might here be supposed drawing his own portrait yet more truly than that of his *quondam* friend.

Diderot was married and had one daughter; and although he possessed considerable irritability of temper, he was, it is said, a kind husband and a tender parent. His conjugal virtues are not, however, supposed to include fidelity. His sentiments on marriage sufficiently appear in the article on that subject in the Encyclopædia; and his numerous infidelities to his wife, who is said to have been virtuous and affectionate, show how consistently he exemplified them!

At the conclusion of the Dictionary, the state of his affairs having rendered it necessary for him to dispose of his library, it was purchased by the empress of Russia, who, with the king of Prussia, was at that time much given to patronize literature and literary men. These sovereigns were also considered as disciples of the French school. The price which Diderot received for his library was fifteen thousand livres, and he was to have the use of it during his life; or rather Catherine paid him many years' pension in advance, as *librarian* of his own library. "Elle acheta," says the *Biographie Universelle*, "en 1765, la bibliothèque de Diderot, pour 15,000 livres, à condition qu'il continuerait d'en jouir. Elle y ajouta une pension annuelle pour l'entretien et la garde de la bibliothèque; et ayant appris, l'année suivante, que le paiement de cette pension avait été retardé, elle lui en fit compter, cinquante années." Diderot was so charmed with Catherine's liberality, that he repaired to St Petersburg to express his gratitude; and then, dazzled with his reception, expressed it in terms which sound odd enough in a philosopher of *his* professed principles. "In a country," he declared, "*called* a country of slaves, he felt like a freeman." On his return he lodged in state in the Rue Richelieu at Catherine's charge. Diderot had been admitted a member of the Academy of Sciences at Berlin; but the doors of the French Academy remained closed against him to the last. He died suddenly, as he rose from table, on the 30th July 1784. According to his daughter, who left a memoir of him, he conversed on the evening preceding his death on philosophy, and the means of attaining it. She says the last remark she heard him make was, "The first step towards philosophy is incredulity." If so, he had certainly taken *that* step. Whether he had taken any other may be doubted. His literary and philosophical works were collected and published by his friend and disciple Naigeon, in 15 vols. 8vo, at Paris, in 1798. This collection has been enlarged, in subsequent republications, to 22 vols. 8vo, Paris, 1821; it contains a memoir of Diderot, or rather a critique on his writings.

Diderot, it would seem, had a hand in several of the most remarkable works of his time, published under the names of others. "Who does not know," says Grimm, in his *Correspondance*, "that nearly a third of the *Histoire Philosophique* of Raynal belongs to him? He laboured on it during two years, and a considerable part of it was even composed under my own eyes. Diderot himself was often startled at the boldness with which he had made his friend the abbé speak. 'Who,' asked he, 'who will venture to subscribe this?' 'I,' replied the abbé, 'I will subscribe it; proceed, I tell you.' What man of letters is there who may not easily recognise in the book *De l'Esprit* (of Helvetius), and in the *Système de la Nature*, all those fine passages which are, and could only be, from the pen of Diderot? If we undertook to make a more complete enumeration, we should run the risk of naming many ungrateful individuals." (*Correspondance Littéraire, Philosophique, et Critique*, tom. iv. p. 85.) Grimm further states that Diderot furnished a considerable number of pages to the *Système de la Nature*; and that he laboured, though to a less extent, on the *Système Social* and the *Morale Universelle*, also published by Baron d'Holbach. Such were some of the indirect literary efforts of Diderot. But neither as a writer nor as a philosopher did he make for himself any very enviable reputation. As a writer he was decidedly a vicious model; he had neither plan nor connection, and knew not how *proprie communia dicere*, whilst his style was deformed by obscurity, neologisms, and a tone of insufferable dogmatism; nevertheless it must be conceded that he was often vigorous, sometimes eloquent, and now and then stumbled on happy traits of expression; as well as striking truths, which, however, would have gained much by being more simply stated. In fact, he had frequently the air of speaking *ex cathedrâ;* his ambitious diction, his strained style, his eccentric sallies, and an enthusiasm which seldom appeared natural, fatigue the reader. As a philosopher he wrote under the influence of a heated imagination rather than under that of cool reason. He was almost always extravagant; seldom or never simple and natural. Admirers, however, have not been wanting who have celebrated his *bonté*, his frankness, his easy and obliging character, and the vigour and *entraînement* of his conversation. Grimm, who has praised him warmly in his *Correspondance*, regards Diderot as having had the most naturally encyclopædiacal head of all men that ever lived. He admires his energy, the variety of his ideas, the multiplicity of his acquirements, the impetuous tumult of his imagination, and the charm and irregularity of his conversation: but he adds, "However willingly I may pardon all men for *believing nothing*, I think that it would have been very desirable for the reputation of Diderot, perhaps even for the honour of his age, if he had not been an atheist. The determined war which he thought himself obliged to carry on against God, caused him to lose the most precious moments of his life." (*Correspondance*, 3me partie, tom. iv. p. 87.) But Naigeon, who is less scrupulous than Grimm, praises his friend without qualification, adding, besides, that "his age has not done him justice." It would have been difficult.

The general opinion in regard to him seems now to be pretty well fixed, and posterity has at length put him in his right place. He had talent; but he wanted sagacity, moderation, and taste. "He has written fine pages," says Marmontel in his *Mémoires*, "but he never knew how to make a book." His desolating atheism and licentious principles explain the reason why he never entered the Academy, whose doors, as we have already stated, were constantly shut against him, notwithstanding the anxious desire of his friends to procure him admission. Voltaire, who had himself solicited his election, appears latterly to have become less enamoured of the merit of Diderot, and even to have formally censured some of his works. D'Alembert also cooled towards him, and at last they did not even see each other. His rupture with Rousseau, however, was the work of the latter, who began the war which was afterwards waged between them. But Diderot maintained his connection with Baron d'Holbach, whose sentiments approached the nearest to his own. In the society of the baron he was relished and admired for his facility in general conversation, but especially, no doubt, on account of his antipathy to that creed and to those institutions which that coterie so cordially hated. On these topics he never tired, and his friends often amused themselves with giving him opportunities of abandoning himself to his imagination, or, in other words, blaspheming for their diversion. In an unexcited state he exhibited constraint, awkwardness, timidity, and even a kind of affectation. He was never truly Diderot except when his fancy had transported him as it were beyond himself. Enthusiasm had become the condition most natural to his mind, nay, even to his voice and fea-

tures; and he was himself only when in a state of intellectual inebriety. Grimm has reproached him with having consumed in fugitive conversations the time which he might have devoted to more enduring achievements; but Diderot loved to talk, especially when he could indulge his vehement volubility without interruption. As Voltaire once remarked on leaving a company where Diderot had engrossed the whole talk, "*Cet homme-là n'est pas propre pour le dialogue.*" The correspondence recently published has thrown but little new light on the character of this remarkable man, nor has it tended in any degree to increase the estimation in which his talents and character were previously held by the world. He will retain an unenviable notoriety as one of the principal figures in that group of so-called philosophers of the last century who, unable to distinguish between superstition and religion, vainly strove to extinguish religion itself, and entered into an unhallowed conspiracy against the best interests of humanity. Their fantastical theories, licentious maxims, and, too generally, immoral characters, constitute the best antidote to their absurdities, and the best comment on their systems.

DIDIER, St, a city of the department of the Upper Loire, in France, with 3203 inhabitants, who are employed chiefly in the silk manufacture.

DIDO, or Elisa, in *Ancient Mythology*, the reputed founder of Carthage, was the daughter of Mutgo (or as he is called by others Belus or Agenor) king of Tyre. On the death of this prince Dido married his brother, her own uncle, Acerbas, or as he is called by Virgil Sichæus, high-priest of Hercules, and a man of immense wealth. On the death of Mutgo, Pygmalion succeeded to the Tyrian throne. Envying the great possessions of his uncle Sichæus, he is said to have put him to death, and Dido immediately made preparations for leaving the country. In company with a few of the Tyrian nobles, who were discontented with the rule of Pygmalion, she left her native country, taking with her the treasures of her murdered husband. The fugitives first landed at the island of Cyprus, whence they carried off eighty virgins to furnish wives for the settlers in the new colony which they intended to found. Pursuing her voyage, Dido landed on the northern coast of Africa, where she purchased from the natives as much soil as she could cover with the hide of a bull. She cut the hide however into such thin stripes that she inclosed a large tract of country, on which she immediately began to build a city. As the city, which was named Carthage, rose from its foundations, the neighbouring chiefs viewed it with jealousy; and one of their number, Hiarbas, at length sent to demand the hand of Dido in marriage, threatening to make war on the infant state in the event of a refusal. Dido at first declined, and ultimately demanded three months to make the needful preparations. At the end of that period she caused a splendid funeral pyre to be erected in the city. Ascending this with a drawn sword in her hand, she stabbed herself in presence of all the people. The story of Dido as narrated by Virgil differs considerably from that which we have given. In the Æneid, Dido is represented as falling in love with the hero of that epic, and killing herself when she discovers that her passion is not reciprocated. The glaring anachronism involved in this version of the story has been frequently remarked.

DIDRACHMA, in *Antiquity*, a silver coin, equal to two Attic drachmæ, and also to the Jewish half shekel. It was equivalent to about 1s. 4d. of our money.

DIDYMUS, a celebrated grammarian of the Augustan age. He was the son of a seller of fish at Alexandria, and was born about B.C. 64. He was a disciple of Aristarchus, and in his literary labours he followed strictly the critical principles of his master. Athenæus computes the works of Didymus at 3500, and Seneca at 4000. The names of χαλκέντερος (brazen-bowelled), and βιβλιολάθας (forgetter of his own books), by which he was distinguished amongst his contemporaries, sufficiently indicate his perseverance, and the voluminous character of his writings. His principal works seem to have been his scholia on Homer, Aristophanes, Pindar, Sophocles, Euripides, and several of the Greek orators. It is probable that many of the comments of the later scholiasts were borrowed from him. He is said also to have written against Cicero's *Republic*. The collection of Greek proverbs, and the fragments of the books on agriculture, which bear his name, are at least only in part genuine.

DIDYMUS, of Alexandria, an ecclesiastical writer who flourished in the fourth century. Notwithstanding his blindness, which took place before he had learned to read, he succeeded in mastering the whole circle of the sciences then known; and on entering the service of the church he was placed at the head of the Alexandrian theological school. Most of his theological works are lost. We possess however a Latin translation by Jerome of his *Treatise on the Holy Ghost*, and a similar translation by Epiphanius of his *Brief Comments on the Canonical Epistles*. A *Treatise against the Manichæans* is extant in the original Greek, and was first published at Bologna in 1796.

DIDYNAMIA, in *Botany*, the fourteenth class in the Linnæan system, comprehending such plants as have four stamens.

DIE, a small cube used in gaming, as described under Dice. It is also used generally for any cubic body.

Die also denotes a stamp used in coining, in foundries, &c. Its plural form is *dies*. See Coinage.

Die (*Dea Vocontiorum*), a town of France, capital of an arrondissement of the same name, in the department of Drôme, and situated in a fertile valley on the right bank of the Drôme, 36 miles E.S.E. of Valence. It is surrounded by old walls flanked by towers, and was formerly the seat of a bishop and of a Calvinistic university. Manufactures—silks, paper, and leather. Pop. (1851) 3858.

Dié, St, a town of France, department of Vosges, and capital of a cognominal arrondissement. It is situated on the Meurthe, 24 miles E.N.E. of Epinal, and is surrounded by an old wall. It is the seat of a bishop, and has a communal college and public library. Manufactures—cottons, hosiery, and ironware. Pop. (1851) 8692.

There is also a small town of this name in the department of Loire-et-Cher on the left bank of the Loire, arrondissement, and eight miles N.E. of the town of Blois. Pop. about 1300.

DIEBURG, a town of Hesse-Darmstadt, province of Starkenburg, and capital of a bailiwick of the same name, is situated on the right bank of the Gersprenz, seven miles E.N.E. of Darmstadt. It is defended by a strong castle (formerly the residence of the Counts of Lerchenfeld), and has about 3200 inhabitants.

DIEMERBROEK, Isbrand van (1609-1674), a learned professor of physic and anatomy at Utrecht, was born at Montfort. He wrote a well-known treatise on the plague, and several works on subjects connected with anatomy and medicine.

DIEPPE, a seaport town of France, capital of an arrondissement of the same name, in the department of Seine-Inferieure, situated at the mouth of the Arques on the English Channel, 32 miles N. of Rouen, and 92 miles from Paris; in N. Lat. 49. 55. 34., E. Long. 1. 4. 44. Pop. (1851) 16,216. The town proper is separated from its suburb of Pollet by the port, but communicates with it by means of a flying bridge. It extends about a mile along the coast; and to the westward on a chalk cliff stands the castle, an edifice of the fifteenth century, commanding both the town and harbour. The port, inclosed by two jetties, is large and secure, and admits vessels of 600 tons. It is however dry at low water, and the entrance is narrow and rather dangerous. The town is well built, the streets are

wide and regular, and the houses mostly of brick, ornamented with balconies. It is well supplied with water by means of an aqueduct 3 miles in length; and has 68 public fountains, besides numerous private ones. The principal street runs parallel to the sea, from the harbour to the castle, and contains some fine shops and hotels. Dieppe is the seat of a court of original jurisdiction, and has a communal college, public library, navigation school, theatre, assembly rooms, and hospital. It is much resorted to in summer as a watering-place, and has a handsome bathing establishment. It is a place of a very extensive general trade, which has been much increased since the completion of the line of railway connecting it with Paris. Ship-building, and the herring and other fisheries are carried on; and there are manufactures of leather, lace, ivory articles, paper, &c. Dieppe has regular communication by steam-vessels between Brighton and Dieppe.

DIES MARCHIÆ was the day of congress or meeting of the English and Scotch, annually appointed to be held on the marches or borders, in order to adjust all differences between them.

DIESIS, in *Ancient Music*, the difference between a major and a minor semitone. In modern music it means the sign ♯, otherwise called a *sharp*, which, prefixed to a note, indicates that the note is to be raised a semitone.

DIESPITER, in *Antiquity*, a name given to Jupiter, as the father or lord of heaven. It is a contraction of *Diovispater;* or perhaps a protraction of *Dis*, an old Umbrian name for that god.

DIEST, a town of Belgium, province of South Brabant, and capital of a cognominal canton, is situated on the Demer, 28 miles E. by N. of Brussels. Pop. (1851) 8335. It has manufactures of woollens, hosiery, &c., and some extensive breweries. It was taken from the French by Marlborough in 1705, and retaken the same year.

DIET (Lat. *dies, day*), the name given to the principal national assembly in various countries of modern Europe. In Dutch it is called *ryksdag;* in German *reichstag;* in Swedish *riksdag*, and in Danish *rigsdag;* all which words prove the above mentioned derivation.

DIET, in *Law*, the day or time fixed for compearance in court.

DIETETICS.

THE necessity of aliment is explained by a knowledge of the functions of the body, and its selection depends upon the same principles. The living machine, as well as those that are inanimate, wastes in proportion as it is used, and this waste must be supplied. To learn the kind of supply required, the kind of waste and its mode must be ascertained.

General view of the subject. The human body is of a very compound nature; indeed it is the most compound of all bodies, as well as the most complicated of all machines. It is composed of solids and fluids, and these again consist of various chemical elements in different states of combination. A great part of the mass of our bodies consists of water, and certain animal substances, to which chemists have given the name of fibrin, albumen, gelatin, mucus, and osmazone. Our bones consist principally of phosphate of lime. Besides these, some other principles enter into the composition of our bodies, though in comparatively small proportion. All the elementary matters of which these principles consist are continually discharged by the various excretions, but generally in states of combination different from those in which they existed as a part of our body. By the lungs a great deal of carbon and hydrogen is exhaled in the form of carbonic acid gas and vapour; by the skin carbon and hydrogen are also thrown off in considerable quantity; by urine, in addition to carbon, hydrogen, and oxygen, much azote, phosphorus, and lime, are discharged in the form of urea and the phosphate of lime; and by the alvine evacuation, not only the indigestible parts of our aliment are expelled, but also carbon, hydrogen, and azote, which formed integrant parts of our bodies, and have fulfilled their functions in the form of bile, mucus, and intestinal flatus. We therefore see that there is a constant waste of carbon, azote, hydrogen, oxygen, phosphorus, and lime, going on, which must be replaced. But there are only two sources from which this waste can be repaired, the atmosphere in which we live, and the aliment which we introduce into our stomach The atmosphere consists of oxygen and azotic gases, and it is very doubtful whether any part of either be absorbed or converted into a part of our bodies. At least we may assume, that from the air no part of the materials to supply the waste of the body is derived. These must, therefore, be furnished entirely from the matters introduced into the stomach, and those which are calculated to restore any of the deficient elements or principles alone are alimentary. It is not at all necessary that these elements should be in the same state of combination with the principles whose loss they are to supply. It is sufficient that the elements be there, for it is the very essence of the function of digestion to analyse the alimentary matters, and reunite their elements into other combinations assimilated to our nature. From this view of the subject, it would however seem, that the more nearly the alimentary substances approach to the nature of the substances whose waste they are to supply, the less change upon them is necessary, and their digestion and assimilation will be more easy. Upon these principles, animal substances should be more easily digested than vegetable, and a larger proportion of their elements should be assimilated, while a smaller proportion should be separated to form excrementitious or indigestible compounds. In the same manner, vegetable substances are more digestible, and generate less excrementitious matter, than inorganic substances, which furnish only a small proportion of assimilable matter, and which must be separated from combinations totally foreign to our nature.

Besides alimentary substances properly so called, there is another class of substances which do not contribute much to repair the waste of our bodies, and yet perform an essential part in the function of digestion. These are called condiments, and their use is to stimulate the organs of digestion to greater activity; and, in fact, they are all much more sapid than the proper alimentary substances, which are in themselves generally insipid or mawkish.

From the view we have taken of aliments, it will appear that they are furnished by all the kingdoms of nature; the mineral kingdom supplying chiefly water and lime, while the vegetable, in addition to these in smaller quantity, yields much carbon and hydrogen; and the animal kingdom, in addition to a proportion of all the preceding elements, furnishes almost all the azote which enters into our composition. Although this statement be generally true, there are facts which at first do not seem to accord with it; and there are some grounds for believing that living bodies have either the power of changing the elementary nature of bodies, or of analysing these bodies we at present consider as simple, so that one is apparently changed into another. Thus some animals, in the state of nature, live only upon animal substances, and it is easy to conceive how, by a very simple process, the blood and flesh of their prey should become a part of their proper blood and flesh. Their elements, and even the combina-

tions of them, are alike. But there are other animals whose flesh and blood do not differ materially from those of carnivorous animals, and which live almost entirely upon vegetable substances far removed from animal nature, and containing little if any azote.

This subject has lately engaged the attention of Magendie,[1] the most distinguished Parisian physiologist of the present day; and his views are the most important lately promulgated upon this point, and throw very great light upon the subject of dietetics. To ascertain the sources from which animals derive the azote which enters into their bodies, he performed some experiments, which appear to prove that azote is an indispensable constituent in the food of animals. For the subjects of his experiments he chose dogs, because, like man, they can be supported by vegetable as well as animal food, and he confined them to the use of pure water, and substances totally devoid of azote. *Sugar,* perfectly pure, was first tried. Of this, and of distilled water, he allowed an unlimited quantity to a small dog, three years old. For the first seven or eight days it seemed to agree very well with this diet. It was lively, active, and eat and drank as usual. In the second week it began to fall off, although its appetite continued very good, and it eat from six to eight ounces of sugar in the course of twenty-four hours. Its alvine excretions were scarce and scanty, while that by urine was abundant. In the third week it became more emaciated, it lost its liveliness, and its appetite began to fail. During this period also its eyes became affected in a singular and very distressing manner. The emaciation increased every day, its strength failed, and although it continued to eat from three or four ounces of sugar daily, it became so weak that it could neither chew nor swallow, and of course could not move. It died on the thirty-second day of the experiment; and, on opening its body, there was a total absence of fat; the muscles were reduced to one sixth of their bulk, and the stomach and intestines were much contracted. The gall and urinary bladder were both filled with fluid; but on analysis, the bile and urine resembled those of herbivorous animals. The urine, instead of being acid, as in those which eat flesh, was like that of herbivorous animals, sensibly alkaline, and did not contain a trace of uric acid or the phosphates, while the bile contained the picromel so remarkable in ox gall. The excrements also contained much less azote than usual. This experiment was twice repeated, with nearly the same result.

Olive-oil was next tried with two healthy young dogs, which seemed to agree with them for the first fifteen days, but then produced the same bad effects, and both died on the thirty-first day.

Gum was given to several dogs, and always with the same result.

Butter, an animal substance, but which does not contain azote, was also tried; and although, after the thirty-second day, the dog was allowed as much meat as it could eat, it died on the thirty-sixth day, similarly affected.

M. Magendie also killed several dogs at a proper period, after they had got a full meal of oil, sugar, or gum, in order to observe the nature of the chyle thus furnished. The chyle of the oil was of a decided milky white, whilst those of the gum and sugar were transparent, opaline, and more watery. These experiments, in M. Magendie's opinion, render it doubtful whether the oils, fats, gum, and especially sugar, are so nutritive as is generally supposed. But before we adopt his conclusion, we must remember that whole nations subsist upon food which contains very little if any azote. The Hindus live almost entirely upon rice, the peasants of Lombardy upon maize, those of Ireland upon potatoes, the slaves in the West Indies get fat during the cane crop, and the negroes of Senegal during the gum harvest, and herbivorous animals are nourished at all times upon grass. M. Magendie is not ignorant of these facts, but tries to explain them away by doubting the accuracy of some of the relations, and alleging that few vegetables are altogether destitute of azote He cites, in confirmation of his observations, the experiments of Dr Stark, who injured himself by trying to live on sugar, bread, and water; and of M. Clouet, who grew extremely weak upon potatoes and water; and instances the insufficiency of sugar and a little rum to support the crew of a shipwrecked Hamburg vessel. The legitimate conclusions from all the facts relating to this subject seem to be,

1. That animals derive the azote which enters into their composition entirely from their food, and hence that no animal can live for a considerable time upon food totally destitute of azote.

2. That animals, even those naturally carnivorous, can live a certain time upon food entirely destitute of azote, in consequence of which the excretions of the naturally carnivorous become altered, and throw off less azote than when fed on animal food, acquiring the properties which these excretions have in animals whose food contains a very small proportion of azote.

3 That vegetable and animal substances destitute of azote are highly nutritious, provided, at the same time, azote be supplied from the admixture of some other aliment containing it, though in small proportion.

Upon these principles, alimentary substances may naturally and philosophically be divided into three great classes.

I. Those which contain azote, carbon, hydrogen, and oxygen.

II. Those which contain carbon, hydrogen, and oxygen

III. Those which contain neither azote nor carbon.

I. *Alimentary Principles which contain Azote, Carbon, Hydrogen, and Oxygen.*

The aliments which contain azote correspond with the animal substances in general, and are calculated to repair the waste of our solids and fluids, without great alteration or effort in the digesting organs. All the immediate principles of this class are not, however, equally digestible, or possessed of the same properties. We shall say a few words of each.

Fibrin constitutes the great mass of the solid matter of the muscles of animals; especially of those which are old and have dark-coloured dry flesh. It is also a principal constituent of the blood of all animals. There can be no doubt, therefore, that it is pre-eminently nutritious in these its natural forms of combination, but we know of no experiments to ascertain its nourishing powers when used alone. The purest form of fibrin which occurs in common circumstances is the fibre of flesh which has been long boiled in a great quantity of water, as in the remains of the meat from which beef-tea is made, or of that boiled down for soup. This is generally considered, and is often thrown away, as totally indigestible, and deprived of all its nourishing principles; but this is probably a vulgar error, for animal fibre in this state still contains, as much as ever, all the elementary substances which are necessary for animal food; and the only circumstance which can account for their indigestibility, is their great aggre-

[1] *Mémoire sur les propriétés nutritives des substances qui ne contiennent pas d'azote,* 8vo, Paris, 1816.

gation, which it is the business of cookery to overcome. Fibrin also forms a large proportion of the substance of some of the internal organs of animals, all of which are nutritious. Pure fibrin is white and opaque when moist, but acquires a dark colour on being dried. It does not become putrid when kept in the air, nor even when immersed in water for a considerable length of time. It contracts and shrinks on the application of heat, and gives out, on being burnt, the smell of burning horn or feathers. It is insoluble in cold water; is corrugated by boiling in water; is insoluble in alcohol; but strong acetic acid swells it considerably, and renders it transparent like cartilage, in which state it may be dissolved, or, at least, diffused through water by long boiling.

Fibrin varies in every species of animal, and in the same animal at different ages, either from a difference in its nature, or from a difference in the matter with which it is combined. In many fishes, and the lower classes of animals in general, it is semitransparent and colourless. In veal, pork, salmon, chicken, and some other kinds of poultry, it has a pink colour; in beef and mutton it is of a fuller red; and in pigeon and game, both birds and quadrupeds, it is dark coloured. In general it is more tender in the female than in the male, and in the young animal than in the old.

Albumen is also a principal constituent of animal substances, in which it exists in two states, one uncoagulated and the other coagulated. Of the former, the purest example occurs in the raw white of eggs. Cartilage, horn, hair, nails, consist chiefly of the latter. It is also a principal constituent of blood and brain; and it seems to be the chief substance of oysters, mussels, and snails. Uncoagulated albumen is sometimes solid, often glairy, always transparent, and, when fluid, is soluble in water, and its taste is bland or almost insipid. At 165° Fahrenheit it is converted into a white solid mass, of which we have a familiar example in the white of a hard-boiled egg. There can be no doubt that albumen, especially in its uncoagulated state, is highly nutritious and easily digestible.

The curd of milk may be considered as a variety of albumen, although it possesses some peculiar properties, especially that of being converted into cheese by a particular mode of management.

Gelatin is a third very principal constituent of animal solids, as bones, ligaments, tendons, membranes, skin, muscles, &c. and exists in much larger proportions in the flesh of young than of adult animals. Thus we see the gravy of veal and lamb always gelatinize, while that of beef and mutton does not. The swimming bladder of the several species of sturgeon is gelatin in a state of very great purity, and by boiling it may be extracted pure from the shavings of hartshorn. Its taste is bland and nearly insipid. It is characterized by its solubility in water, being much increased by a boiling temperature, and by the solution, when of a certain strength, gelatinizing or cooling. It is highly nutritious, and supposed to be the most easily digestible of animal matters.

Mucus differs from albumen chiefly in not being coagulated by heat or corrosive sublimate, and from gelatin in not being precipitated by vegetable astringents, nor gelatinizing when its solution is concentrated. It exists nearly pure in saliva, and is a constituent of most of the secretions. There can be no doubt of its easy digestion and nutritious quality.

Of these four principal constituents of animal matter we may remark, that in themselves they are almost insipid; that gelatin exists almost entirely in a solid form, more or less dense; that mucus and albumen exist in every form of aggregation, from perfect fluidity to the density of cartilage; and that fibrin is only fluid in the living blood, but in every other instance is a tough solid: and that gelatin is very soluble in boiling water, and gelatinizes on cooling; that albumen in soluble in cold water, and coagulates at 165°; and that fibrin is not soluble either in cold or hot water. We may also remark that, although chemists have given very definite characters of each, as if they constituted absolutely distinct species of matter, these characters are taken from certain selected kinds of each, and that, in reality, we find that there is a regular and insensible gradation from mucus, through gelatin and albumen, to fibrin; and that, as in the process of animalization, as well as in the progress of life, they pass into each other, and many intermediate states are found which cannot be distinctly referred to any of them.

Osmazome, or animal extractive, differs very much from the preceding principles; chemically, in being soluble in alcohol, and to the senses, in being very savoury or sapid. It is upon this, which seems to admit of considerable varieties, that the flavour of animal food, and of each of its kinds, depends. It exists chiefly in the fibrous organs, or combined with fibrin in the muscles, while the tendons and other gelatinous organs seem to be destitute of it. The flesh of game and old animals also probably contain it in greater quantity than that of young animals abounding in gelatin.

Gluten is the only vegetable substance which contains a notable proportion of azote in its composition. When separated from other principles, it forms a tough, ductile, elastic, and tenacious mass of a gray colour, resembling, when drawn out, thin animal membrane; when dried it is brittle, hard, and slightly transparent, like glue. When kept moist it ferments and acquires some of the properties of cheese. Immersed in water it at last putrefies. When burnt or distilled it resembles in its properties horn or feathers. It is soluble in concentrated acetic acid, and, by the assistance of heat, in muriatic acid and in the alkalies. It then bears a strong analogy to the animal substances in general, resembling, by different properties, fibrin, albumen, and gelatin. It is very generally found, though only in a small proportion, in the vegetable kingdom, in all the farinaceous seeds, in the leaves of cabbages, cresses, &c.; in some fruits, flowers, and roots, and in the green feculum of vegetables in general; but it is particularly abundant in wheat, and imparts to wheat-flour the property of fermenting and making bread. On the nutritious powers of gluten separated from other principles nothing certain is known; but the superior nutritious powers of wheat-flour over that of all other farinaceous substances sufficiently proves that, in combination with starch, it is highly nutritive; and in all probability it is the gluten of the green feculum which supplies the azote necessary for the support of the herbivorous animals.

II. *Alimentary Principles which contain Carbon, Hydrogen, and Oxygen.*

Starch is very abundantly diffused through the vegetable kingdom. It exists in great purity in various farinaceous grains, such as rice, barley, maize, and millet; it is combined with gluten in wheat; with saccharine matter in some grains, as oats, and in many leguminous seeds, such as haricot-beans, lentils, vetches, and peas; with viscous mucilage, in rye, potatoes, and Windsor beans, with fixed oil and mucilage in the emulsive seeds, such as nuts, almonds, cocoa, tamarinds, in linseed, rapeseed, hempseed, poppyseed, and, in general, all those from which an oil can be obtained by expression. Lastly, starch is sometimes united to a poisonous substance. Of this singular union of a nutritious with an injurious principle the most remarkable instance occurs in the roots of the Ja-

tropha manihot, and of many species of arum, to the former of which the negro slaves of the West Indies are indebted for their cassada bread, and from the latter is prepared the best arrow-root starch. Only one species of grain, the *Lolium temulentum*, is hurtful; but many leguminous seeds are poisonous, of which the most familiar example occurs in the laburnum peas.

Starch is artificially prepared in great purity from various substances. *Starch* is got from wheat and potatoes, *arrow-root* from various species of arum, *cassada-flour* from the manioc root, *salep* from the orchideæ in general, *sago* from the pith of various species of palm-trees, *tapioca* from the bitter and sweet cassava root. In all of these varieties of form, starch furnishes a bland and wholesome nutriment.

Gum or *Mucilage* is also a principal ingredient in the composition of our alimentary vegetables. The distinctive character of gum is its solubility in cold as well as hot water, and its insolubility in alcohol. It is devoid of smell, and to the taste it is bland and agreeable. In Arabia, Senegal, and the East Indies, it is obtained in great quantities from the various species of *Mimosa*, from the bark of which it exudes in great purity; and in hot climates in general it is furnished by many trees, especially those which have an astringent bark. In our own country an example of its production is seen on the bark of the plum and cherry trees. Where it is produced in sufficient quantity it constitutes a principal article of diet; and the Africans of Senegal are said to live entirely upon it during the gum harvest. Eight ounces of gum are the daily allowance, and furnish sufficient nourishment, for each man.

Mucilage is the alimentary principle of many of our esculent vegetables. In some it is united only to green colouring matter, as in the leaves of beet and spinach; with bitter matter, which may be prevented by the process of blanching, as in endive, lettuce, succory, and cardoon, or by using the plant very young, as in asparagus. It exists also in every part of the mallow tribe; in many roots, as scorzonera, salsafy, and Jerusalem artichokes, in the receptacle of the flower of the artichoke. It is combined with an acid in sorrel leaves; with saccharine matter in many fruits, as the fig and date; in roots, as the carrot, parsnip, and beet; and with slight acrimony in the turnip, cabbage leaves, cauliflower, and broccoli, and with considerable acrimony in the radish, cress, and mustard. It exists in great quantity, combined with a peculiar nauseous principle, in onions, garlic, shalot, leek, &c.; and, lastly, in small quantity, with much aroma, in those vegetables which are used only for seasoning, as parsley, thyme, &c. In short, it is very generally found throughout the vegetable kingdom, and in every mode of union with other principles.

Sugar, the common properties of which, in a state approaching to purity, are familiar, is also highly nutritious. It is crystallizable, soluble in water both cold and hot, in alcohol and the weak acids, readily undergoing, when dissolved in sufficient water, the vinous and acetous fermentation, but, on the other hand, when concentrated, preserving vegetable substances. Chemically considered, it presents many varieties. It exists in greatest quantity, combined with mucilage, in the juice of the sugar cane, of the maple tree, the manna ash tree, and of beet-root. It seems to be a constant attendant upon the inflorescence of vegetables, for almost every flower furnishes honey to the bee, and is a chief constituent of all the acerb, subacid, and sweet fruits, in combination with vegetable jelly. Sugar is produced, or at least collected, by several insects. To the bee we are indebted for honey; and a species of locust in New Holland covers the trees and ground with a kind of sugar. In all animals a principle having some analogy with sugar exists in the bile, and it is a product of morbid action in the disease called diabetes.

Oil and fat are also nutritious. They differ most obviously in fluidity, and they coincide in being insoluble in water, and in containing a larger proportion of hydrogen than the alimentary matters already spoken of. The oils may be divided into the fluid and concrete, and both are furnished by the vegetable and animal kingdoms. Fluid oil exists in quantity in the emulsive seeds; in some of them combined with prussic acid, as in the bitter almond, and in others with an acrid matter, as in the seeds of the ricinus; but it is obtained in greatest quantity and purity from the olive. The animal fluid oils are all more or less nauseous, as spermaceti oil, seal oil, whale oil, and cod liver oil. The concrete oils are generally furnished by the animal kingdom, and these are often bland and agreeable when fresh, but are apt to become rancid in proportion as they are less solid. Butter is the least consistent, if we except the fat of some birds; then hog's lard, the subcutaneous fat of beef, and the kidney fat of beef and mutton in succession. The only concrete oil obtained from the vegetable kingdom is the butter of cocoa.

III. *Alimentary Principles which do not contain Carbon.*

Water is perhaps the only real alimentary substance which belongs to this class, but it is one of the most essential. It is not only necessary to replace the constant waste of water which is drained off from our bodies, by the secretions, the cuticular discharge, and the vapour of the breath, but it is in itself strictly digestible, and capable of supplying either hydrogen or oxygen to the system, as may be required, according to the nature of our other food. When we consider how large a proportion of the whole weight of our bodies consists of water only, and that the fluids require more frequent renewal than the solids, the necessity of water as an aliment cannot be disputed. Some animals, as the rabbit, are supposed to be capable of living a long time or altogether without water; but this is a mere deception, for their vegetable food consists almost entirely of water. On the other hand, Dr Fordyce kept gold fishes six months in distilled water, and thought himself warranted in concluding that animals could live in water and air alone. Pouteau allowed some of his patients nothing but water for several weeks, without their falling off; and the histories of shipwrecked mariners prove with how small a portion of solid food man can subsist, provided he has sufficient allowance of water, whilst without water, or a substitute, no quantity of solid food can support man for even a few days.

Earths are, perhaps, not altogether unalimentary. Not to mention the depraved appetite of many young females, and of the dirt-eating negroes of the West Indies, for chalk, cinders, and such substances, earth is sought after and devoured by whole nations. The luxurious Capuans paid a considerable tribute to the Neapolitans for an earth called *Leucogæum*, which they considered necessary for the preparation of a favourite dish, *Alica*. The Tungusses, according to Laxmann, eat a fine clay with rein-deer's milk. Chandler saw the women and children in Samos chewing pieces of steatite as a luxury. La Billardière saw the same practised in New Caledonia, and found edible earth sold in the market in several villages in Java. Throughout all India lime is used along with the betel leaf. Kepler partook of the butter earth, which is eaten with great relish, spread upon bread, by the millstone quarriers of Thuringia; and, lastly, Humboldt has made us acquainted with the existence of a whole nation of earth-eaters, the Ottomacs on the Orinoco.[1] We may

[1] Tableaux de la Nature. Par A. Humboldt, 2 tomes 12mo, Paris, 1808.

Dietetics.

also mention that bird-fanciers find it necessary to supply birds shut up in cages with sand and earth. All these facts, we are aware, might be explained upon principles different from the digestibility of the earthy substances taken into the stomach; and we have no idea that any earthy substances can supply carbon or azote to the system; but we have absolute proof that earthy matter may enter into the circulation, in the growth and absorption of the bony frame of our body, for which phosphate of lime is as necessary as carbon or azote for our soft solids.

Sea Salt is more obviously necessary than earth. Even in insular and maritime situations it is voluntarily used as a condiment by all; but it is only in inland countries, at a distance from the sea, that its necessity is duly appreciated. Muriate of soda enters into the composition of all our fluids, and is thrown off by many of our secretions; hence its waste must be supplied, and where the vegetables are not naturally impregnated with it, it becomes one of the most indispensable articles of our food.

Alimentary substances, as presented to us by nature or prepared by art, may be considered in various points of view.

Digestibility of various alimentary substances.

They differ in regard to digestibility, or the facility with which they are decomposed by the powers of the stomach, to enter into new combinations fitted to repair the waste of the blood. In this particular, also, they may differ in respect to the length of time, or in regard to the digestive power of the stomach, required for their digestion. Thus the digestion of one substance may be slow, though ultimately complete, even in a weak stomach, and that of another quick enough in a strong stomach, although imperfectly digested by one that is weak. In reference to their digestibility, aliments are commonly described as being light or heavy; but in this respect there is very great difference in regard to different individuals, the same substances being light to one and heavy to another, and *vice versa.*

Sir Astley Cooper made some experiments to ascertain the comparative digestibility of different kinds of raw meat without fat; and the following table exhibits the loss 100 parts of each sustained in the stomach of dogs, which were killed, one, two, three, and four hours after being fed.

Pork	10	20	98	100
Mutton	9	46	87	94
Beef	0	34	37	75
Veal	4	31	46	69

In another experiment, after four hours, the digestibility appeared in the following order,—cheese, mutton, pork, veal, beef. Fat appeared to be also much more digestible than cheese; beef than potato, and codfish than beef. Boiled veal was much more digestible than roast; and of different parts of the same kind of food, the digestibility was in the following order,—fat, muscles, skin, cartilage, tendon, and bone.[1] From the experiments detailed in the inaugural dissertation of Dr Macdonald, *De Ciborum Concoctione*, Edinburgh, 1818, which were made in company with the late Dr Gordon, there appears to be great irregularity in the time necessary for the completion of digestion, so that they scarcely furnish any conclusion as to the comparative digestibility of different substances. Dr Macdonald infers that, of those he tried, butter was the most, and rice the least, digestible in the stomach of the dog. In the experiments which Dr Stark made upon himself, to ascertain the nutritious properties of oily substances, he found that, with a daily allowance of thirty ounces of bread and three pounds of water, two ounces of olive oil taken at one meal was so large a quantity as to be disagreeable; three ounces in the day caused some uneasiness in his bowels; and four ounces griped him very much, although he gained weight; but this experiment was not conclusive, as at that time he was suffering under sloughing gums, the effects of a protracted diet of sugar. A diet of four ounces of pure fat, obtained from the subcutaneous fat of beef, made into a pudding, with twenty ounces of flour, and twelve or twenty ounces of water, with the remainder of three pounds of water in drink, was both nourishing and agreeable; but when the fat was increased to six ounces, great part of it passed unassimilated, and his bowels were affected. The same pudding without the suet was not sufficiently nutritious, and did not satisfy his appetite in the same manner. When the pudding was made with butter, although only four ounces were used, he was made very ill by it. Oil of butter agreed very well; and oil of marrow, of all the fats Dr Stark tried, he found to be the mildest in the bowels. His gums having again become purple and swelled, with petechial appearances on his body, while making these experiments, suggested to him the following queries, which seem important to the science of dietetics. "Although at present I take more food than what is absolutely necessary for the support of the body, I remain perfectly well, whereas I have several times suffered considerable inconvenience from committing any excess in the quantity of oils. Is it not evident that excess in the quantity of oils is more hurtful to the body than excess in any other article of food? and that, of course, we ought to be particularly careful in regulating the quantity and quality of the oils we may employ in diet? Is it not probable, then, that animal oils, though they nourish and increase the weight of the body, are not of themselves sufficient to prevent a morbid alteration from taking place in the blood and fluids? whilst, on the other hand, the lean of meat, though less nutritious, is of more efficacy in preserving the fluids of the body in a sound state."[2]

Difference of aliments in respect of nutrition, taste, &c.

Aliments also differ in regard to the proportional quantity of nourishment they furnish, and, in this point of view, they are said to be strong and weak, or rich and poor. This difference may arise either from the proportional quantity of digestible and indigestible parts in the various kinds of aliment, or from the digestible parts being different in kind, and furnishing a supply of a different kind to the blood. There is even in this respect some opposition between light food and strong food, and it may be generally observed, that food which is most quickly digested, requires the soonest to be repeated, while digestible food, that is only slowly digested, supports the body for a greater length of time.

Aliments also differ in the impression they make on our palate; and it is chiefly in this respect that they are considered by the epicure. This impression proceeds from two distinct qualities in the aliment; the one depending upon their grosser physical properties, and the other upon their finer, recognizable only by the senses of taste and smell. To the former class belong the sensations of solid and fluid, hard and soft, tough and tender, crisp and stringy, hot and cold, greasy, glutinous, gritty, smooth, &c. These are judged of by the tongue and palate, rather

[1] A Treatise on the Nature and Cure of Gout and Rheumatism, including General Considerations on Morbid States of the Digestive Organs; some Remarks on Regimen, and Practical Observations on Gravel. By Charles Scudamore, M. D. 8vo, London, 1817.

[2] The Works of the late William Stark, M. D. consisting of Clinical and Anatomical Observations, with Experiments Dietetical and Statistical, revised and published from his original Manuscripts. By James Carmichael Smyth, M. D. 4to, London, 1788.

as organs of touch than of taste, and are altogether independent of flavour, as capable of affecting the organs of taste and smell. The latter class consists of all the variety of tastes properly so called, namely, sweet, bitter, sour, salt, alkaline, astringent, aromatic, nauseous, pungent, acrid, spirituous, cooling, &c., and also the want of taste, the vapid or mawkish. Of these, some are almost universally agreeable, and others generally disliked, but much depends upon idiosyncracy, state of health, education, habit of the individual, and upon the degree or quantity of flavour.

Aliments also differ in the impression made upon the stomach; but the sensations arising from this source are more obscure and less varied. Except the sensation of heat, which may arise from caloric, and is transient, or from acrimony or spirit, which is more durable, most of the sensations experienced in the stomach are indications of its mechanical state, or of affections of the appetite. Hence we have the feeling of gratification, from removal of a sense of emptiness, of repletion, distension, cessation of hunger or thirst, satiety, and sickness.

General observations on diet.

We should also consider the effect of different kinds of diet, when the body is in a state of health, and different states of disease; but accurate experiments are still wanting to enable us to give any thing more than fragments of this interesting subject. It is extremely difficult to institute these experiments satisfactorily. They are irksome to the person on whom they are tried; and so many causes tend to interfere with the results, that it is only by frequent repetition that the real effects can be fairly deduced.

Our diet may be either proper, or it may err, and this either in quantity or quality. When the quantity is too small, the body is not nourished; it becomes lean, the fat disappears, and the muscles either get soft and flabby, or shrivelled and dried up, accompanied by loss of strength or stiffness, with predisposition to an actual disease. Errors in regard to the quantity of food are merely relative; so much depends upon circumstances, as individuality of constitution, period of life, state of health, degree of mental and corporeal exertion, habit and temperature. Each person may be said to have a different standard quantity, deviations from which are to be accounted errors. In our army, the rations allowed for each soldier at home are, three quarters of a pound of meat, boiled so as to afford broth, with 1½d. worth of potatoes and other vegetables, one pound of bread, or one and one eighth pound of oatmeal; and in most cases one pound of milk or coffee is purchased for his breakfast. On service the rations are, one pound of meat, one and a half pound of bread, and one pint of wine or one sixth of a pint of spirits.

Mr Buxton states that the diet allowed to the prisoners in the jails in London varies from fourteen ounces of bread per day, and two pounds of meat per week, which, he says, is not enough to support life, up to one pound and a half of bread, one pound of potatoes, two pints of hot gruel, and either six ounces of boiled meat, without bone, and after boiling, or a quart of strong broth, mixed with vegetables, per day, which is as much more than enough; and Mr Buxton thinks that the meat should be discontinued. A fit prison diet, in his opinion, should consist of one pound and a half of bread, at least one day old, to each prisoner, daily, and one pint of good gruel for breakfast; and, upon good behaviour, half a pound of meat on Sundays.[1]

Some experiments have been made in order to ascertain the quantity of different kinds of food necessary for the sustenance of individuals. Dr Franklin, when a journeyman printer, lived a fortnight on bread and water, at the rate of ten pounds of bread a week. Dr Stark, whose weight was 171 pounds avoirdupois, found that thirty-eight ounces of bread daily were not more than sufficient to satisfy his appetite; forty-eight ounces were the utmost he could consume in one day, and the greatest quantity he could take at one meal, without uneasiness, was thirty ounces; and, with this diet, he required necessarily three pounds of water for drink, for with only two pounds he was not satisfied. In another experiment, thirty ounces of bread and three pounds of water, with six ounces of boiled beef, sufficed: with four ounces of the beef his appetite was not satisfied; with two pounds of bread and three pounds of infusion of tea, he found that one pound of cold stewed beef was not more than sufficient: he was not satisfied with four ounces of beef to breakfast; but eight ounces at dinner, and four ounces at supper, were rather too much.

Absolute starvation produces diminished excretions, fetid breath, foul skin, and death. The most distressing histories of this dreadful end are recorded in the account of shipwrecks, and of those unfortunate persons who fall into the hands of the Arabs of the desert. Man can sustain the absolute want of food for several days, more or fewer in number according to circumstances; the old better than the young, and the fat, probably, better than the lean. The total want of drink can be borne only a very short time, and its effects are even more distressing than those of want of food. They have been strikingly described by Mungo Park and by Ali Bey, as experienced in their own persons. The narratives of shipwrecked mariners also prove with how very little food life may be supported for a considerable length of time; and the history of those impostors who pretend to live altogether without food or drink display this adaptation of the wants of the body to its means of supply in a still more striking manner; for, even after the deception in such cases as that of Ann Moore is exposed, it will be found that the quantity of aliment actually taken was incredibly small.[2]

Captain Woodard has added to his interesting narrative many instances of the power of the human body to resist the effects of severe abstinence.[3] He himself and his five companions rowed their boat for seven days without any sustenance but a bottle of brandy, and then wandered about the shores of Celebes six more without any other food than a little water and a few berries. Robert Scotney lived seventy-five days alone in a boat, with three pounds and a half of meat, three pounds of flour, two hogsheads of water, some whale oil, and a small quantity of salt. He also used an amazing quantity of tobacco. Six soldiers deserted from St Helena in a boat on the 10th of June 1799, with twenty-five pounds of bread and about thirteen gallons of water. On the 18th they reduced their allowance to one ounce of bread and two mouthfuls of water, on which they subsisted till the 26th, when their store was expended. Captain Inglefield and eleven others, after five days of scanty diet, were obliged to restrict it to a biscuit divided into twelve morsels for breakfast, and the same for dinner, with an ounce or two of water daily. In ten days, a very stout man died, having

[1] An Inquiry whether Crime or Misery are produced or prevented by our present System of Prison Discipline. By Thomas Fowell Buxton, M. P. 12mo, Edinb. 1818.

[2] An Examination of the Imposture of Ann Moore, called the Fasting Woman of Tutbury, illustrated by Remarks on other Cases of Real or Pretended Abstinence. By Alexander Henderson, M. D. 8vo, London, 1813. Also, Rev. Leigh Richmond, in Medical and Physical Journal, by Samuel Fothergill, M. D. and William Royston, 469, vol. xxix. 8vo, London, 1813.

[3] The Narrative of Captain David Woodard and Four Seamen. 2d edit. 8vo, London, 1805.

become unable to swallow, and delirious. Lieutenant Bligh and his crew lived forty-two days upon five days' provisions.

In the tenth volume of Hufeland's *Journal*, M. Gerlach, a surgeon-major of the Prussian army, has related a very remarkable and well authenticated case of voluntary starvation. A recruit, to avoid serving, had cut off the fore-finger of his right hand. When in hospital for the cure of the wound, dreading the punishment which awaited him, he resolved to starve himself, and on the 2d of August began obstinately to refuse all food or drink, and persisted in this resolution till the 24th August. During these twenty-two days he had absolutely taken neither food, drink, nor medicine, and had no evacuation from his bowels. He had now become very much emaciated, his belly was somewhat distended, he had violent pain in his loins, his thirst was excessive, and his febrile heat burning. His behaviour had also become timid. Having been promised his discharge unpunished, he was now prevailed upon to take some sustenance, but could not at first bear even weak soup and lukewarm drinks. Under proper treatment he continued to mend for eight days, and his strength was returning, when, on the 1st of September, he again refused food, and assumed a wild look. He took a little barley water every four or five days to the 8th; from that day to the 11th he took a little biscuit with wine; but again, from the 11th September to the 9th October, a period of twenty-eight days, he neither took food, drink, nor had any natural evacuation. From the 9th to the 11th he again took a little nourishment, and began to recruit; but, on the 11th, he finally renewed his resolution to starve himself, and persevered until his death, which took place on the 21st November, after a total abstinence of forty-two days.

On the other hand, the quantity of nourishment which can be devoured with impunity is often very great. Almost every person in good circumstances eats more than is necessary for supporting his body in a state of health, and many bring their stomachs to require a very excessive allowance as almost necessary. In some individuals an inordinate appetite seems constitutional. Charles Domery, aged twenty-one, six feet three inches high, and well made, but thin, when a prisoner of war at Liverpool, consumed in one day four pounds of cow's udder and ten pounds of beef, both raw, together with two pounds of tallow candles and five bottles of porter, and, although allowed the daily rations of ten men, he was not satisfied.[1] Baron Percy has recorded a still more extraordinary instance in a soldier of the name of Tarare, who, at the age of seventeen, being of moderate size, rather thin, and weighing only a hundred and seventy pounds, could devour, in the course of twenty-four hours, a leg of beef twenty-four pounds in weight, and thought nothing of swallowing the dinner prepared for fifteen German boors.[2] But these men were remarkable, not only for the quantity they consumed, but also for its quality, giving a preference to raw meat, and even living flesh and blood. Domery in one year eat 174 cats, dead and alive; and Tarare was strongly suspected of having devoured an infant, which disappeared mysteriously. Many other histories of the same kind are preserved; and although some of the individuals were men of large stature and great strength, others were of ordinary size. The excess of food may be taken either in the form of too much at one meal or of too many meals. It is either digested and furnishes an excess of nourishment, or it passes through the canal simply indigested, or it undergoes the fermentation natural to it. An excess of nourishment either produces a great or rapid increase of the size of body generally, or of the fat and abdominal viscera in particular, or, by inducing great fulness of blood, produces diseases which sometimes counteract the effects of the plethora. When the excess passes simply indigested, it only occasionally proves hurtful as a mechanical irritation in the bowels, especially when it is of a hard substance, and has sharp angles. When it undergoes its natural fermentation this is either acid or putrid, as the substance is vegetable or animal, or rather as it is destitute of or contains a notable proportion of azote.

When diet errs in quality, it gives rise to a greater variety of cases. It may either produce a directly hurtful effect upon the constitution, in the manner of a poison or medicine, in its natural state, or after fermenting in the stomach; or it may prove injurious more indirectly by not supplying an element necessary for its healthy condition, or by supplying one in excessive proportion. The poisonous effects of alimentary substances are always occasional, and arise from a peculiarity in the aliment itself, as in the case of poisonous fishes, or in the individual, as in those persons who cannot eat particular kinds of food, which are to others wholesome and nutritious. The unpleasant effects of substances undergoing their natural fermentation in the stomach are much more frequently observed. They occur either from a very strong disposition in the food to ferment, so that the action of a healthy stomach is not able to restrain it, or from excess of the food, so that part of it is left to its natural changes, or from weakness of the stomach, which exerts little action upon it. Fermenting substances are hurtful, by acting as direct poisons, and by distending the stomach; in the non-azotized substances becoming acid and producing flatulencies, in the azotized substances becoming putrid and producing fetid eructations and flatus. Diet, which errs by supplying one of the elementary constituents of our body in excess, or in not supplying another, does not produce its full effects at once, but gradually changes the condition of the body. When an elementary principle is furnished in excess, it is thrown off by the various excretions, and hence we find that the urine of omnivorous animals, when confined to animal food, contains more urea, and their perspirations and stools are more fetid; while the urea disappears, and the stools and perspirations lose their fetor, when they are restricted to vegetables. The same observations have been made in regard to man. Also, when the supply of an elementary principle is deficient, it ceases to be thrown off by excretion, even after it has performed its functions in the body, but is re-absorbed, and thus the body, for a time, lives as it were upon itself.

The chief varieties of diet, in regard to quality, depend upon their immediate effects, and in this respect they may be divided into the simply nutritious and the stimulant. All animal flesh seems to be more or less stimulant, and, in general, the more so the darker its colour is; and upon this principle chiefly has Dr Darwin founded his classification of aliments, but he has erred in considering them as also more nutritious. Moor-game, pigeon, hare, and venison, are more stimulating, but perhaps not more nutritious, than the turkey or barn-door fowl, veal, or lamb. The effect upon the composition of our bodies is the secondary but most important effect. In this respect, food

[1] Account of a Man who lives upon large quantities of Raw Flesh, by Dr Johnston; in the Medical and Physical Journal, by Drs Bradley, Beatty, and Nohden, vol. iii. 8vo, London, 1800.

[2] Mémoire sur la Polyphagie. See Journal de Médécine, Chirurgie, et Pharmacie, par MM. Corvisart, Leroux, et Boyer, tome ix. 8vo, Paris, An. xiii.

might be divided into the azotized, hydrogenous, carbonaceous, and oxygenous, or rather into those which supply abundantly azote, hydrogen, carbon, and oxygen. This view is, however, chiefly theoretical, as we are very far from possessing facts enough to establish it completely, or to overturn it; but yet there are some which favour it. We have already noticed Magendie's experiments on substances which do not contain azote, from which he inferred that a certain supply of it was absolutely necessary to the support of animal life. Other facts lead to the same conclusion, especially the effect of restriction to one kind of aliment in the generation and cure of disease.

It is many years since Dr Rollo[1] was led, by the singular sweetness of diabetic urine, to conclude that, if he deprived the patient of all food which contained sugar, or the principles of sugar, he should be able to cure this hitherto untractable disease. He accordingly restricted his patients to the use of animal food, especially fat, and absolutely prohibited all vegetables, even bread, and all fermented liquors. The effects were very striking, and some patients were believed to be cured; at least the nature of their urine was completely altered from a morbid to a healthy state. As conducted by others, the same regimen has produced the same effects; but it is so disagreeable to the patients that they can seldom be prevailed upon to adhere to it, and unfortunately, notwithstanding the temporary removal of this prominent symptom, the disease generally continues its fatal course. We may, however, notice, that Rollo and others were guided in their choice of regimen by the principle of withholding the elements of sugar, and hence fat formed a chief part of it, and was a principal cause of the disgust it excited; but perhaps it would be better to select a highly azotized diet, in which point of view the muscular parts of dark-fleshed animals, such as game and old mutton, and those kinds of fish, such as skate, which contain much azote in a loose state of combination, should be selected; while wheaten bread, the want of which is so distressing to many, might be allowed, and fat, which contains no azote, should not be prescribed.

Magendie[2] ascribes the gravel to the superabundance of azote in our food, as the uric acid of which gravel consists is a highly azotized substance, and seems to be produced as a means of throwing off the excessive azote; and among the various causes with which gravel is connected, the most active in its agency is high living, or the use of animal food in excess. A Hanseatic citizen, who kept a good table previous to 1814, was afflicted with the gravel. He emigrated and lived very miserably in England, but his gravel completely left him. He re-established his affairs, and with his fortune his gravel returned. Again he was ruined, and went to France almost destitute, and his gravel disappeared. By industry he finally acquired a competency, and with it his old complaint, for which he then consulted Magendie. A Parisian lady of sixty, subject to gravel, read in a journal a short notice of Magendie's experiments, in which it was said that he had discovered in sugar a cure for the gravel. Without more advice she set about eating sugar, often to the extent of a pound daily, and in effect she removed the gravel, but disordered her stomach so much that she was obliged to resume her usual food, and with it the gravel returned.

The chemical theory of the scurvy is, that it is owing to the want of oxygenous food; and it cannot be denied that this theory has been very ingeniously supported by Dr Trotter, Dr Beddoes, and others. The rapidity with which those afflicted with it recover by the use of recent vegetables, especially the fresh citric acid, shows that it proceeds from an error in diet, but whether from a deficiency of nourishment in general, or from a deficiency of oxygenous aliment, is not quite so clear. When we compare the accounts of the ravages formerly committed by this dreadful disease, even during short voyages, with the almost total immunity which the British fleet has enjoyed since the time of Captain Cook, we have the strongest possible proof of the influence of diet upon the human frame, either as inducing or preventing disease.[3]

Hydrogenous food, such as the excessive indulgence in fat meat, butter, and oil, and still more especially in spirituous liquors, produces a change in the chemical constitution of our bodies, independently of the exhaustion of excitability by excess of stimulus. Bilious diseases, and a tendency to unwholesome fatness, are its most common effects; and it is only in the excessive hydrogenation of the system that we can find a rational explanation of that very singular phenomenon called the spontaneous combustion of the body; for even admitting that the clothes are accidentally set on fire in these cases, there appears no reason to doubt that the combustion is continued by the burning of the body itself. Now the greatest number of instances have occurred in old women addicted to the abuse of ardent spirits.[4]

The effects of oxygenous food, in imparting oxygen to the body, are not so well ascertained. Acids, and the subacid fruits, quench thirst, and are supposed to reduce animal heat; but their more obvious action is to affect the bowels and induce diarrhœa, and ultimately to render the body spare and thin. The new chemical pathology led to the exhibition of nitric acid for the cure of syphilis, as mercury was supposed to act by oxygenizing the system; and this acid has since been much employed also, from analogy, in the liver complaint. That the acid has excellent effects as a tonic, seems to be perfectly ascertained. It does not act upon the bowels like the vegetable acids, but there is no proof of its decomposition in the stomach, or of its imparting oxygen to the body. The oxygenizing of the system by means of the nitro-muriatic or oxymuriatic bath, now so fashionable in London, is a mere chimera. Pulmonary consumption was also, at one time, considered as a disease proceeding from superabundant oxygen, and the florid colour of the cheeks was adduced in proof of it.

No observations have yet been made on the effects of aliments containing an unusually large proportion of carbon, nor has any disease been ascribed to the carbonization of the system.

Peculiar species of regimen called *Training*.

It would extend this article much beyond the space we can allot to it, if we were even hastily to sketch the varieties of diet recommended in disease, and to explain their action; but it will not be superfluous to enter a little into the detail of that kind of regimen which has been found by experience to bring animals and man to the highest possible state of health, at least as measured by

[1] An Account of two Cases of Diabetes Mellitus. By John Rollo, M. D. 2 vols. 8vo, London, 1747.

[2] Recherches Physiologiques et Médicales sur les Causes, les Symptomes, et le Traitement de la Gravelle, 8vo, Paris, 1818.

[3] Observations on the Scurvy. By Thomas Trotter, M. D. 8vo, Lond. 1792. Observations on the Nature and Cure of Calculus, Sea Scurvy, Consumption, Catarrh, and Fever; together with Conjectures upon several other subjects of Physiology and Pathology. By Thomas Beddoes, M. D. 8vo, London, 1793.

[4] An Essay, Medical, Philosophical, and Chemical, on Drunkenness, and its Effects on the Human Body. By T. Trotter, M. D. 8vo, London, 1804. Essai sur les Combustions Humaines produits par une long abus des liqueurs spiritueuses. Par Pierre-Aimé Lair, 12mo, Paris, 1801.

Dietetics.

the amount of their physical force, and their power of continuing its exertions. It is to bring animals to this state that constitutes the business of *trainers*, as they are called. Cocks, greyhounds, race-horses, and men, are much more active and vigorous after being trained than in their ordinary condition. They are, in fact, in a higher state of health; and we are fully convinced that, by training, many diseases might be removed, and by living according to the same principles, general ill health might be commonly prevented. The public is very much indebted to Sir John Sinclair for having taken the pains to collect the fullest information on this subject.[1] He was assisted in his inquiries, we have reason to believe, by Mr John Bell, whose attention was directed to the subject by having the professional care of Captain Barclay during his great walking-match. From the answers procured to Mr Bell's inquiries, it appears that the whole secrets of training reduce themselves to principles which every man may practise, and ought to practise, as far as is consistent with his business and other duties; and, in particular, we think that they ought to be studied, thoroughly understood, and enforced, by all those to whom, in consequence of accidental circumstances, the care of the health and lives of many individuals are intrusted. We allude chiefly to military and naval officers, and the proprietors of large manufactories. In the British navy the importance of this subject has been long appreciated; and the comparative state of health of our fleets, in recent times, is as honourable to our naval commanders as the laurels of victory which encircle their brows. Soldiers are left more to themselves, and their officers have neither the same control nor responsibility; but we think that more might be done in keeping the troops, as well as the military horses, when at home or in garrison, always in a state fit for active service. The evil of not attending to this was very severely experienced during the Spanish campaigns. The artillery horses sent from Chatham were found to be unfit for the fatigues of service, and good cart-horses were at last substituted with great advantage. In garrison both men and horses are over-fed and under-worked. In manufactories the opposite evils sometimes occur; the workmen, and especially the children, are over-worked and under-fed. This subject has lately occupied the attention of parliament; and it is connected with some interesting inquiries, which belong properly to the science of political economy. In a medical point of view, the principle to be followed is, that the food and labour bear a just proportion to each other. When the quantity and quality of the food is not limited by its expense, the best possible condition of the individual is attainable, by attending to the principles upon which training is conducted, and which resolve themselves into temperance without abstemiousness, and regular exercise in the open air. Mr Jackson says, that a man properly trained feels himself light and *corky*, as the technical phrase is; and that, during a course of training, the skin always becomes clear, smooth, well coloured, and elastic; or that cleanness of skin is the best proof of a man being in good condition. Another very striking effect of training is upon the lungs. Trained men can draw a much fuller inspiration, and retain their breath longer, than others. But it is not only on the state of bodily health that the good effects of training are conspicuous; for Mr Jackson distinctly, and we believe correctly, states, that the mental faculties are always improved, the attention is more ready, and the perceptions are more acute. From these observations some valuable hints may be derived by physicians, for the cure of many cutaneous and pulmonary affections, which obstinately resist the power of medicines.

Cookery.

Cookery is strictly a branch of dietetics, and one of the most important. Only a small part of our food is consumed as it is furnished by nature. Many alimentary substances are disagreeable, and some even poisonous, until they have undergone certain preparations. Few of them are to be had at all seasons of the year, although produced at others in greater quantity than can be consumed; and all of them occur of very different qualities. Hence the selection, preservation, and preparation of alimentary substances, are arts of primary importance in life.

We hold the contempt with which cookery is very generally spoken of to be downright affectation, we had almost said hypocrisy; for, in the practice of life, every individual who is not perfectly imbecile and devoid of understanding is an epicure in his own way. The epicures in the boiling of potatoes even are innumerable; and every school-boy in Scotland passes a judgment on the culinary skill of the servant who makes his porridge. Cookery only becomes truly degrading when it occupies an undue proportion of attention; and that epicurism is to be utterly condemned which produces more pain than pleasure. Boswell, the biographer of Johnson, has defined man to be a cooking animal; and, in fact, man is the only animal which does not consume his food as presented to him by nature. We are not from this to conclude that man in cooking deviates from the ordinary course of nature; but that the appetite for cooked food is given to him for wise and useful ends. Count Rumford has not considered the pleasure of eating, and the means that may be employed for increasing it, as unworthy the attention of a philosopher.

"The enjoyments which fall to the lot of the bulk of mankind are not so numerous as to render an attempt to increase them superfluous. And even in regard to those who have it in their power to gratify their appetites to the utmost extent of their wishes, it is surely rendering them a very important service to show them how they may increase their pleasures without destroying their health.

"If a glutton can be made to gormandize two hours upon two ounces of meat, it is certainly much better for him, than to give himself an indigestion by eating two pounds in the same time.

"The pleasure enjoyed in eating depends first upon the agreeableness of the taste of the food; and, secondly, upon its powers to affect the palate. Now there are many substances extremely cheap, by which very agreeable tastes may be given to food, particularly when the basis or nutritive substance of the food is tasteless; and the effect of any kind of palatable solid food (of meat, for instance) upon the organs of taste, may be increased almost indefinitely, by reducing the size of the particles of such food, and causing it to act upon the palate by a larger surface. And if means be used to prevent its being swallowed too soon, which may be easily done by mixing with it some hard and tasteless substance, such as crumbs of bread rendered hard by toasting, or any thing else of that kind, by which a long mastication is rendered necessary, the enjoyment of eating may be greatly increased and prolonged.

"The idea of occupying a person a great while, and affording him much pleasure at the same time, in eating a small quantity of food, may perhaps appear ridiculous to some; but those who consider the matter attentively will perceive that it is very important. It is, perhaps, as

[1] The Code of Health and Longevity, vol. ii. Appendix, No. IV. 8vo, Edinburgh, 1807.

much so as any thing that can employ the attention of the philosopher."

But we shall consider cookery in another point of view, and that one, the importance of which will not be denied by the most austere philosopher. The political economists have extolled agriculture above all other arts, and have obtained the assent of mankind to their dogma, that he who makes two blades of grass grow where only one grew before, is a benefactor to his race. And why? Truly because he thus increases the quantity of food, and enables the world to support a larger population. And is not he who by his skill enables the raw material, whether corn or flesh, furnished to him by the agriculturist, to feed a larger population, or who renders articles alimentary which were formerly rejected, equally a benefactor of his race? Again, every country has its own favourite articles of food, and modes of preparing them; and there is perhaps no subject in regard to which local prejudices are so strong. Now, by bringing these to the test of comparison upon scientific principles, much good would ultimately arise by the gradual introduction into each country of whatever was worthy of imitation in the practice of other nations.

The learned Krunitz, in his voluminous *Economico-Technologic Encyclopedia*, has anticipated many of our views of the subject. "The preparation of good food, and the directions for this purpose contained in cookery books, are commonly very much despised, or rather altogether neglected, by literary men. But in itself cookery does not deserve this contempt, for it is an important part of domestic economy. Upon its due practice depend the health and comfort of families, which must inevitably suffer from errors committed in it. The reason of this contempt is to be found in the manner in which it has hitherto been treated in cookery books, which have been prepared by common cooks, as they are accustomed to dress a ragout. Since the economical arts in general have been discussed scientifically, it is now time that the same attention should be paid to cookery, which is so generally useful, and which is capable of being considered in so many points of view. But then a totally different course from that commonly followed must be pursued. A man of much knowledge, especially physical, chemical, and dietetical, must condescend to apply to the making experiments on vulgar and refined cookery, and collect the whole into a system, as has been done long since in regard to the knowledge and preparation of medicines. What has been written upon dietetics by Zückert, Bergius, Lorry, Plenk, and others, must be compared with the practices in different countries, and a general view of the whole must be drawn up and arranged in systematic order. In regard to the preparations themselves, certain fixed processes and principles are to be determined, general operations to be accurately described, and new improvements to be brought forward. After this the subject might be treated in detail, and a variety, first of simple, then of more compound articles, with the best modes of preparing each as to palatableness, and in relation to effect upon the health, should be perspicuously and thoroughly described. Lastly, their combination into bills of fare, adapted to different ranks in society, modes of life, various tastes, the season of the year, &c. should be pointed out particularly, and with a due regard to good economical arrangements." (A. D.)

DIEU ET MON DROIT, *i.e.*, *God and my Right*, the motto of the royal arms of England, first assumed by Richard I. to intimate that he did not hold his empire in vassalage of any mortal. It was afterwards assumed by Edward III., and was continued without interruption to the time of William, who used the motto *Je maintiendray*, though the former was still retained upon the great seal. After him Anne used the motto *Semper eadem*, which had been before used by Elizabeth; but ever since the time of Anne, *Dieu et mon Droit* has continued to be the royal motto.

DIFF, or DOUFF, an Arabian musical instrument of the same kind as the *tambour de Basque* or tambourine.

DIFFARREATIO, in *Roman Antiquity*, a ceremony by which a marriage which had been contracted by the solemn form of *confarreatio* was dissolved. The word comes from the preposition *dis*, which is used, in composition, for *division* or *separation*, and *farreatio*, a ceremony with wheat, from *far*, wheat or corn. See CONFARREATIO.

DIFFERENCE, in *Mathematics*, the remainder of a sum or quantity after a lesser number or quantity has been subtracted from it.

DIFFERENCE, in *Logic*, an essential attribute, belonging to some species, and not found in the genus; being the idea that defines the species. Thus body and spirit are the two species of substance, which in their ideas include something more than is included in the idea of substance. In body, for instance, are found impenetrability and extension; and in spirit, a power of thinking and reasoning; so that the difference of body is impenetrable extension, and the difference of spirit is cogitation.

DIFFERENCE, in *Heraldry*, a term given to a certain figure added to coats of arms, serving to distinguish one family from another, or to show how distant a younger branch is from the elder or principal branch.

DIFFERENTIAL, in the higher geometry, an infinitely small quantity, so small as to be less than any assignable quantity. It is called a *differential*, or *differential quantity*, because frequently considered as the difference of two quantities; and, as such, it is the foundation of *differential calculus*. Sir Isaac Newton and the English call it a *moment*, from its being considered as the momentary increase of quantity. See FLUXIONS.

DIFFERENTIAL *Equation* is an equation involving or containing differential quantities, as the equation $3x^2dx - 2axdx + aydx + axdy = 0$. Some mathematicians have also applied the term differential equation in another sense, to certain equations defining the nature of facts.

DIFFERENTIAL CALCULUS, or *Method*, a method of finding quantities by means of their successive differences. See FLUXIONS.

DIFFERENTIAL THERMOMETER, an instrument for measuring differences of temperature. See METEOROLOGY.

DIFFORM (*difformis*, from *dis*, asunder, and *forma*, shape), is a word used in opposition to uniform; irregularity in form or appearance; as a difform flower or corolla, the parts of which do not correspond in size or proportion.

DIFFUSION (Lat. *diffundo*, to *pour out*), a spreading or flowing of a liquid or a fluid, as of water, air, light: a scattering or dispersing.

DIFFUSION *of Gases*, a term in chemistry, denoting the mixing, in any relative proportions, of two gaseous bodies which do not act chemically on each other; so that whatever be their relative densities they remain permanently blended. Hence Dalton has represented gaseous bodies as acting as *vacua* to each other.

DIGAMMA, an obsolete letter of the Greek alphabet, equivalent in sound to the English *v*. In the Æolic, and sometimes in the Ionic dialect, the old Greek γ was a kind of aspirate called from the manner of writing it *Digamma* (Ϝ). This aspirate was carried by the Pelasgic race into

Italy, and remained in Latin as a real consonant, V, as may be seen from many words originally Greek, such as Ϝοῖνος, Ϝοῖκος, *vinum*, *vicus*. It disappeared from the Greek tongue so early that it ceased to be written in the Homeric poems; and many even deny its influence in softening the *hiatus*, while others allow this effect even in Pindar.

DIGBY, Sir Kenelme, an eminent English philosopher, was born at Gothurst, Buckinghamshire, in 1603. He was descended from an ancient and illustrious family. His great-grandfather had distinguished himself at Bosworth on the side of Henry VII.; and his father, Sir Everard Digby, was one of the leading Roman Catholic gentry at the time of the Gunpowder Plot. Having risen in arms on that occasion, Sir Everard was apprehended, tried, and executed at London, Jan. 27, 1606. The young philosopher was thus three years old at his father's death, and was educated by his guardians in the Protestant faith. Having finished his education at Oxford, he went abroad in 1621; and on his return he received from Charles I. the appointments of gentleman of the bed-chamber, commissioner of the navy, and governor of Trinity House. At the head of a small squadron he sailed in 1628 against the Algerines, and afterwards defeated the Venetians near the port of Scanderoon. During a brief stay in Paris, he joined the Church of Rome. Having returned to England in 1638, he espoused the cause of the king, and was imprisoned in Winchester House by order of the parliament. He was, however, liberated in 1643, and retired to France, where he was taken into the confidence of the court, and enjoyed the friendship of Descartes and other learned men. Here he wrote his *Treatise on the Nature of Bodies*, his *Treatise on the Soul*, *Peripatetick Institutions*, and other works. He visited England during the Protectorate of Cromwell, and seemed to be more zealous for the advancement of the interests of the Commonwealth than befitted a staunch royalist. At the Restoration he returned finally to London, where he died in 1663. He married Venetia Anastasia, the daughter of Sir Edward Stanley of Shropshire, "a lady of an extraordinary beauty and of as extraordinary a fame." His whimsical experiments to preserve her beauty procured him as much notoriety as his sympathetic powder for the cure of wounds at a distance. Besides the works already mentioned, Digby wrote *A Conference about a Choice of Religion*, Paris, 1638; Letters on the same subject, Lond. 1651; *Observations on Religio Medici*, Lond. 1643; *A Treatise of Adhering to God*, Lond. 1654; *On the Cure of Wounds by the Powder of Sympathy*, Lond. 1658; and a *Discourse on Vegetation*.

DIGENTIA, now the *Licenza*, a small river of Italy, flowing into the Anio about nine miles from Tivoli. In a historical point of view, the Digentia is quite unimportant, but it is highly interesting as the stream on whose banks Horace's Sabine farm was situated. Numerous allusions to the Digentia and the surrounding scenery occur in the works of that poet. The whole topography of this interesting district will be found fully discussed in Champy's *Maison d'Horace*, and in Milman's *Life of Horace*.

DIGEST (*Digestum*), a collection of the Roman laws, arranged and digested under proper titles, by order of the Emperor Justinian. See Civil Law.

DIGESTER, a strong metal vessel with an air-tight lid furnished with a safety valve, in which substances may be subjected to a very much higher temperature than in the ordinary method of boiling. This apparatus is figured and described under the head Steam.

DIGESTION, in the animal economy, is the dissolution of the aliments into such a state as renders them fit to pass into the lacteal vessels, and thence into the blood. See Gastric Juice.

Digestion, in *Chemistry*, the operation of exposing bodies to a gentle heat in order to assist their action upon each other; or the slow action of a solvent on any substance.

DIGGES, Leonard, an able mathematician in the sixteenth century, was born at Digges Court, in the parish of Barham, Kent, and was educated at Oxford. He was the author of the following works: viz., *Tectonicum, briefly showing the exact Measuring and speedy Reckoning of all manner of Lands, Squares, Timber, Stones, Steeples*, &c., 1556, 4to; a geometrical practical treatise, named *Pantometria*, in three books, published posthumously by his son in 1591; and *Prognostication Everlasting of right good effect, or Choice Rules to judge the Weather by the Sun, Moon, and Stars*, &c., 4to, 1555, 1556, and 1564; afterwards corrected and augmented by his son, 4to, 1592. Digges died about 1574.

Digges, *Thomas*, only son of the preceding, and one of the ablest mathematicians of his age. He was sent by Queen Elizabeth as muster-master-general of the British forces in the Netherlands, and thus acquired an extensive and accurate knowledge of military affairs. He died in 1595.

Besides revising, correcting, and enlarging some of his father's works, he wrote *Alæ sive Scalæ Mathematicæ, or Mathematical Wings or Ladders*, 1573, 4to; *An Arithmetical Military Treatise*, containing so much of Arithmetic as is necessary towards military discipline, 1579, 4to; *A Geometrical Treatise, named Stratioticos, requisite for the perfection of Soldiers*, 1579, 4to; *A perfect Description of the Celestial Orbs, according to the most ancient doctrine of the Pythagoreans*, &c., placed at the end of his father's *Prognostication Everlasting*, printed in 1592, 4to; *A humble motive for association to maintain the Religion established*, 1601, 8vo—to which is added, his *Letter to the same purpose to the Archbishops and Bishops of England; England's Defence*, or, *a Treatise concerning Invasion*, a tract of the same nature with that printed at the end of his Stratioticos, and called a *Briefe Discourse*, &c., but not published till 1686; A letter printed before Dr John Dee's *Parallaticæ Commentationis praxeosque nucleus quidam*, 1573, 4to. Besides these and his *Nova Corpora*, he left several mathematical treatises ready for the press, which, by reason of law-suits and other engagements, he was prevented from publishing.

DIGGING, among miners, the operation of freeing ore from the bed or stratum in which it lies, where every stroke of their tools turns to account; in contradistinction to the openings made in search of ore, which are called *hatches*, or *essay-hatches*, and the operation itself named *tracing of mines*, or *hatching*.

DIGIT (Lat. *digitus*, a *finger*), the measure of a finger's breadth, or three-fourths of an inch.

Digit, or *Monade*, in *Arithmetic*, any integer under ten, as, 1, 2, 3, 4, 5, 6, 7, 8, 9, and by means of which all numbers are expressed.

Digit, in *Astronomy*, the twelfth part of the diameter of the sun or moon; a term used to express the quantity of an eclipse. Thus an eclipse is said to be of six digits when one-half of the disk is hid.

DIGITALIS, a genus of scrophulariaceous plants. See Botany.

DIGLYPH, in *Architecture*, a kind of imperfect triglyph, console, or the like, with two channels or engravings, either circular or angular.

DIGNE (the ancient *Dina* or *Dinia*), a town of France, capital of the department of Basses-Alpes, and of a cognominal arrondissement, is situated at the foot of the Alps, on the left bank of the Bleone, 55 miles N.E. of Aix. Pop. (1851) 4119. The streets are generally narrow, crooked, and filthy, and the houses mean. The principal buildings are the cathedral and bishop's palace. Digne is the seat of courts of primary instance, assize, and commerce, a communal college, agricultural society; and has a public library, tanneries, and some trade in cattle and agricultural and garden produce. In the vicinity are saline springs in some repute.

DIGNITARY, a person who holds an ecclesiastical benefice or dignity which gives him some pre-eminence over mere priests; as a bishop, dean, archdeacon, prebendary, &c.

DIGNITY, as applied to the titles of noblemen, signifies

honour and authority. Dignity may be divided into superior and inferior; as the titles of duke, marquis, earl, baron, &c., which are the highest of dignities, and those of baronet, knight, serjeant-at-law, &c., which are the lowest. Nobility only can give so high a name of dignity as to supply the want of a surname in legal proceedings; and as the omission of a name of dignity may be pleaded in abatement of a writ, so it may also be where a peer who has more than one name of dignity is not named by the most noble. No temporal dignity of any foreign nation can give a man a higher title in this country than that of esquire.

Dignity, in the human character, the opposite of meanness.

DII, the divinities worshipped by the ancient inhabitants of the earth, were very numerous. Every object which caused terror, inspired gratitude, or bestowed affluence, received the tribute of veneration. Man saw a superior agent in the stars, the elements, or the trees; and supposed that the waters which communicated fertility to his fields and possessions were under the influence and direction of some invisible power inclined to favour and to benefit mankind. Thus arose a train of divinities, which imagination arrayed in different forms, and armed with different powers. They were endowed with understanding, and actuated by the same passions as men; and these creations of superstition were appeased or provoked in the same manner as the imperfect being who gave them birth. Their wrath was mitigated by sacrifices and incense, and sometimes human victims bled to expiate a crime which superstition alone supposed to exist. The sun, from its powerful influence and animating nature, first attracted the notice and claimed the adoration of the uncivilized inhabitants of the earth. The moon also was honoured with sacrifices and addressed in prayers; and after immortality had been liberally bestowed on all the heavenly bodies, mankind classed amongst their deities the brute creation, and the cat and the sow shared equally with Jupiter himself, the father of gods and men, the devout veneration of their votaries. This immense number of deities has been divided into different classes, according to the will and pleasure of the mythologists. The Romans, generally speaking, reckoned two classes of the gods, the *dii majorum gentium* or *dii consentes*, and the *dii minorum gentium*. The former were twelve in number, namely, six males and six females. (See Consentes.) In the class of the latter were ranked all the gods who were worshipped in different parts of the earth. Besides these, there were divinities called *dii selecti*, sometimes classed with the twelve greater gods; these were Janus, Saturn, the Genius, the Moon, Pluto, and Bacchus. There were also some called demigods, that is, persons who were considered deserving of immortality by the greatness of their exploits, or for their uncommon services to mankind. Amongst these were Priapus, Vertumnus, Hercules, and those whose parents were some of the immortal gods. Besides these, all the passions and the moral virtues were reckoned as powerful deities; and temples were raised to a goddess of concord, of peace, and the like. According to Hesiod, there were no less than thirty thousand gods that inhabited the earth, and were guardians of men, all subservient to the power of Jupiter. To these deities succeeding ages added an almost incredible number; and indeed they were so numerous, and their functions so various, that we find temples erected, and sacrifices offered, to *unknown gods*. It is observable that all the gods of the ancients had lived upon earth as mere mortals; nay even Jupiter, who was the ruler of heaven, is represented by the mythologists as a helpless child; and we are acquainted with all the particulars which attended the birth and education of Juno. In process of time not only good and virtuous men, who had been the patrons of learning and the supporters of liberty, but also thieves and pirates, were admitted amongst the gods; and the Roman senate courteously granted the honour of apotheosis to the most cruel and profligate of their emperors.

DIIAMBUS, in the *Ancient Poetry*, a double iambus, as *sĕvērĭtās*.

DIJON (the ancient *Dibio, Divio, Divionense Castrum*), a town of France, formerly the capital of the duchy of Burgundy, now of the department of Côte d'Or, and of an arrondissement of its own name. This town is of considerable antiquity, and is said by some to have been in existence previous to the Roman Conquest; but if so, it must have been a place of small importance. The more common opinion is, that it was founded by Marcus Aurelius, by whom it was also surrounded with walls, flanked with towers. It was considerably enlarged and improved by Aurelian about 274. It seems to have been, probably about this time, important for its manufactures of iron, from an inscription found here which speaks of the inhabitants as, "*Fabri Ferrarii Dibionenses.*" Dijon, if not the capital, was at least one of the principal towns of the first kingdom of Burgundy. It was destroyed by fire in 1137, but rebuilt twenty years afterwards; and from 1179 to the death of Charles the *Rash* it was the ordinary residence of the dukes of Burgundy.

Dijon is situated in a pleasant and fertile plain at the foot of the Côte d'Or mountains, 105 miles N. of Lyons, and 160 S.E. of Paris; in 47. 19. 25. N. Lat., and 6. 2. 5. E. Long. It is surrounded by ramparts planted with trees, and has five gates. Outside the walls are avenues, parks, and other agreeable promenades. Its southern walls are washed by the Ouche; and the small stream of Suzon traverses it from N. to S. by a channel under the streets, and contributes greatly to the cleanliness for which this town is remarkable. Dijon is generally well built, the streets are wide and well paved, and the houses neat and built of freestone. It contains many remarkable buildings, some of them of great antiquity. The present cathedral, dedicated to St Benigne, was rebuilt in 1271, the previous edifice having been founded in the fifth century. It is a fine specimen of the Gothic style, contains some handsome monuments, and is surmounted by a light and elegant wooden spire 330 feet in height. The church of Notre Dame is a singularly fine specimen of the purest Gothic, and is remarkable for the boldness of its construction. The portal of the church of St Michael is composed of three circular arches, with a very fine frieze above. Many of the ancient churches have been converted into stables, warehouses, &c. That of St Etienne is now used as a covered market, and St Philibert as cavalry barracks; some of these, however, are still worthy of notice for their architecture, as St Jean, which is remarkable for the span of its roof. The palace of the dukes of Burgundy has had its principal front modernized, but otherwise it still retains most of its ancient features. It is now used as public offices, and a portion of it is allotted to an extensive museum. It is surmounted by lofty towers, now used as an observatory. The castle, commenced by Louis XI., and finished by Louis XII. in 1513, became in the eighteenth century a state prison, in which the duchess of Maine, Mirabeau, and others were confined; and now serves as a barracks for the *gens-d'armes*. Dijon is the seat of a bishop, a royal court, tribunals of primary instance and commerce, and of a university and academy, having faculties of law, science, and literature; and has a special school of the fine arts, a royal college, a primary normal school, a seminary, a royal academy of sciences and *belles-lettres*, a botanic garden, agricultural society, and a public library of upwards of 40,000 vols. It has manufactures of woollen, linen, and cotton goods, hats, leather, soap, vinegar, mustard, starch, and brandy; but its principal dependence is on the wine trade, being the chief depôt and market for the sale of Burgundy. Dijon has produced a number of cele-

brated men, of whom may be mentioned Bossuet, Crebillon, Longepierre, and Daubenton. Pop. (1851) 28,998.

DIIPOLEIA, in *Grecian Antiquity*, the name of a festival. See BUPHONIA.

DIKE (Δίκη), the goddess of justice, was, according to Hesiod, the daughter of Jupiter and Themis. The special office of Dike was to punish injustice and to reward virtue. She regarded with particular abhorrence all unjust judges, whose misdemeanours she instantly reported to Jupiter. In the oldest works of art, as for instance the chest of Cypselus, Dike is represented as a young and handsome female, dragging with one hand an old and ugly hag, Adikia (Injustice), while in the other she holds a staff with which to beat her. In the dramas of the three great tragedians of ancient Greece, the idea of Dike or retribution is wrought out with great care, and sometimes, as by Æschylus, with very great success.

DIKE, or *Dyke*, in its primary sense, denotes a ditch or drain. The word seems to have been formed from the verb *to dig;* though others derive it from the Dutch *dijk*, a dam, sea-bank, or wall. It is generally used to signify a work of stone, timber, or fascines, raised to oppose the entrance or passage of the waters of the sea, a river, lake, or the like. Junius and Ménage conceive the Flemish to have borrowed their word from the Greek τεῖχος, *wall;* but Guichard derives it from the Hebrew *dayhah*.

Dyke is also a geological term denoting a mass of unstratified or igneous rock, such as trap, granite, or lava, which appears as if injected into rents and fissures in the stratified rocks. Veins of basalt, greenstone, &c., sometimes present the appearance of walls, standing detached on the surface of a country.

DILAPIDATION, in *Law*, signifies both a wasteful destroying, and the suffering buildings to fall to decay for want of necessary repairs. If a clergyman neglect to repair any house or building belonging to his benefice, the bishop may sequester the profits thereof for that purpose; and in such a case a prosecution may be brought, either in the spiritual court or at common law, against the incumbent himself, or against his executor or administrator. Dilapidation extends also to the waste or destruction of wood, &c.

DILATATION, the act of expanding; a spreading or enlarging in every direction. It is opposed to contraction; and differs from extension, as the latter is applied to lines and surfaces. A line is *extended*; a balloon or an artery is *dilated*.

DILEMMA, in *Logic*, an argument equally conclusive by contrary suppositions. Hence, used to signify any difficult or doubtful state of things, which renders one uncertain what course to pursue.

DILETTANTE (Italian), an admirer of the fine arts; or one who delights in promoting the fine arts.

DILIGENCE, in *Scots Law*, a general term for the process by which persons, lands, or effects are attached on execution, or in security for debt.

DILL, an annual plant, *Anethum graveolens*. It is cultivated for its aromatic seeds, which are used medicinally as a carminative.

DILLENBURG, a town in the duchy of Nassau, capital of a bailiwick of the same name, situated on the Dill, an affluent of the Lahn, 16 miles N.W. of Wetzlar. It is the seat of a court of appeal; and has manufactures of tobacco and potash. In the vicinity is an extensive copper foundry. Pop. 2600.

DILLENIUS, JOHN JAMES, a distinguished botanist of the eighteenth century, who may be called the father of cryptogamic botany, was born at Darmstadt in 1687. He was educated as a physician in the university of Giessen; but his attention was very early diverted from medical studies to the observation and discrimination of plants; nor does he appear to have ever followed any branch of the practice of physic. In botany he was strictly a practical observer, having addicted himself but little to the principles of classification, and not at all to the physiology of vegetables. Some branches of zoology occasionally engaged him, which in their native situations can hardly escape an assiduous collector of plants, so closely are these studies, especially that of insects and the lower tribes of animated beings, connected with botany. Dillenius, whilst at Giessen, wrote several papers for the *Ephemerides Naturæ Curiosorum*, on American plants naturalized in Europe, on coffee, on opium obtained from poppies in Germany, with some minute critical remarks on *Spergula pentandra*, as well as on various cryptogamous plants. He published also a paper on leeches, and on two species of *papilio*. He printed at Giessen in 1719 his *Catalogus Plantarum sponte circa Gissam nascentium*, a valuable little octavo volume, with figures drawn and engraved by his own hand, of the parts of fructification, particularly designed to illustrate the generic characters of plants previously not well arranged or understood. In this work he established many new genera, which have for the most part kept their ground. His great merit as a general botanist consisted in a constant attention to the only sound principle of scientific botany, the discrimination of *genera* by the parts of the flower and fruit. This principle, first proposed by the great Conrad Gesner, Dillenius applied to practice, with a severer judgment and closer attention than perhaps any other person from Gesner to Linnæus. The little book in question is arranged most inconveniently according to the times of the plants flowering. In the preface, however, he enters into the subject of classification, a subject to which young botanists are generally prone, but of which they as generally, after having embroiled it, take their leave, in proportion as they acquire more practical knowledge. Dillenius so far displayed his judgment, that he rather showed the faults of the systems of Tournefort, Knaut, and Rivinus, than offered anything of his own. This led him into some controversies, from which he soon disengaged himself, and never subsequently took up the question at all.

The great William Sherard, while returning in 1718 from Smyrna through Germany, met with Dillenius, whose scientific merit could not have escaped so eminent a botanist. He brought him to England in 1721, and excited him to publish, in 1724, that valuable enlarged edition of Ray's *Synopsis* of British plants, which has ever since been in general use, and which the editor enriched with engravings of his own. In this publication, compared with the *Catalogus* of the plants of Giessen above mentioned, we cannot but perceive the difference between an author working upon his own original materials, and the commentator or illustrator of the labours of another. Though Dillenius made numerous and correct additions to Ray's work, in the cryptogamic tribes at least, he rather confused than improved the other parts of the book, especially with regard to synonyms, in which department he was never supremely accurate.

In 1732, Dillenius published his magnificent *Hortus Elthamensis*, in two volumes folio, containing 324 plates, engraved on pewter, with his own hand. Their merit consists in their very great precision and fidelity. The descriptions, and historical as well as botanical remarks, render this a classical book in botany. Its style is good, and the whole performance is worthy of the author, and of his eminent patron, whose brother, Dr James Sherard, was the owner of the garden at Eltham, which furnished the rich materials of this publication. Before this book appeared, its author was established at Oxford, in the new professorship founded there by the will of William Sherard, who died in August 1728, and who left L.3000 for the purpose, besides his own library, manuscripts, and ample herbarium.

Dillenius took the degree of M.D. in this university in 1735, though he had previously obtained the same rank at Giessen; and he now devoted himself to the completion of the *Pinax*, or universal collection of synonyms, which was Sherard's chief object in this foundation. The work was never finished; for indeed neither Dillenius nor any one else could even at that time be competent to it: still less, as botanists and botanical works multiplied excessively, was this undertaking practicable. The publications of Linnæus soon rendered it unnecessary. That illustrious foreigner in 1736 visited Dillenius, who was desirous of fixing him here as his coadjutor; but to this scheme there were several impediments. Nevertheless these distinguished men continued ever after in correspondence, certainly to the advantage of their common study, except in one but too important instance. We allude to the theory of the fructification of mosses, in which Linnæus implicitly adopted the faulty opinion of the Oxford professor, contrary to his own better observation and judgment, taking the capsule for the anther. This leads us to mention the immortal work on which the fame of Dillenius rests, and which, in its way, will never be excelled, the *Historia Muscorum*, published in 1741, in one quarto volume, with eighty-five plates, drawn and engraved by the author. In this performance, laborious investigation, acute discrimination, supreme accuracy, and profound learning, are displayed beyond all example or comparison. Following inquirers, like the celebrated Hedwig, may, with better helps, have examined the same objects more deeply; but none has taken so complete a view of the subject, nor made so very few mistakes. No botanical book perhaps is so perfect in synonyms. Whether the labour of this undertaking was too much for the health of its author, or whether his sedentary mode of life was, on the whole, injurious, we have no particular information; but he began, soon after the publication of the *Historia Muscorum*, to complain of ill health and advancing age. He was of a short stature and corpulent habit, and died of an apoplexy April 2, 1747, in his sixtieth year. A picture of this distinguished botanist is preserved in the picture-gallery at Oxford, from which a print has been published in Sim's and König's *Annals of Botany*, vol. ii. Dillenius is said to have been amiable and respectable in his private character. He never married. His books and collection of mosses referring to his great work, with many drawings, especially of *Fungi*, were bought by his successor Dr Humphrey Sibthorp, and added to the Sherardian Museum, where they still remain. (J. E. S.)

DILLINGEN, a town of Bavaria, in the circle of Suabia, on the left bank of the Danube, 24 miles N.W. of Augsburg. Pop. 3500. It was formerly the ordinary residence of the bishops of Augsburg, and the seat of a university founded in 1552, but abolished in 1804. It has a lyceum, gymnasium, and other schools, 4 churches, 2 chapels, 2 monasteries, an orphan asylum, ship-building docks, paper mills, and some trade. There is also a small town of this name in Rhenish Prussia, 26 miles south of Treves.

DILUTE, to render liquid, or more liquid, or to weaken the strength by the addition of a fluid that is thinner or weaker. The fluids thus added are called *diluents*.

DILUVIAL, pertaining to, or effected by, a flood or deluge; a term used more especially with reference to the great deluge in the days of Noah.

DIMACHÆ (δις, *double*, and μάχομαι, *I fight*), in *Antiquity*, Macedonian horsemen, who sometimes fought also on foot, like our dragoons. This species of troops was first introduced by Alexander the Great.

DIMENSION, in *Geometry*, denotes either length, breadth, or thickness. A line has one dimension, or length; a superficies two, length and breadth; and a solid has three, length, breadth, and thickness.

DIMINUTION, in *Architecture*, the gradual decrease in the diameter of the shaft of a column from the base to the capital.

DIMINUTION, in *Music*, is the abating something of the full value or quantity of any note.

DIMINUTIVE, in *Grammar*, a word formed from some other, either to diminish its force or to signify that a thing is little in its kind. Thus, *cellule* is a diminutive of *cell*, *globule* of *globe*, *hillock* of *hill*.

DIMISSORY LETTER (*Literæ Dimissoriæ*), in the canon law, a letter given by a bishop to a candidate for holy orders having a title in his diocese, directed to some other bishop, and giving permission for the ordination of the bearer.

When a person produces letters of ordination or tonsure conferred by any other than his own diocesan, he must, at the same time, on pain of nullity, produce the letter dimissory given by his own bishop. Letters dimissory cannot be given by the chapter, *sede vacante;* this being deemed an act of voluntary jurisdiction, which ought to be reserved to the successor.

DIMITY, a kind of cotton cloth similar in fabric to fustian, but less stout, and frequently ornamented with crossbars or stripes. It was originally imported from India, but is now extensively manufactured in Britain, especially in Lancashire.

DIMSDALE, THOMAS, Baron, an English physician, greatly distinguished by his practice of inoculation for the smallpox, was the son of a surgeon and apothecary at Theydon-Gernon, in Essex, and was born in 1712. His family belonged to the society of Quakers; and his grandfather, after having accompanied William Penn to America, had returned and settled in his native village. Thomas was educated for the medical profession, and commenced his practice at Hertford about 1734. Here he married the only daughter of Nathaniel Brassey, an eminent London banker; and at her death in 1744 he became assistant physician to the forces under the Duke of Cumberland, and continued with the army till the surrender of Carlisle. Having returned to Hertford, he married, in 1746, Anne Iles, and by her fortune he was enabled to retire from practice. He afterwards resumed it, and took the degree of doctor of medicine in 1761. His reputation procured him an invitation to inoculate the Empress Catherine of Russia and her son in 1768; and for his services he was rewarded with the appointments of counsellor of state and physician to her Majesty, with an annuity of L.500. He was also raised to the rank of a Russian baron, and received a present of L.10,000, besides miniature pictures of the empress and her son. After having inoculated great numbers of the inhabitants of Moscow, he went to the court of Frederick II. king of Prussia, at Sans Souci, and thence returned to England. In 1776 he published his treatise on inoculation, a work which was translated into all the modern languages, not excepting the Russian, and widely circulated over the Continent. In 1779 he lost his second wife; but afterwards married Elizabeth, daughter of William Dimsdale of Bishops-Stortford, who survived him. He was elected representative of the borough of Hertford in 1780, and went again to Russia in 1781, to inoculate some of the imperial family. On returning to England, he again fixed his residence at Hertford, where he died, Dec. 30, 1800, after an illness of about three weeks.

DINAGEPORE, a town in Hindustan, the principal place of the British district of the same name within the jurisdiction of the lieutenant-governorship of Bengal, is situate on the left bank of the Pernabubah river, 260 miles north of Calcutta. The town has no public buildings deserving particular notice; but it is clean and well watched, and contains a population of 30,000. The district of which this place is the capital is bounded on the N.E. by the native state of Bhotan; E. by that of Cooch Behar and the British district of Rungpore; S. by Bograh, Rajeshaye,

and Malda; W. by Purneah; and N. by the British territory of Darjeeling. It extends from Lat. 24. 53. to 26. 38., and from Long. 88. 2. to 89. 16. Area 3820 square miles. This district possesses a soil much diversified; and the face of the country has a waving appearance, being divided into small valleys, each about two or three miles broad. Besides the Pernabubah already mentioned, the principal rivers are the Teesta, Attree, Jabuna, and Curateea. The district is moreover intersected by numerous smaller streams, which in the rainy season overflow the low lands, and swell into large lakes fifty or sixty miles in length, which, while the Ganges is in flood, have no outlet; and thus are so much increased as to be navigable for vessels of considerable burden. After the inundation these low lands become covered with a luxuriant pasture, on which are fed numerous buffaloes, and large herds of other cattle; or with rich crops of rice, which is the great staple of agriculture; besides tobacco, indigo, and hemp. The land does not answer for wheat or barley. The soil of the elevated portions of the country is in general a stiff clay, in some places black and porous, in others stiff and tenacious. Many sorts of fibrous plants for cordage and sackcloth are sown in April, May, and June. Several sorts of pulse are also sown at the commencement of the cold season; and, where the soil is good, the sugar cane is planted in February and March. The inhabitants are in general extremely poor, and their farming utensils are proportionally rude. They are in the proportion of seven Mussulmans to three Hindus. Among both marriages take place at a premature age; the effects of which are stated to be manifested in the deterioration of the inhabitants, who are described as a weak and puny race. The population has been estimated at 1,200,000. Dinagepore constituted one of the provinces of the empire of Delhi, and was transferred with the remainder of Bengal to the East India Company in 1765, by the grant of the emperor Shah Alum. The town of Dinagepore is in Lat. 25. 34., Long. 88. 38. (E. T.)

DINAN, a town of France, capital of an arrondissement of the same name, in the department of Côtes-du-Nord, pleasantly situated on an eminence near the left bank of the Rance, 32 miles E. of St Brieuc. It is surrounded by walls of great thickness, and is defended by an old castle. The town is ill-built, and the streets are generally narrow and dirty, though some of them have lately been much improved. Dinan is the seat of a court of primary instance; and has a communal college, hospital, concert-hall, public library, and manufactures of sailcloth, cottons, hats, shoes, leather, &c. Vessels of from 70 to 90 tons come up to the town, and a considerable trade in butter, hemp, thread, &c., is carried on. Dinan is connected with Rennes by means of the canal of Ille-et-Rance. Pop. (1851) 7732.

DINANT, a town of Belgium, province of Namur, and capital of a cognominal arrondissement, on the Meuse, 12 miles S. of Namur. It occupies the declivity of a rocky hill, the summit of which is crowned by a castle; and has a Gothic cathedral richly decorated in the interior, two hospitals, and a Latin school; besides salt refineries, tanneries, breweries; and oil, flour, hemp, and paper mills, and mills for cutting and polishing marble. Pop. (1851) 6867. Dinant is a place of great antiquity, for we find that a church was consecrated here in 558, and a second in 604. It did not, however, rise to any great importance till the eleventh century. In the twelfth century it was fortified, and was considered a place of great strength. In 1466 Philip the Good, duke of Burgundy, took and destroyed the town and its fortifications; but, three years later, his successor, Charles, allowed it to be rebuilt. It was taken and pillaged by the French in 1554, and again in 1675. By the treaty of Ryswick in 1697 it was restored to the Bishop of Liège, but was again taken by the French in 1794, and became the capital of an arrondissement in the department of Sambre-et-Meuse.

DINAPOOR, in Hindustan, a town in the British district of Patna, within the jurisdiction of the Lieutenant-Governor of Bengal, and situate on the right or south back of the Ganges. It has a military cantonment belonging to the British, consisting of two handsome squares, built of brick, and capable of containing 1200 European soldiers, and the European officers of the native corps. There is also a capacious and handsome church. Pop. exclusive of the military, estimated at about 16,000. Distant W. of Patna 10 miles. Lat. 25. 37.; Long. 85. 7. (E. T.)

DINARIC ALPS. See ALPS.

DINDIGUL, a district in the south of India, situated between the 10th and 11th degrees of N. Lat. To the N. it has Coimbetoor and Kistnagherry; to the S. Travancore and Madura; on the E. the Polygar territory and Madura; and on the W. Travancore, Cochin, and Malabar. The principal rivers are the Noil and the Amravati; and the chief towns Dindigul, Balny, and Palapetty. This district was conquered by the Mysore government in 1757. It was taken possession of by the British in 1783, and subsequently restored to Tippoo Sultan. In 1792 it was again ceded to the British, and is now included in the collectorship of Madura. The capital is of the same name. It is a place of considerable consequence, and possesses a strong fortress situated on a rock. Its population, exclusive of the military, has been returned at 6550. Elevation above the sea, 700 feet. E. Long. 78. 5.; N. Lat. 10. 22. (E. T.)

DINDING, a small island in the Straits of Malacca, at the entrance of the river Pera, about twenty miles in circumference. E. Long. 100. 36; N. Lat. 4. 15.

DINDYMENE, a surname of Cybele; probably derived from Mount Dindymus in Phrygia.

DINGLE, a market-town of Ireland, country of Kerry, on the N. side of Dingle Bay, 8 miles E. of Dunmore Head. It carries on some trade in corn and butter with Liverpool, but the harbour is only fit for small vessels. In the seventeenth century Dingle carried on a considerable trade with Spain, and many of the houses are built in the Spanish fashion. The linen manufacture, formerly extensively carried on here, is now all but extinct. Pop. (1851) 3261.

DINGWALL, a royal burgh of Scotland, and capital of the county of Ross; 15 miles N.W. from Inverness, and 182 from Edinburgh. It lies in a low situation at the mouth of a glen opening into the north side of the Cromarty Frith, near the western extremity of that estuary. The town is rather neatly built, and consists of one main street, from which several smaller ones branch off. The town-house is a curious old building, with a spire and clock. The Established church is a plain edifice, on the north side of the town; and near it stands an obelisk, 57 feet in height, erected to the memory of the first Earl of Cromarty, who was buried here. The harbour was formerly some distance from the town; but in 1815–17 a canal was formed, by means of which vessels of considerable burden are brought to the immediate vicinity of the town. It is, however, a place of little or no trade. Near the harbour formerly stood the mansion of the powerful family of Ross; but of this princely structure only a few fragments remain. Dingwall was created a royal burgh by Alexander II.; and its charter was renewed by James IV. It is governed by a provost, two bailies, a dean of guild, treasurer, and ten councillors; and unites with Tain, Dornoch, Wick, Kirkwall, and Cromarty, in returning one member to the imperial parliament. Market-day, Friday. Pop. (1851) 1990.

DINKELSBUHL, a fortified town of Bavaria, and the capital of a bailiwick in the circle of Middle Franconia, on the Wernitz, 20 miles S.W. of Anspach. It was formerly a free imperial city, and now contains about 5500 inhabitants, engaged chiefly in the manufacture of woollen cloths, hats, stockings, and leather.

DINNER, the principal meal of the day. The word is derived from the French *disner*, which Du Cange derives from the barbarous Latin *disnare;* but Henry Stephens derives it from the Greek δειπνεῖν, and contends that it should be written *dipner*. Ménage deduces it from the Italian *desinare*, to dine; and that from the Latin *desinere*, to leave off work.

DINOTHERIUM (δεῖνος, *terrible;* θήριον, *a wild beast;*) a genus of extinct herbivorous animals of gigantic size. See GEOLOGY.

DIOCESE, the circuit or extent of the jurisdiction of a bishop. The word is formed from the Greek διοίκησις, *government, administration*, derived from διοικεω, which the ancient glossaries render *administro, moderor, ordino;* and hence διοίκησις τῆς πόλεως the *administration* or *government of a city*.

DIOCESE is also used in ancient authors for the province of a metropolitan.

Diocæsis was originally a civil government, or prefecture, composed of different provinces.

The first division of the empire into dioceses is ordinarily ascribed to Constantine, who distributed the whole Roman world into four, namely, the diocese of Italy, the diocese of Illyria, that of the East, and that of Africa. And yet long before the time of Constantine, Strabo, who wrote under Tiberius, takes notice (lib. xiii. p. 432) that the Romans had divided Asia into dioceses; and he complains of the confusion which such a division occasioned in geography, Asia being no longer divided by people, but by dioceses, each of which had a tribunal or court, where justice was administered. Constantine, therefore, was only the institutor of those large dioceses, which comprehended several metropolises and governments; the former dioceses only comprehending one jurisdiction or district, or the country which had resort to one judge, as appears from the above passage in Strabo, and also from two in Cicero (lib. iii. *epist. ad Famil.* 9, and lib. xiii. *ep.* 67).

Thus at first a province included different dioceses, and afterwards a diocese came to comprehend different provinces. In after times the Roman empire became divided into thirteen dioceses or prefectures; though, including Rome and the suburban regions, there were fourteen. These fourteen dioceses comprehended a hundred and twenty provinces; each province had a proconsul, who resided in the capital or metropolis; and each diocese of the empire had a consul, who presided in the principal city of the district.

On this civil constitution the ecclesiastical one was afterwards regulated; and each diocese had an ecclesiastical vicar or primate, who judged finally of all the concerns of the church within his territory. At present, however, diocese does not signify an assemblage of different provinces, but is limited to a single province under a metropolitan, or more commonly to the single jurisdiction of a bishop.

Brito observes that diocese is properly the territory and extent of a baptismal or parochial church; and hence various authors use the word to signify merely a parish. See PARISH.

DIOCLEIA, in *Antiquity*, a festival with gymnastic and other contests, celebrated during spring at Megara, in memory of an ancient Athenian hero Diocles, who died in battle in defence of a youth he loved.

DIOCLETIANUS, CAIUS VALERIUS JOVIUS (A.D. 245–313), Roman emperor, was born of obscure parents in Dalmatia. His reign lasted from A.D. 284 to 305. The rest of his life was spent in retirement at Salona. The era of Diocletian, or era of the martyrs, began August 29, 284. See ROMAN HISTORY.

DIODATI, GIOVANNI (1576–1649), a celebrated Protestant divine and biblical annotator, was born at Geneva, of an Italian family which had fled from Lucca to escape religious persecution. At the recommendation of Beza he was appointed professor of Hebrew when only twenty-one years of age. In 1608 he was appointed parish minister of Geneva, and in 1609 professor of theology. Along with Theodore Tronchin, he was deputed to attend the synod of Dort, and concurred in the condemnation of the Arminians. Besides numerous theological treatises on questions connected with the reformation, Diodati translated the Bible into Italian (1607); and afterwards into French (1644). He also wrote *Annotationes in Biblia*, which was translated into English in 1648; and translated Paul Sarpi's *History of the Council of Trent*, and Sir Edwin Sandys' *Account of the State of Religion in the West*.

DIODORUS SICULUS, a Greek historian, born at Agyrium in Sicily. Of his life we know nothing except what he himself has narrated, that, in prosecution of his historical researches, he undertook frequent and dangerous journeys, and studied Latin at Rome. His history occupied thirty years in writing, and was at last completed in forty. From internal evidence it is certain that it was written after the death of Julius Cæsar; but the passages which show him to have survived the alteration of the calendar by Augustus are generally regarded as spurious. His history, to which from its comprehensive plan he has given the title of *Bibliotheca*, is divided into three parts. The first treats of the mythic history of the Non-Hellenic, and afterwards of the Hellenic tribes; the second section ends with Alexander's death; and the third continues the history as far as the beginning of Cæsar's Gallic war. Of this extensive work there are still extant only the first five books, treating of the mythic history of the Egyptians, Assyrians, Æthiopians, and Greeks; and also from the 11th to the 20th book inclusive, beginning with the second Persian war, and ending with the history of the successors of Alexander, previously to the partition of the Macedonian empire. The rest exists only in fragments which have been collected by Photius. The faults of Diodorus arise principally from the gigantic nature of the undertaking, the cumbrous nature of the materials, and the awkward form of annals into which he has thrown his narrative. He has been at little pains to sift his materials, and hence frequent repetitions and contradictions may be found in the body of the work. As a critic, he seems to have been altogether ignorant of the ethical advantages of history, and shrinks from administering praise or blame to the persons whose history he writes. In the chronology of the strictly historical period he is occasionally inaccurate; and the poetical myths which take the place of the early history are related with all the gravity of historical detail. His narrative is without colouring, and monotonous; and his simple and clear diction, which stands intermediate between pure Attic and the colloquial Greek of his time, enables us to detect in the narrative the undigested fragments of the materials which he employed. The particulars, however, which he has handed down are valuable as enabling us in several points to rectify the errors of Livy. The best editions of Diodorus are Wesseling's, 2 vols., Amstel. 1745; that printed at Deux-Ponts, 11 vols., 1793–1801; Eichstadt's (to book xiv.) 2 vols.; Halle, 1802–4; and Dindorf's, 5 vols., Leipz. 1828–31.

DIOGENES, of Apollonia in Crete, a celebrated natural philosopher who flourished at Athens about 460 B.C. As the pupil of Anaximenes, and contemporary and friend of Anaxagoras, his speculations stand midway between the systems of these philosophers. With Anaximenes he regarded air as the single element of the world, and in this respect he fell short of the dualism of Anaxagoras; but according to him this primal principle existed in various modes, it was especially endowed with intelligence, and in this respect he advanced beyond the pure materialism of Anaximenes. From the identification of intelligence and air, of mind and nature, the next step was obvious, viz., their recognition as distinct independent principles. Of his

Diogenes. treatise on Cosmology, some fragments remain, which have been collected and edited by Panzerbeiter.

DIOGENES, the famous Cynic philosopher, was the son of Icesias, a money-changer of Sinope in Pontus. Having been detected in adulterating coin, his father and he were compelled to leave their native city. According to another account however, Icesias died in prison, and Diogenes fled to Athens with a single attendant. On his arrival in that city he dismissed his attendant with the piquant question, "If Manes could live without Diogenes, why not Diogenes without him?" and on the same principle he denuded himself of all superfluous dress, furniture, and even ideas. A wooden bowl, which, with his cloak and wallet, formed his only moveables, is said to have been immediately discarded when he saw a boy drinking water from the hollow of his hand. The fame of Antisthenes soon attracted him to Cynosarges, and the pertinacity with which, for the sake of wisdom, he not only endured the scoffs but volunteered to submit to the blows of the great teacher, soon procured him a favourable reception from the whole Cynical school. The favourite pupil, however, soon outstripped his master in the extravagancies of his life, and the pungent keenness of his sarcasms. That he took up his abode in a cask belonging to the temple of Cybele, is a circumstance liable to suspicion, from being more frequently alluded to by the satirists than by the biographers of Diogenes. That he used to inure himself to the vicissitudes of the weather by rolling himself in hot sand in summer, and in winter by embracing statues covered with snow, are facts resting on the authority of all the ancient historians. His numerous witty apothegms are preserved by Diogenes Laertius. After his voyage to Ægina, during which he fell into the hands of pirates, who sold him as a slave in Crete, the conduct of Diogenes appears in a much less ridiculous light. With characteristic boldness he proclaimed to his captors that he knew no trade except "to govern men," and wished to be sold "to a man that wanted a master." Such a purchaser he seems to have found in Xeniades, who took him to Corinth to superintend the education of his children. Here he spent the rest of his life, and is said to have reached an extreme old age. Here at the Isthmian games he taught the assembled concourse in the Kraneion; and hither he attracted a crowd of disciples when Antisthenes had ceased to tickle their ears in Cynosarges. Here, too, in all probability, his famous interview with Alexander took place, in which the only favour he had to beg of the prince was that he would not stand between him and the sun; when Alexander is said to have exclaimed, "If I were not Alexander I would be Diogenes." To Athens Diogenes seems never to have returned. Of his death, which is said to have taken place on the same day with that of Alexander the Great, there are various conflicting accounts. That he perished by the bite of a dog, or from the immoderate use of raw-flesh, or by his own hands, are all generally disbelieved. It is more probable that his death was calm and peaceful; and in spite of his desire to be thrown to the beasts of the field, he received from Xeniades an honourable interment. In the days of Pausanias the Corinthians pointed with pride to his grave; and on the isthmus there was a pillar erected to his memory, on which, as the self-chosen symbol of his life, there rested a dog of Parian marble. His connection with Lais, and the open indecencies of which he is said to have been guilty, have thrown a shade upon his character. The former incident is, however, it must be confessed, exceedingly improbable; and the latter charge was undoubtedly exaggerated, if it was not originated by the shameless excesses of the later Cynics.

It is difficult to give any systematic account of the philosophical opinions of Diogenes. His highest ethical principle was the exercise, or as he usually styled it the gymnastics of the soul, and in carrying out this idea in the family of Xeniades the most honourable part of his life was spent. With him virtue was merely negative, and its most prominent features were resolution and impassibility. With Plato his model state was based on a community of goods and wives. Even in antiquity his opinions seem to have been confounded with those of Diogenes of Apollonia, and works which were undoubtedly spurious were confidently attributed to him. For his relation to Socrates and to the later schools of philosophy, see CYNICISM.

Diogenes Laertius || Diomedes.

DIOGENES LAERTIUS, the biographer of the Greek philosophers, is supposed by some to have received his surname from the town of Laerte in Cilicia, and by others from the Roman family of the Laertii. Of the circumstances of his life we know nothing. The date at which he wrote—probably the reign of Septimius Severus—is known only from conjecture. His own opinions are equally uncertain. By some he was regarded as a Christian; but it seems more probable that he was an Epicurean. The work by which he is known professes to give an account of the lives and sayings of the Greek philosophers. Although it is at best an uncritical and unphilosophical compilation, its value, as giving us an insight into the private life of the Greek sages, justly led Montaigne to exclaim that he wished that instead of one Laertius there had been a dozen. In the commencement of the work he divides philosophers into the Ionic and Italic schools. The biographies of the former begin with Anaximander, and end with Clitomachus, Theophrastus, and Chrysippus; the latter begins with Pythagoras, and ends with Epicurus. The Socratic school, with its various branches, is classed with the Ionic; while the Eleatics and sceptics are treated under the Italic. The whole of the last book is devoted to Epicurus. From the statements of Burlæus, the text of Laertius seems to have been much fuller than that which we now possess; and hopes have been entertained of obtaining a more complete copy. The best modern edition is that of Hübner, Leipzig, 2 vols. 8vo, 1828–31.

DIOMEDES, the most valiant, after Achilles, of all the Greeks who took part in the Trojan war. He was the son of Tydeus (from whom he inherited his patronymic of Tydides) and Deïpyle, and succeeded Adrastus on the throne of Argos. According to the old traditions, Tydeus perished in the famous expedition of the Seven against Thebes, leaving his son an infant. Diomedes' first act on attaining the years of manhood, was to lead another expedition against that city, which he took, and amply avenged his father's death. When war was declared against Troy, Diomede, in company with Sthenelus and Euryalus, set sail with eighty ships to avenge the injuries of Menelaus. The numerous exploits of Diomede in the Trojan war are all recorded in the glowing verse of Homer in the *Iliad*. He fought with the bravest heroes of the Trojan army, Hector and Æneas, both of whom he put to flight. Even the gods who did battle on the side of Troy were encountered by him with the same reckless boldness which marked his engagements with ordinary mortals. Mars himself retired wounded before him from the field of battle; and even Venus did not escape the resistless impetuosity of his attack, when she ventured to mingle in the fight in defence of her favourite Trojans. In the games instituted by Achilles to commemorate the death of Patroclus, he gained the prize in the horse-race, and defeated the mighty Ajax in single combat.

In the hands of later writers the valour and warlike exploits of Diomede received various embellishments. He was the companion of Ulysses in persuading Philoctetes to join the camp; and, along with him, carried off the palladium. In returning home he was stranded off the coast of Lycia; and on his arrival at Argos he was either too indignant at the faithlessness of his wife to remain, or was expelled by the adulterers. According to one account, he retired for a while to Ætolia, where he died; according to another, he returned to Argos; and a third tradition represents that

he went to Corinth, and in attempting to return to his native city was wrecked on the coast of Italy, where he espoused the cause of the Trojans against Turnus. Hence several towns in the eastern part of Italy trace their origin to Diomede.

DION CASSIUS COCCEIANUS, the celebrated historian of Rome, was born at Nicæa in Bithynia, A.D. 155. His father's name was Cassius Apronianus, and by his mother's side he was the grandson of Dion Chrysostom, who also obtained the surname of Cocceianus. When a young man he accompanied his father to Cilicia, of which he had the administration; and on his father's death he went to Rome, where in the last year of the reign of Marcus Aurelius, or immediately after the death of that emperor, he was received into the senate. During the reign of Commodus, Dion continued to practise as an advocate at the Roman bar, and held the offices of ædile and quæstor. He was raised to the prætorship by Pertinax; but did not assume office till the reign of Septimius Severus, with whom he was for a long time on the most intimate footing. By Macrinus he was intrusted with the administration of Pergamus and Smyrna; and on his return to Rome he was raised to the consulship about A.D. 220. After this he obtained the proconsulship of Africa, and again on his return was sent as legate successively to Dalmatia and Pannonia. He was raised a second time to the consulship by Alexander Severus A.D. 229; but under pretext of suffering from a diseased foot, he soon after retired to Nicæa, where he died. The date of his death is unknown. Previous to writing his history Dion Cassius had inscribed to the emperor Severus an account of various dreams and prodigies which had presaged his elevation to the throne, and had also written a biography of the emperor Commodus, which was afterwards incorporated into his larger work. The History of Rome, which consisted of 80 books, and after the example of Livy was divided into decades, began with the landing of Æneas in Italy, and was continued as far as the opening of the reign of Alexander Severus. The first 24 books exist only in fragments; from the 36th to the 54th, the work is extant complete; from the 55th to the 60th, it is probably an abridgment; and besides these, parts of the 71st and 75th books have also been recovered. As a historian the diligence of Dion is undoubted, and the various important offices which he held under the emperors gave him valuable opportunities for historical investigation. Although more philosophical than the compilations of the mere annalist, his work is not remarkable for vigour of judgment or critical acumen. His style is far clearer than that of Thucydides, whom he took as his model; but his diction is full of Latinisms. His history was first published in a Latin translation by N. Leonicenus, Venice, 1526: the best modern edition is that of Sturz, Leipzig, 1824-43, which contains the *Excerpta Vaticana.* Varies other works, such as a *History of Persia*, *Enodia or Itineraries*, a *Life of Arrian*, *Getica*, and a *Work on the Emperor Trajan*, are attributed to Dion Cassius, but in all probability without foundation. The substance of his history is reproduced in the annals of Zonaras.

DION *Chrysostom* (*i.e.*, *Golden-mouthed*), was born at Prusa, in Bithynia, about the middle of the first century. He visited Egypt with his father at an early period of his life; and went to Rome during the reign of Domitian. Being implicated in a plot against the tyrant, Dion fled from the capital, and wandered about in Thrace, Mysia, Scythia, and the other countries of the Getæ, with only Plato's *Phaedon* and Demosthenes *On the Embassy* in his possession, till the accession of Nerva, when he was allowed to return. With Nerva and Trajan he continued on the most friendly footing. He retired to Prusa for a short time; but having been accused of peculation and treason, he returned to Rome, where he remained till his death. Eighty orations of his are extant entire, and there are fragments of about fifteen others. They are written in a lucid and elegant style, and treat mostly of political, ethical, and mythological subjects.

DION, of Syracuse, was the son of Hipparinus, and brother-in-law of Dionysius the Elder. In his youth he was an ardent admirer and diligent pupil of Plato, whom Dionysius had invited to Syracuse; and he used every effort to promote the ascendency of his master's maxims in the administration of the kingdom. His near relationship to the despot gave him great influence at court; and also enabled him to amass considerable wealth. Accordingly, on the accession of the younger Dionysius, the stern morality of the philosopher stood in marked contrast to the dissolute character of the prince. An antagonism thus silently sprung up between the two; and the proposal of Dion to invite Plato again to Syracuse was made the occasion of an open rupture. To counteract the influence of that distinguished philosopher, the enemies of Dion obtained the recal of the historian Philistus, who had already signalized himself as a faithful supporter of despotic power. This artful courtier quickly regained his ascendency over the mind of Dionysius, and was at length successful in procuring the banishment of Dion. The exiled philosopher retired to Athens, where he was at first permitted to enjoy his revenues in peace; but the intercessions of Plato served to exasperate the tyrant, and at length inflamed him to confiscate the property of Dion, and give his wife to another This last outrage roused Dion to seek the liberation of his country by force of arms. Assembling a small force at Zacynthus, he sailed to Sicily, and, in the absence of Dionysius, was received with demonstrations of joy. He succeeded in defeating the forces of the tyrant, but was himself soon after supplanted by the intrigues of Heraclides. Again he was banished; but the incompetency of the new leader soon led to his recal. He had, however, scarcely made himself master of Sicily when the people began to express their discontent with his tyrannical conduct, and he was assassinated by Caliphus, an Athenian who had accompanied him in his expedition.

DIONIS, PIERRE, one of the greatest surgeons of the eighteenth century, was born at Paris. During the reign of Louis XVI., he was appointed anatomical demonstrator in the Jardin des Plantes. His earliest publication is entitled *Anatomie de l'Homme, suivant la circulation du sang, et les nouvelles découvertes*, 8vo, 1690, and has been frequently reprinted. It was translated into the Tartar dialect by a Jesuit, for the use of Kang-hi, emperor of China. In another work, published in 1698, entitled *Dissertation Historique et Physique sur la Génération de l'Homme*, he supports the ovarian hypothesis. In 1707 he published a work on surgery, entitled *Cours d'Opérations de Chirurgerie*, 8vo, which was several times reprinted; and was afterwards edited with notes by Lafaye, in two vols. This treatise was long received as a standard book on the subject. He also wrote *Dissertation sur la Mort Subite*, 12mo, published in 1709, and a *Traité Générale des Accouchements*, 1718, 8vo. The last is little more than an abridgment of Mauriceau's work on the same subject. Dionis died at Paris Dec. 11, 1718.

DIONYSIA, in *Grecian Antiquity*, festivals in honour of Dionysus (Bacchus), sometimes called by the general name of *Orgia*, and by the Romans *Bacchanalia* and *Liberalia*. See BACCHANALIA, and BACCHUS.

DIONYSIUS, the Elder, tyrant of Syracuse, was born about B.C. 430. He began life as a clerk in a public office, and first took part in political affairs during the dissensions that followed the destruction of the Athenian expedition. He was wounded in the attempt of Hermocrates to seize upon Syracuse; and during the disasters inflicted by the Carthaginians who had invaded the island, he succeeded, along

with Philistus and Hipparinus, in procuring the deposition of the Sicilian generals, and was himself included in the number appointed in their stead. By intriguing with the inhabitants of Gela, which he had been sent to relieve, and spreading insinuations of treachery in regard to his colleagues, he was ultimately invested with the supreme command; and by the help of a large body-guard he soon made himself independent of the popular opinion. Pestilence having thinned the Carthaginian army, Dionysius, in spite of his ill success, found no difficulty in procuring peace (B.C. 605). In the stronghold of Ortygia he defied the machinations of his enemies, until, partly from defeats and partly from dissensions, the opposition died away. After a successful expedition against Naxos, Catana, and Leontini, his next efforts were directed against Carthage. (See CARTHAGE.) He also carried an expedition against Rhegium and its allied cities in Magna Græcia. In one campaign, in which he was joined by the Lucanians, he devastated the territories of Thurii, Croton, and Locri. After a protracted siege he took Rhegium B.C. 387, and sold the inhabitants as slaves. He joined the Illyrians in an unsuccessful attempt to plunder the temple of Delphi, and also pillaged the temple of Cære on the Etruscan coast. In the Peloponnesian war he espoused the side of the Spartans. Not content with his military renown, Dionysius aspired also to poetical glory. His poems were hissed at the Olympic games; but having gained a prize for tragic poetry at Athens, he was so elated that he engaged in a debauch which proved fatal, B.C. 367. His life was written by Philistus, but the work has unfortunately perished. See SYRACUSE.

DIONYSIUS, the Younger, ascended the throne of Syracuse at his father's death. He was driven from the kingdom by Dion, and fled to Locri; but during the commotions which followed the assassination of that leader, he managed to make himself master of Syracuse. On the arrival of Timoleon he was compelled to surrender and retire to Corinth, B.C. 343, where he spent the rest of his days in poverty.

DIONYSIUS, of Halicarnassus, was born about the middle of the first century B.C. His father's name was Alexander. From the introduction to his great work we learn that he went to Italy after the termination of the civil wars, and spent twenty-two years in preparing materials for his history, which is entitled *Archæologia*, and embraced the history of Rome from the mythical period to the beginning of the first Punic war. It was divided into twenty books; of which the first nine remain entire, the tenth and eleventh are nearly complete, and the remaining books only exist in fragments. In the first three books of Appian, and in the Camillus of Plutarch, much of Dionysius has undoubtedly been embodied. As a historian he is minute and painstaking; but his attempts to Grecianize the early history of Rome, that the Greeks might in some measure be reconciled to a foreign yoke, renders his accuracy more than suspicious. Dionysius was also the author of a treatise on rhetoric, which, with his criticisms on Thucydides, Lysias, Isocrates, Isæus, Dinarchus, Plato, and Demosthenes, have been preserved. The best editions of his works are those of Hudson and Reiske. The rhetorical works have been edited separately, by Gros and by Westermann.

DIONYSIUS, surnamed *Periegetes*, from his being the author of a περιήγησις τῆς γῆς, containing a description of the whole earth in hexameter verse, and written in a terse and elegant style. This work enjoyed a high degree of popularity in ancient times, and two translations or paraphrases of it were made by the Romans, one by Rufus Festus Avienus, and the other by the grammarian Priscian. The best edition of the original is that by Bernhardy, Leip. 1828. Great differences of opinion have been entertained as to the age and country of this Dionysius. All however are agreed in placing him in the time of the Roman emperors, and it seems highly probable that he flourished in the latter part of the third, or the beginning of the fourth century. Eustathius says that he was by descent a Libyan.

DIONYSIUS *the Areopagite*, according to Suidas, was an Athenian by birth, and eminent for his literary attainments. He studied first at Athens, and afterwards at Heliopolis in Egypt. While in the latter city, he beheld that remarkable eclipse of the sun, as he terms it, which took place at the death of Christ, and exclaimed to his friend Apollophanes, ἢ τὸ θεῖον πάσχει, ἢ τῷ πασχόντι συμπάσχει, "Either the Divinity suffers, or sympathises with some sufferer." He further details, that after Dionysius returned to Athens, he was admitted into the Areopagus; and, having embraced Christianity about A.D. 50, was constituted Bishop of Athens by the apostle Paul (Acts xvii. 34). Aristides, an Athenian philosopher, asserts that he suffered martyrdom—a fact generally admitted by historians; but the precise period of his death, whether under Domitian, Trajan, or Adrian, is not certain. A writer in later times attempted to personate the Areopagite, and contrived to pass his productions on the Christian world as of the apostolic age, thereby greatly influencing the spirit both of the Eastern and Western Churches. These writings consist of a book called *The Celestial Hierarchy;* another *Of the Ecclesiastical Hierarchy; A Treatise on the Divine Names;* another *Of Mystical Divinity;* and *Ten Epistles.* Different opinions have been held as to the real author of these productions. They were ascribed, at an early period, to Apollinaris, Bishop of Laodicea, in the fourth century—an opinion to which the learned Cave inclines, though he thinks that Apollinaris the son may have been the author. There have not been wanting instances in which supposititious works were fathered upon great names by disciples of the Apollinarian school. The resemblance between the *Areopagitica* and the writings of Proclus and Plotinus is so obvious as to afford great probability that the Pseudo-Dionysius did not write much earlier than the fifth century. The first uncontroverted occasion on which these supposititious writings are referred to, is in the conference between the Severians (a sect of Eutychians) and the Catholics, held in the Emperor Justinian's palace, A.D. 532, in which they are quoted by the heretical party. Maximus, and other writers in the following ages, refer to them frequently.

DIONYSUS. See BACCHUS.

DIOPHANTINE PROBLEMS, in *Mathematics*, certain questions relating to square and cube numbers, and right-angled triangles, the nature of which was determined by Diophantus, a mathematician of Alexandria, who is believed to have lived about the third century. The works of Diophantus were published with notes at Paris in 1621, by Bachet de Meziriac; and another edition appeared at Toulouse in 1670, with observations on every question by M. Fermat.

DIOPHANTUS, a celebrated mathematician of Alexandria, the reputed inventor of algebra. His era is uncertain. Some have placed him before Christ, and some after, in the reigns of Nero and the Antonines, but all with equal uncertainty. It is doubtful whether or not he be the same Diophantus who wrote the *Canon Astronomicus*, which Suidas says was commented on by the celebrated Hypatia, daughter of Theon of Alexandria. By the ancients, he was ranked with Pythagoras and Euclid in mathematical learning. From his epitaph in the Anthologia, Bachet has gleaned the following particulars concerning him, namely, that he was married when he was thirty-three years old, and had a son born five years thereafter; that this son died at the age of forty-two, and that his father did not survive him above four years. From this it appears that Diophantus lived to the age of eighty-four. See ALGEBRA.

DIOPTASE of *Haüy;* the rhombohedral emerald malachite of *Mohs.* This is a very rare mineral. It occurs in crystals of small dimensions, of a brilliant emerald-green

colour, disposed in limestone, and is only found in the Kirghese steppes, Siberia. See index to MINERALOGY.

DIOPTER, or DIOPTRA, the same with the index or alhidade of an astrolabe, or other similar instrument.

DIOPTRA was an instrument invented by Hipparchus, which served several purposes, as to level water courses, to take the height of towers or places at a distance, to determine the places, magnitudes, and distances of the planets, and the like.

DIOPTRICS, that part of optics which treats of the laws of refraction, and the effects which the refraction of light has in vision. See OPTICS.

DIORAMA (δια and ὁραμα, *view*), a mode of painting and of scenic exhibition, by which landscapes, and architectural and other objects are represented with the most perfect degree of optical illusion. The diorama is an imitation of the panorama, which was invented by Barker, an English artist, about 1796, and afterwards greatly improved in France. The first diorama was exhibited by MM. Daguerre and Bouton at Paris in 1822. The painting, which in the panorama is cylindrical, in the diorama is prepared on a plane surface. The management of the lights is a most important part of the exhibition. Various means are employed to enhance the illusion by optical combinations, such as transparencies, coloured glass, the light of torches, screens, &c.; and the differences of reflected and transmitted light afford an almost infinite variety of effects. By such means the transitions from day to night, and all the varied tints of sunshine and shadow, are imitated with a degree of illusion that is almost magical. The spectator is introduced into a chamber from which light is excluded, and sees through a large aperture or proscenium a view that is sometimes of great extent, and which is illuminated with all the effect of reality. The illusion is sometimes enhanced by several adjuncts, such as music, the singing of birds, the sound of rushing water, &c.

DIOSCORIDES, PEDACIUS or PEDANIUS, a celebrated physician, born in Cilicia, who flourished probably in the first century. He was author of a treatise on Materia Medica; and some smaller works on Toxicology are also attributed to him.

DIOSCURI (from Ζεύς, Διός Jupiter, and κοῦροι children), or sons of Jupiter, the common designation of the brothers Castor and Pollux. According to the myths, which however are very variously narrated by different authors, these twins were the children of Tyndareus, king of Sparta, and Leda. According to other accounts they were the children of Jupiter and Leda. In other versions of the same myth Leda is mentioned as having produced two eggs, from one of which sprang Castor and Clytemnestra, and from the other Pollux and Helen. The place is as variously given as the manner of their birth. Some authors give Amyclæ on the Eurotas, others Mount Taygetus in Laconia, others Thalamæ in Elis, others various islands of the Ægean. As soon as they grew up, they became distinguished for their skill in all athletic sports. Castor took under his especial patronage all equestrian exercises; while Pollux became equally renowned for his skill in boxing, of which he became, in after times, the tutelary god. It is in allusion to this fact that Horace (lib. i., ode 12) talks of the

> ———— pueros Ledæ
> Hunc equis, illum superare pugnis
> Nobilem.

The leading events in the lives of the Dioscuri are three in number. The first of these is their invasion of Attica, in which they rescued their sister Helen, who had been carried off by Theseus: the second, their share in the Argonautic expedition; and the third, their battle with the sons of Aphareus, in which Castor was killed. Pollux, finding his brother dead on the battle-field, implored Jupiter to be allowed to die along with him. Jupiter gave him his choice either to live as an immortal with the other gods, or to spend his time alternately, day by day, in Hades and in the upper world. According to other accounts the brothers were translated to heaven together after death, and ranked among the stars under the name of Gemini. The worship of the Dioscuri was very widely diffused throughout the ancient world; but especial honours were paid to them in Sparta and the Dorian colonies of Magna Græcia. It is in allusion to this fact that Mr Macaulay in his Lay of the battle of the Lake Regillus, in which they fought on the side of Rome, describes them as accounting for their appearance on that occasion—

> By many names men call us,
> In many homes we dwell;
> Well Samothracia knows us,
> Cyrene knows us well:
> Our house in gay Tarentum
> Is hung each morn with flowers;
> High o'er the masts of Syracuse
> Our marble portal towers;
> But by the proud Eurotas
> Is our dear native home,
> And for the right we come to fight
> Before the ranks of Rome.

They generally appear in the ancient classics as kindly, and disposed to help and protect all such as do them due honour. On this account their worship was carefully observed by travellers, whether on land or sea. Sailors were consequently very scrupulous in paying their homage to these deities both before and after a voyage; and even in the midst of a storm their prayers were believed to be not unheard by the Tyndaridæ. Hence Horace describes them as divinities—

> ———— quorum simul alba nautis
> Stella refulsit,
> Decidit saxis agitatus humor;
> Concidunt venti fugiuntque nubes
> Et simul quod sic voluere Ponto
> Unda recumbit.

Though their worship was perhaps most carefully observed among people of Dorian origin, they were held in no small veneration at Rome. It was the popular belief in that city from an early period, that the great day of the Regillus had been decided by their interposition. They had fought, it was said, armed and mounted, at the head of the legions of the commonwealth, and had afterwards carried the news of the victory with incredible speed to the city. The well in the forum at which they alighted was pointed out. Near the well rose their ancient temple. A great festival was kept in their honour on the Ides of Quintilis, believed to be the anniversary of that battle, and sumptuous sacrifices were offered to them at the public charge. It was further ordained that a grand muster and inspection of the equestrian body should be part of the ceremonial performed. All the knights, clad in purple, and crowned with olive, were to meet at a temple of Mars in the suburbs. Thence they were to ride in state to the forum, where the temple of the twins stood. This pageant was during several centuries considered as one of the most splendid sights of Rome. In the time of Dionysius the cavalcade consisted of 5000 horsemen, all persons of fair repute and independent fortune.

DIOSCURIA, in *Antiquity*, festivals in honour of the Dioscuri (Castor and Pollux), which were observed with great solemnity by the Cyreneans, and very generally throughout Greece, but especially by the Spartans, whose country was believed to have been honoured by the birth of these heroes. At Athens the Dioscuri were called *Anaktes*, and their festival *Anakeia*. Little is known regarding the ceremonies observed on these occasions.

DIOTA, an ancient Greek vessel for holding wine; so called because it had two *ears* or handles. See AMPHORA.

DIPHTHONG, in *Grammar*, a double vowel, or the mixture of two vowels pronounced together so as to make one syllable.

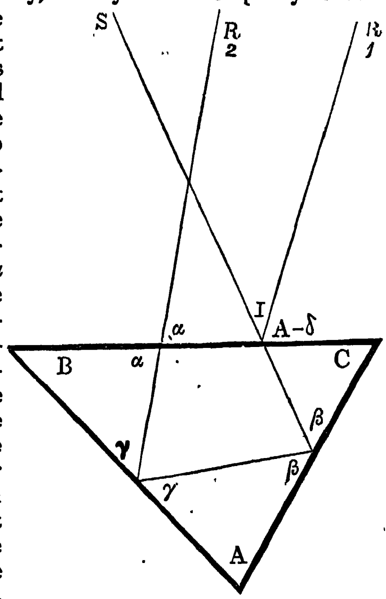
Dipleidoscope.

The Latins pronounced the two vowels in their diphthong *ae* or *æ*, and *oe* or *œ*, much as we do, only that the one was heard much weaker than the other, though the division was made with all the delicacy imaginable. Diphthongs with reference to sight, are distinguished from those with reference to sound. In the former, either the particular sound of each vowel is heard in the pronunciation; or the sound of one of them is drowned; or, lastly, a new sound, different from either, results from both; but the first of these only are real diphthongs, as being such both to the eye and ear. Diphthongs with regard to the ear are either formed of two vowels meeting in the same syllable, or of two vowels whose sounds are severally heard; or of three vowels in the same syllable, which only afford two sounds in the pronunciation.

English diphthongs, with regard to the eye and ear, are *ai, au, ea, ee, ei, oo, ou.* Improper English diphthongs, with regard to the eye only, are *aa, ae, eo, eu, ie, ei, oe, ue, ui.*

DIPLEIDOSCOPE, an instrument invented by Mr Bloxam, whose name has already been mentioned in the article on CLOCK AND WATCH WORK, for ascertaining the time of solar noon more exactly than can be done by a common sun-dial. It can also be used when the sun is covered with thin clouds, not thick enough to hide it, though sufficient to prevent it casting a distinct shadow. The name is compounded of διπλόος double, εἶδος an image, and σκοπέω I see, because in all positions except one it presents a double image of the sun. The instrument is to be fixed by a chronometer so that it may be in the position of showing the single image of the sun exactly at noon; and then at about a minute before noon the two images make their first contact, and at the same time after noon they completely separate, and the times of these contacts and also of the complete coincidence can be observed within two or three seconds. The following is the principle of the construction.

Let A B C be the rectangular section of a prism set so that a ray of the sun S I, and its reflected ray I R_1, lie in the plane perpendicular to the axis of the prism. It is not solid, but composed of three small glasses of which A B, A C, are mirrors, but B C is only a plain glass not silvered. Consequently, the ray S I will be partly reflected from B C in the direction I R_1, but part of it will pass through the glass and be reflected by the mirror A C on to A B, and there reflected again and sent through B C in the direction $a R_2$, making some angle a with B C. Suppose the angle of incidence, and therefore of first reflection to R_1, to be $A-\delta$ (A being the opposite angle of the prism), and the other angles as marked in the figure; and let us see what a the angle of the twice reflected ray will be.



Now, $\beta = \pi - (C + A - \delta)$, in the small triangle near C; therefore, in the one near A, $\gamma = \pi - (A + \beta) = C - \delta$; and in the triangle near B, $a = \pi - (B + C - \delta) = A + \delta$. And, therefore, the difference between the directions of the once reflected and the twice reflected rays is $2\,\delta$; and if the prism is so placed that the angle of incidence = the opposite angle of the prism at noon, the rays will then emerge parallel at noon, and the two images of the sun will be seen as one; as noon approaches, the images converge, and after noon diverge, with a velocity double that of the sun itself.

But the plane of incidence and reflection can only be perpendicular to the axis of the prism twice a-year. Still the same result will take place if it is once set properly. For suppose it to be set perpendicular to that plane at the equinox: then at midsummer the incident and reflected ray I R_1 will lie in planes making the angle ω (the obliquity of the ecliptic) with the equinoctial plane; but S I and I R_1 will be sections of two other planes parallel to the axis of the prism, in which the incident and reflected rays also lie. And, in like manner, the ray reflected from A C will lie in a plane at the angle ω below the equinoctial plane; and that reflected from A B to R_2 also; and the projections of these rays on the equinoctial plane will lie in the same direction as before; and, therefore, the twice reflected and the once reflected rays will emerge parallel, as before, when S I is in the plane of the meridian.

The prism is inclosed in a small solid brass box in the shape of an irregular pyramid about two inches high; and it is made so that it only requires fixing on a horizontal bed. They are only made by Mr Dent, as he is the proprietor of Mr Bloxam's patent. Instead of fixing them and so leaving them exposed to the air, he has lately adopted the plan of fixing a brass plate on the window-sill where the instrument is to stand, with a raised edge against which one side of the dipleidoscope is laid when it is first set by the chronometer, and afterwards whenever it is used. It is generally necessary either to smoke the front glass, or to look at it through a piece of smoked or coloured glass, which is supplied with it, as well as the necessary table of the times of first and last contact for every day in the year. Mr Dent has also lately made them to revolve upon an axis parallel to the earth's axis, and with a graduated hour circle, so that they may be used for any other hour as well as noon. But in this case the instrument can only be used (except at noon) for the latitude for which it is constructed, like a sun-dial, unless it has an adjustment for latitude also, as some of them have.

Some instrument of this kind ought to be kept by everybody who thinks it worth while to have a good clock, and yet has no other means of occasionally obtaining the real time, more accurately than from railway clocks, or public clocks of ordinary quality. For those who feel any difficulty about using the dipleidoscope, or who wish to be quite independent of the setting by a chronometer in the first instance, Mr Denison recommends, in his Treatise on Clocks, the following simple and independent construction of a sun-dial on a larger scale for noon only, which is quite sufficient for the occasional correction of a tolerably good clock:—Fix a thin plate of metal (protected against rust in any way you please) with a small hole in it, facing the south as nearly as you can, and inclined to the horizon at about 50° (not that the inclination is material), with the hole about nine inches above a stone slab set quite firm and level. Mark the point on the slab exactly under the hole by means of a pointed plumb-bob, and call it C. About 11 o'clock see where the bright spot falls on the slab, and call that A, and with radius C A draw as much of a circle as is likely to be wanted for the bright spot again to reach it about 1 o'clock. Mark the place where it does reach it a, and bisect the arc A a in M suppose, and draw a straight line C M, as long as the slab will hold, from C through M. That line is the meridian, and the spot will always fall upon it at solar noon. Before you mark the line strongly, it will be as well to take several observations of this kind at different times, before and after noon, and on different days:

and if their bisections agree in falling on the line CM you may be sure it is right. We have seen one of these dials with the gnomon only six inches high, and the time can be taken from it perhaps as accurately as from a dipleidoscope, and certainly with far less trouble.

In order that the bright spot may fall on the slab in winter, the distance of its northern edge from C must be rather more than four times the height of the hole above the slab. If this size is inconvenient, there may be a second hole made at half the height, the plate or gnomon not being finally fixed; then on any fine day in the summer half of the year, move the gnomon until the spot from this second hole also falls on the line CM at noon (it can be done in a moment), and there fix the gnomon. The lower spot will then always fall on the slab if it is made only half the size above mentioned, though in winter the upper one will fall beyond it. It is best to make the slab a light colour, and an equation-table may as well be cut upon it. (E. B. D.)

DIPLOMA (Greek, from διπλόος, *double*), originally denoted any charter, letter, or other composition written on paper or parchment, and folded. In its modern acceptation it denotes an instrument or letter, duly signed, which confers some privilege, honour, or authority. Such are the diplomas given to graduates of colleges; to clergymen who are licensed to exercise the ministerial function; to physicians and surgeons who are licensed to practise their professions; to agents authorized to transact business for their principals, &c. See DIPLOMATICS.

DIPLOMACY

Is the art of conducting the intercourse of nations with each other. The word obviously owes its origin to the source subsequently explained in the article DIPLOMATICS. It is singular that a term of so much practical importance in politics and history should be so recent in its adoption, that it is not to be found in Johnson's dictionary. There has indeed ever been a reluctance in the English nature to acknowledge the art of transacting international business, as a pursuit worthy of a British statesman, or as one entitling its adepts to honourable fame. It is popularly looked on as the art of carrying into the business of nations a morality condemned in the intercourse of men with each other, and as a means of employing subtlety where force is insufficient to accomplish some statesman's object. Hence the term has been colloquially used to express a modified degree of cunning; and conduct which is wily and subtle, without being directly false or fraudulent, is styled "diplomatic." The subject has been usually treated under the head of the Law of nations, or as it is now more properly termed International law. But a little examination will show that diplomacy, though closely associated with international law, is a separate sphere of intellectual exertion. The diplomatist undoubtedly requires to be acquainted with international law, and to observe its general injunctions. He often finds it necessary to appeal to the rules, or supposed rules, of that code; but it would be a confusion of terms to count him an officer engaged in the execution of international law. He has to accomplish objects which are not achievable through any law real or fictitious, but are achieved solely through the art of diplomacy. The close connection of the two systems with each other, and at the same time the distinction of the sphere occupied by each, may be illustrated by an example. In the year 1841, some slaves, the property of citizens of the United States, seized the vessel in which they were embarked, and proceeded with it to a British settlement, where on landing they asserted their freedom according to British law. A question thence arose, in that department of international law which is sometimes called the conflict of laws. On the American side it was maintained, that all civilized nations admit the sacredness of private property; and that when courts of law have to deal with the citizens of another state, they enforce among them that state's adjustment of the laws of property. Hence the slaves, being, it was said, property by American law, must be held so by the judges in the English colony when American citizens were the parties. On the other hand it was maintained, that the civilized states, while they uphold property, should not enforce the political laws of their neighbours, by persecuting refugees fleeing before a dominant influence; and it was observed that British political offenders have always been hospitably received in America. This view was adopted, and the British courts holding the question to be political, or between man and man, not a mere affair of property, refused to ratify the demands of the slave-owners. The case of the Creole, as this affair was called, was a question of international law, in which British judges had to decide how far their own law permitted them to give effect to a foreign law. Had the American government, from a preponderance of power in the southern states, or from any other cause, thought fit to demand that Britain should make reparation for the effect of this decision, or should adjust her laws so as to decide otherwise in future—then the question would have become one of diplomacy. Questions in which private rights and obligations are concerned, are a perpetual source of diplomatic exertion. In this country, and to some extent in the other states called the great powers, the administration of justice is pursued on rules so absolute, that there is no chance of their being relinquished to favour a friendly or to injure a hostile nation. Of this there was a remarkable instance in the late war, when British judges would not admit the orders in council of 1809 to be an effectual blockade, so as to justify a forfeiture of neutral vessels for their infringement. Undoubtedly, however, in those states where the power of the law is not so independent and supreme, the decisions of the courts in questions with foreigners will often be swayed by the strength or feebleness of the nation to which these belong, or by the question, whether its representatives will or will not give them support. In this manner diplomacy and international law are often mixed up with each other; and so lately as the year 1850 it became a question whether or not a European war should arise out of the circumstance, that the petty kingdom of Greece refused to make good some pecuniary claims by British subjects, the chief of whom, though he was legally entitled to that designation, was by birth and origin an Italian Jew. It was well known that Greece, in refusing these demands, was instigated by Russia. It was important to the maintenance of British diplomatic influence in Europe, that the petty states should be taught the fallacy of such a dependence, and the claims were enforced by the presence of a fleet, and a threat of bombardment, not so much to terrify Greece, as to show her that Britain would not permit encroachments by Russia on the rights of her subjects. From such instances it will be seen that diplomacy, besides the larger operations connected with great treaties or alliances, keeps a vigilant eye on the ordinary details of international law, for the purpose of seeing that it is equitably administered. In this sense the diplomatist is like a law-agent, whose duty it is to see that his client receives justice at the hands of other nations under this code.

Diplomacy, as a science, has arisen out of the development of the European powers, and their rise on the ruins of the Roman empire. As a uniform system, following principles nearly as well established as those of many codes of law, it

exists solely among the European powers, partly embracing those nations, such as Turkey and Persia, which have been brought into close association with them. The difficulty, however, of getting these Eastern states to understand and obey the laws of diplomacy, and submit to its restraints, has ever been an object of anxious comment to Wickefort and the other systematic writers on diplomacy. To submit to be bound in the moment of power by a theoretical system not enforced by the strong hand of any judge, spiritual or temporal, is not consistent with the Oriental mind; and the great civilized powers, in dealing with the Eastern states, as in their intercourse with barbarous tribes, have relied on their own strength, exercised with cruelty or with mildness as the case might be. Alliances and leagues, declarations of war and treaties of peace, have taken place, it is true, among those states, but it would be a historical absurdity to suppose diplomatic relations connecting together China, Burmah, and Japan, as they connect Britain, France, Holland, and Prussia.

In the same manner the ancient world had its treaties and leagues, but no systematic diplomatic relations. The pretensions of Rome during the empire, indeed, superseded every kind of international engagement, since she would permit of no relation between the empire and any other state, save that of predominance on her part and subjection on the other. Yet it is evidently from this system of centralization that the diplomatic relations of the European states arose. Freed from the temporal jurisdiction of the empire, and no longer mere dependencies, the European states were still subject in a modified shape to an influence radiating from the old centre of imperial authority. The Bishop of Rome, in claiming a spiritual authority at least co-extensive with the geographical area of the temporal authority of the departed emperors of Rome, created a sanction, though an imperfect one, for the execution of justice among nations, and acted in some measure as a controlling influence over their diplomatic operations. A memorable instance of the influence of the Pope is found in the relations between King John of England and Philip of France. The semi-judicial authority of the court of Rome was cited in support of the English conquest of Ireland, and was appealed to by both parties in the Scottish war of independence. Little as the papal authority was respected by even the most Catholic monarchs when they were at the head of large and well-found armies, yet in matters of dubious equilibrium the authority of the Pope had some weight; and as his was a power not limited to any particular state or cluster of states, but ever present throughout all the transactions of Christian realms with each other, it had, beyond doubt, an influence gradual and continuous, in giving modern diplomacy the amount of specific character which it had obtained at the period of the Reformation. Thus a kind of traditional uniformity of practice has provided a partial substitute for that supreme power always necessary for the enforcement of what are termed laws. Under the heads Balance of Power, and the Law of Nations, the evils arising from the absence of a supreme power to judge between states, as the courts of law decide questions between individual citizens, will be found amply discussed. It suffices here to say, that much of the deficiency is filled up by the fortunate train of events which have created, throughout the civilized world, a traditional system of diplomatic practice. On great occasions, when sovereigns have made up their minds to the commission of high national crimes, as for instance, the partition of Poland, the violation of the Baden territory for the capture of the Duke of Enghien, or the project in which Russia so fallaciously expected the countenance of the British ambassador for a partition of Turkey, the rules of diplomacy have been violated. But there is always a certain shame attached to such violations —a certain coercive influence in the uniform practice of diplomatic officers, which serves to bind powers the most tyrannical and fraudulent, unless when they are influenced by strong temptations; and the system altogether is thus a powerful protection to the smaller states, and an instrument for the conservation of peace and justice throughout the world.

It is hence generally in weak states that the science of diplomacy has flourished. The politicians of the Italian republics, among whom the name of Machiavelli stands supreme, have been counted the earliest adepts in the science; and it was the practice of the greater states to choose their diplomatists from Italy on account of the peculiar aptitude of the educated Italians for the subtleties of the profession, just as private employers selected clerks in Geneva and valets from the Swiss. The nature of the skill thus supposed to be acquired will readily be understood by reflecting, that a small state standing alone against a great power, and bluntly putting it at defiance so as to bring on an immediate trial of strength, would be speedily lost; and that it has been held the special and peculiar function of the diplomatic representatives of such feeble governments, to act on skilful calculations of the influence of the combined interests of nations great and small—as the chess-player, when making a move, calculates on its influence over the relation towards each other of the symbols of various degrees with which he plays his game.

The representatives of great nations, following up the traditions of the science of diplomacy, have often sought by similar acts to do what they considered their duty to their country by taking advantage of every opportunity of aggrandizing it. But modern political philosophy and morality teach us that this is not the manner in which great nations are to be supported or aggrandized, and that for their diplomatic servants there is spread out a far nobler field of exertion. It is founded on the consciousness that the real power of states must come from within—from the sound condition of the people, physically, industrially, and morally—from well-poised political institutions and good government. If these are absent no diplomatic skill can make up for them; if they be present it cannot enhance the real power of the state which possesses them. But to the diplomatic representatives of states both powerful and honest a function of a higher character still than mere national aggrandizement belongs, in the capacity, by able, temperate, and honourable negotiation to keep feeble states from being crushed by their potent neighbours, to preserve peace in the world so long as it can honourably be preserved, and to see generally that international justice is observed among mankind. The true functions of the great powers are in some measure embodied in the renowned lines in which Virgil told Rome the duties she was not to fulfil:

> "Tu regere imperio populos, Romane, memento;
> Hæ tibi erunt artes; pacisque imponere morem,
> Parcere subjectis et debellare superbos."

The historical events, and the industrial and commercial progress which have during the past hundred years so aggrandized the power of Britain among European nations, have, in this view of the uses of our diplomacy, become a great boon to the smaller states, and even to the citizens of the greater. The parliamentary responsibility, and the perpetual public scrutiny and discussion to which the acts of our statesmen are subjected, are not only checks on our own diplomatic acts, but on those of every other civilized state. It was a boast attributed to one of the great fabricators of British diplomacy, the elder Pitt, that not a gun should be fired throughout the world without Britain knowing why. If Britain could make good this boast, it would extend in some measure to mankind at large the blessings enjoyed at home from living under a responsible government. As it is even at present, the continuous liability of having whatever he does called before parliament and the public, must be an ever present and influencing motive

with every British diplomatist. Hence he not only dare not countenance any act of national rapacity, tyranny, or fraud, but he is, as the representative of a nation which has great power and no secrets, a check upon the diplomatic honesty of all the world.

Of the advantages afforded to mankind at large by the public responsibility of British diplomatists, a memorable instance is afforded by the renowned Holy Alliance. It was contracted on the 26th of September 1815 by three monarchs who personally signed the document—the emperors of Russia and Austria and the king of Prussia. This treaty, announcing the determination of those who acceded to it to act as Christian princes on the precepts of the Gospel, and to follow the rules of justice, charity, and peace, is known to have been a combination among the despotic monarchs to aid each other in the maintenance of arbitrary power, and the suppression by them collectively of any efforts in favour of constitutional principles occurring in the dominions of any member of the league. Every considerable European monarchy finally joined the combination with the signal exception of Great Britain. The crown was then represented by the Prince Regent, afterwards George IV. Though it was known that few monarchs had more sympathy with the objects of the league, he was obliged to state that "The forms of the British constitution which he was called upon to maintain, in the name and in the place of the king his father, prevented him from acceding to it in the form in which it was laid before him." Governed as Britain for some subsequent years was by members of the political party whose sympathies with the Holy Allies were the strongest, yet their efforts were, by the necessity of their position as British ministers, directed to the effective counteraction of the great plot of the despotic powers. More lately, in connection with the source of the war which Britain and France are now (1854) pursuing against Russia, there was an instance of the effects of British responsibility and publicity which will teach the rapacious governments in future not to include in their projects the chance of securing British co-operation. When the czar of Russia was maturing his projects for the seizure of Constantinople and European Turkey—as his predecessors had seized on Poland, Finland, and the Crimea—he tried to gain the co-operation of the British ambassador, Sir Hamilton Seymour, by seductive offers of British aggrandizement in the East. Sir Hamilton, feeling the importance of the proffers so made to him, and his high responsibility to the British parliament, communicated to his own government all the details; which, being then at the command of parliament, were published to the world, and were received as a signal instance of imperial treachery.

The aggressive projects to which these revelations referred have produced a revolution in European diplomatic relations calculated to influence the condition of the world for ages to come. It had become a sort of political superstition that France and Britain are natural enemies. This arose pretty obviously out of those claims which the peculiar rules of succession attributed to the Salic law had given to English monarchs, on the throne of France. A continuous succession of untoward events widened the hostile schism thus created; and although on several occasions there has been a popular sympathy between the two countries, it can hardly be said that France and England have had an opportunity of showing sincere and cordial co-operation in the pursuit of a common policy from the period of the Crusades down to the spring of 1854, when in the Baltic and the Euxine they united their forces against Russia. With Scotland France had much diplomatic intercourse down to the union of the crowns, and she occasionally made tempting offers to Scotland as well as to Ireland while they had separate legislatures. These were efforts directed to the creation of a diversion against England, and they pointed to diplomatic relations entirely the reverse of the present connection between Britain and France. If that connection should prove permanent, it cannot fail, as has been here before indicated, to create a signal revolution in European diplomacy; and, onerous as its inauguration has been in a hard contest with Russia, there can only be anticipated from the cordial co-operation of the two most powerful states of Europe the most benign influence over the destinies of the world.

In contrast to the old opinions which attributed the power and prosperity of nations to diplomatic ability, overlooking the substantial sources of material progress, a political sect has lately appeared who denounce the diplomatic system as foolish or wicked, and proclaim the doctrine of non-intervention in the affairs of other nations. It is practically clear, however, that whatever degree of perfection the world may reach in time, the first great power which avows this opinion will become the immediate victim of its rivals; and thus, should Britain withdraw herself from the diplomacy of Europe, the despotic states would soon become strong enough to shut up the commerce of the world, and cast the world two centuries back in civilization. There is reason, indeed, to believe that the late aggressions of Russia were founded on a supposition that the doctrines of this kind so often proclaimed by enthusiasts, had really taken such deep root in the public mind, that Britain would never go to war unless for her own defence—a supposition which turned out to be signally erroneous.

There is indeed a species of intervention from which British diplomacy has been generally but not always free, which cannot be sufficiently condemned. It is that which endeavours to dispose of a resisting people, by compelling them to belong to this or that state, to adopt some particular form of government, or to accept some dynasty as its rulers. For nearly a century after the revolution of 1688, the existence of the direct descendants of the exiled house of Stewart enabled France and the other European powers to menace Britain from time to time with the prospect of a civil war, creating within the country a diversion in favour of hostile efforts from without. On the outbreak of the French revolution, the despotic European states, exulting in the success of the partition of Poland, combined for the purpose of forcing back the Bourbons on their old throne, or partitioning France; and in this project they were joined, to her shame and loss, by Britain. The result was a miserable chastisement of national presumption, since the new republic, its spirit rising to the emergency, drove its enemies away on every side, and entering the despotic states, propagated and enforced republicanism with reactionary fanaticism. In the revolutions which have overtaken France in later times, the British government has acknowledged whatever power the French have chosen to submit to for the time being; but it is probable that the despotic powers of the Continent are awaiting the moment to strike a blow for that legitimacy which it is so much their personal interest to preserve.

The free-trade policy lately adopted by Britain, will not only remove many causes for interference with other nations, but must have the effect of generally simplifying our diplomacy by the removal of one of its most troublesome departments. Among the many advantages which it was deemed within the power of able diplomacy to achieve, successful trade was one of the most important; and a multitude of treaties for accomplishing reciprocity of trading privileges remain to attest the earnest labour with which such projects were carried out, and to perplex the historical inquirer. Every advantage on one side was supposed to be acquired by a loss on the other; and, as it is the duty of a diplomatist as of a soldier to make the enemy suffer, it may easily be imagined how much diplomatic exertion these illusory trading negotiations have caused. The belief of

the free trader is, that for whatever a nation sells it must buy; for whatever it exports it must import. This is the reciprocity of the natural laws of trade, which requires neither treaties nor battles to enforce it. Few nations in possession of anything worth acquiring refuse to sell; and if diplomatic skill shall ever be called on to help our trade, it will not be in the arrangement of reciprocity treaties, but in preventing the interference of arbitrary powers with the freedom of trading populations.

It is perhaps scarcely necessary to mention that the source of the diplomatic organization in any nation is its supreme power; but it is useful to keep in view, that, for the rapid movements of this department of politics, nations the most jealous of their constitutional rights have been obliged to place at least provisional power in the hands of individual rulers. Thus in Britain the Sovereign, independently of parliament, has technically the power to make treaties and to declare peace and war; and an authority not much less extensive is committed to the President of the United States. The guidance of a great state's relations with foreign countries is generally committed to one department of the government—with us it is the function of the foreign secretary. How far he is bound to consult his colleagues of the cabinet in his intercourse with foreign states, has, even within the last few years, been matter of acrimonious discussion. The various representatives of the government at foreign courts, though the dignified character of their missions sometimes gives them a rank much higher than that of their instructor, must obey the directions of the foreign minister. In the negotiation of treaties there is an old-standing dispute among publicists, how far nations can be bound if their ambassadors exceed the instructions given to them, which are generally kept secret. When, therefore, an important international act, such as a treaty, is undertaken, there are many sanctions and ceremonials to be accomplished before it is held to be completed. While matters are in a vague condition, many briefly expressed fundamental suggestions will have passed among the negotiators in the form of notes. When the matter becomes more ripe for adjustment, it assumes the shape of a protocol, or draft of the conditions. The ambassadors, when all is adjusted, sign the articles of the treaty; but still it is generally deemed essential that the several governments should ratify it, or, admitting that their representatives have not exceeded their instructions, engage to fulfil the bargain they have made. In this country, whenever treaties affect the private rights of the citizen, they must be ratified by act of parliament. The trade-reciprocity treaties were generally of this class. Of late, arrangements with France and the United States for the mutual apprehension of fugitive offenders have been so ratified by parliament; and in 1852 an act was passed for carrying into effect arrangements with foreign powers for the mutual apprehension of deserters from merchant ships. In addition to notes and substantive treaties, the most important documents in diplomacy may be considered the manifestos, in which, paying homage to public opinion and the established rules of diplomacy, governments profess to justify their conduct. When any vile act of oppression or injustice is perpetrated, it is generally followed by an able manifesto, and the ingenuity of the accomplished diplomatist is taxed to make the deed appear just, rational, and necessary.

To know what nations ought to be admitted to co-operate in negotiations, and which should be excluded, is one of the most important objects of diplomatic skill. Thus, when in 1840 the treaty of London united the four powers, Britain, Austria, Prussia, and Russia, in a union to compel the Pasha of Egypt to submit to the Sultan, the absence of France as a party to the treaty nearly caused a European war. While in secondary questions there is generally a mere correspondence between the representatives of two or more powers, on great occasions, when an opportunity has arisen for settling the organization of the civilized world, large congresses or conferences have been held like international parliaments. The latest and the most solemn of these was the renowned congress of Vienna, interrupted by the Hundred Days' reign of Napoleon. Much as the diplomacy of this assemblage has been criticised, yet no one can fail to remark, as a testimony to the general success of its adjustments, that while there have been revolutions and separate contests among European nations—accompanied by severe wars connected with our own Indian empire, and the colonial efforts of France—yet nothing has occurred seriously to affect the general relation to each other of the European powers, between the treaty of Vienna and the Russian war.

The nature and functions of the large body of officers who chiefly conduct the diplomacy of the world having been described under the word AMBASSADOR, it only remains to notice the incidental circumstance, that custom has for some time established the French language as the language of diplomacy. In the sixteenth, and during a great part of the seventeenth century, the Latin was employed. In Ludlow's Memoirs there is, under the year 1656, a curious notice to the effect that the Swedish ambassador "complained of the delays in his business, and that when he desired to have the articles of this treaty put into Latin according to the custom of treaties, that it was fourteen days they made him stay for that translation; and sent it to *one Mr Milton, a blind man*, to put them into Latin, who, he said, must use an amanuensis to read it to him, and that amanuensis might publish the matter of the articles as he pleased, and that it seemed strange to him there should be none but a blind man capable of putting a few articles into Latin." In turning over the pages of the great collection of Treaties by Dumont and Rousset, one may observe how gradually, during the ascendency of Richelieu, and the subsequent reign of Louis XIV., the use of the French language radiates from the immediate diplomatic transactions of France over those of Europe at large. Probably its propagation was originally connected with the visions of that universal French empire to which Louis XIV. seemed to be marching before he encountered the combinations of William of Orange. At the present day it can only be pronounced a fortunate thing that diplomatists have agreed to use one language, and that the best adapted for their peculiar functions. (J. H. B.)

DIPLOMATICS, the science of diplomas, or of ancient literary monuments, public documents, and the like. It does not, however, nor can it absolutely extend its researches to antiquity, but is chiefly confined to the middle ages and subsequent times. For although the ancients were accustomed to reduce their contracts and treaties into writing, yet they engraved them on tablets of brass, copper, stone, or wood; and all that in the earlier ages were not traced on metal or stone have perished.

The word *diploma* signifies properly a letter or epistle which is folded in the middle, and which consequently is not open. But in more modern times the title has been given to all ancient epistles, letters, literary monuments, and public documents, and to all those pieces of writing which the ancients called *Syngrapha*, *Chirographa*, *Codicilli*, and the like. In the middle ages, and in the diplomas themselves, these writings are called *Litteræ*, *Præcepta*, *Placita*, *Chartæ indiculæ*, *Sigilla*, and *Bullæ*; as also *Panchartæ*, *Pantochartæ*, *Tractoriæ*, *Descriptiones*, and so forth. The originals of these pieces are named *Exemplaria* or *Autographa*, *Chartæ authenticæ*, *Originalia*, &c.; and the copies, *Apographa*, *Copiæ*, *Particulæ*, and so on. The collections

which have been made of them are called *Chartaria* and *Chartulia*. The place where these papers and documents were kept the ancients named *Scrinia*, *Tabularium*, or *Ærarium*, words which were derived from the tablets of wood and brass; and, according to the Greek idiom, *Archeium* or *Archivum*.

The time is not precisely known when our modern paper was invented, and when people began to make use of quills in writing instead of reeds. The ink of the ancients was made of soot; and sometimes also they wrote with red ink made of vermilion, or in letters of gold on purple or violet parchment. It is not difficult for those who apply themselves to this study, to distinguish the parchment as well as the ink of the ancients from that of the moderns; but that which best distinguishes the original from the counterfeit is the writing or character itself, which is so different in different centuries, that we may tell with certainty, within about forty or fifty years, when any diploma was written. There are two works which furnish the clearest lights on this matter, and which may serve as sure guides in the judgments we may have occasion to form as to what are called *ancient diplomas*. The one is the celebrated treatise on Diplomatics by Mabillon, with a supplement by Maffei; and the other the first volume of the *Chronicon Gotvicense*. We there find specimens of all the characters, the flourishes, and different methods of writing, of every age. Besides several other works on diplomatics, Gatterer and Schöneman, in more recent times, have treated the science in the most systematic manner.

All the diplomas are written in Latin, and consequently the letters and characters have a resemblance to each other; but there are certain strokes of the pen which distinguish not only the ages, but also the different nations, as the writings of the Lombards, French, Saxons, and so on. The letters in the diplomas also are usually longer and less decided than those of manuscripts. There has also been introduced a kind of court hand, of a very disproportionate length, and the letters of which are called *exiles litteræ crispæ, ac protractiores*. The first line of the diploma, the signature of the sovereign, that of the chancellor, notary, &c., are usually written in this character.

The signature of a diploma consists either of the sign of the cross, or of a monogram or cipher composed of the letters of the names of the persons who subscribed it. The initial letters of the name, and sometimes also the titles, were placed about this cross. By degrees the custom changed, and other marks were invented, as, for example, the sign of Charlemagne, which was thus written:—

R
K—A/V—S
L

Sometimes also were added the dates and epoch of the signature, the feasts of the church, the days of the calendar, &c. The gradual corruption of the Latin language; the style and orthography of each age, as well as their different titles and forms; the abbreviations, accentuation, and punctuation, and the various methods of writing the diphthongs; all these matters united form so many characters by which the authenticity of an ancient diploma may be known.

The seal annexed to a diploma was anciently of white wax, and was skilfully imprinted on the parchment itself. It was afterwards pendant from the paper, and inclosed in a box or case, which was called *bulla*. There are also some which have been stamped on metal, and even on pure gold. When a diploma bears all the characters which are requisite to the time and place where it is supposed to have been written, its authenticity is not to be doubted: but at the same time we cannot examine these too scrupulously, since the monks and priests were very expert in making counterfeits, and the more so as they enjoyed the confidence of princes and statesmen, and were even sometimes in possession of their rings or seals.

With regard to manuscripts which were written before the invention of printing, it is necessary to know their nature, their essential qualities, and matter; to be able to read them freely, and without error; to judge of their antiquity by those characters which we have just mentioned with reference to the diplomas; and to render them of use in the sciences. As there are scarcely any of the ancient codes now remaining written on the Egyptian paper, or on wood, ivory, &c., we have only to consider those which are written on parchment or vellum (*membraneos*), and such as are written on our paper (*chartaceos*). The former of these are in most esteem. With regard to the character, these codices are written either in square and capital letters, or in half square or round and small letters. Those of the first kind are the most ancient. There are no intervals between the words, no letters different from the others at the beginning of any word, no points, nor any other distinction. The codices which are written in half square letters resemble those we have in Gothic characters, as well for the age as the form of the letters. Such as are written in round letters are not so ancient as the former, and do not go higher than the ninth or tenth century. These have spaces between the words, and some punctuation; but they are not so well written as the preceding, and are frequently disfigured with comments. The codices are divided, according to the country, into Lombard, Italian, Gaelic, Franco-Gaelic, Saxon, Anglo-Saxon, and so forth.

In the ancient Greek books the periods of a discourse are frequently terminated, instead of all other divisions, by lines, and these divisions were called, in Latin, *versus, a vertendo*; for which reason these lines are still more properly named *versus* than *lineæ*. At the end of a work the number of verses of which it consisted was put down, in order that the copies might be more easily collated; and it is in this sense that we are to understand Tribonius when he says that the Pandects contain 150,000 *pæne versuum*. These codices were likewise *vel probæ vel deterioris notæ*, more or less perfect, not only with regard to the calligraphy or beauty of the character, but also with reference to the correctness of the text.

It is likewise necessary to observe, in ancient codices, the abbreviations used in different centuries. Thus, for example, A. C. D. signifies Aulus Caius Decimus; Ap. Cn. Appius Cneius; Aug. Imp. Augustus Imperator. The characters which are called *notæ* are such as are not to be found in the alphabet; but which, notwithstanding, signify certain words. Lastly, the learned divide all the ancient codices into *codices minus raros, rariores, editos, et anecdotos*. The critical art is here indispensably necessary; its researches, moreover, have no bounds, and the more as the use of it augments every day, by the discoveries which are made in languages, and by the increase of erudition. Much learned and valuable information on all these matters is to be found in the work entitled *Nouveau Traité de Diplomatique, par deux Religieux de la Congrégation de Saint Maur*, 6 tom. 4to, Paris, 1750–1765.

DIPPEL'S OIL, a highly empyreumatic oil obtained by the destructive distillation of bone.

DIPPING, among miners, the interruption of a vein of ore or stratum. See Mining.

Dipping *Needle*, a magnetic needle that dips or inclines to the earth; an instrument for ascertaining the amount of the magnetic inclination at the different points of the earth's surface. This fact was first observed by one Robert Norman, an Englishman, and a maker of compasses for mariners, about the year 1576, who finding that he was always obliged to counterbalance that end which turns to the north by a bit of wax or such other substance, though the balance had been ever so exact before, published an account of his dis-

covery as a matter of importance. The subject was instantly attended to; and instruments were not only contrived for ascertaining the quantity of the dip, but various speculations were formed concerning the cause of so surprising a phenomenon.

The general phenomena of the dipping needle are, that in the equatorial regions it remains in a horizontal position, but as we recede from the equator towards either pole it dips; the north end if we go northwards, and the south end if we proceed southwards; and the further north or south we go, the greater is the inclination. Its inclination is likewise found to vary very considerably at different times in different places of the earth. See MAGNETISM.

DIPSAS, a serpent whose bite produces a mortal thirst; and hence its name *dipsas*, which signifies thirsty. See Deuteronomy, viii. 15. Cuvier has given this name to a genus of serpents. See index to SERPENTS.

DIPTERA (from δις, and πτερον, *wing*), an order of insects which have only two wings, and under each wing a style, or oblong body, terminated by a protuberance or head, and called a *balancer*. See index to ENTOMOLOGY.

DIPTEROS. See index to ARCHITECTURE.

DIPTOTE, in *Grammar*, a noun that has only two cases; as *suppetiæ*, *suppetias*, &c.

DIPTYCHA, in *Antiquity*, a public register containing the names of the consuls and other magistrates among the pagans; and of bishops, martyrs, and others among the Christians.

The word is formed from the Greek διπτυξ, which is compounded of δις, *twice*, and πτυσσω, *I fold or plait*; though there were some in three, and others in four or five leaves.

There were secular diptycha in the Greek empire, as well as sacred ones in the Greek Church. The former were the matricula or registers wherein the names of the magistrates were entered; in which sense diptycha is a term in the Greek chancery.

The *Sacred* DIPTYCHA consisted of a double catalogue, one part of which contained the names of the living, and the other those of the dead, which were to be rehearsed during the office. We meet with something not unlike the sacred diptycha of the Greeks in the canon of the mass according to the Latin usage, where the people are enjoined to pray once for the living and once for the dead. In such diptycha were entered the names of bishops who had governed their flock aright; and also the names of such as had done any signal service to the church, whether they were living or dead; and mention was made of them in the celebration of the liturgy.

Casaubon, in his observations on Athenæus (lib. vi. cap. 14), supposes the Christians to have borrowed the custom of writing names in a book, and rehearsing them at mass, from the heathens, who entered the names of persons to whom they wished to do any signal honour in the verses of the Salii, as was done in the case of Germanicus and Verus, sons of the emperor Marcus Aurelius, and a long time before, during the ages of the republic; in that of Mamercus Veturius and Lucia Volumnia, as we are told by Tacitus, Spartian, Ovid, Festus, Plutarch, and others. But Rosweyd does not approve of this notion of Casaubon; and the pretended St Dionysius, a very ancient author, asserts that this usage was originally founded on Scripture (2 Tim. ii. 19; Psal. cxvi. 15). Rosweyd adds Ecclesiasticus (xliv. 1), and maintains these to have been the passages which the ancient church had in view, rather than the Salian verses.

The secular diptycha were frequently sent as presents to princes and others, on which occasions they were finely gilded and embellished; as appears from Symmachus (lib. ii. ep. 81). Those presented were usually of ivory. The first law, *De Expens. Ludor.* in *C. Theod.* forbids all magistrates below the rank of consuls to make presents of diptycha of ivory in the public ceremonies.

DIRÆ, a name of the three Furies. See EUMENIDES.

DIRECT, in *Arithmetic*, is when the proportion of any terms or quantities is in the natural or direct order in which they stand. It is the opposite of inverse, which considers the proportion in the inverted order of the terms. Thus, $3:4::6:8$ directly; or inversely $4:3::8:6$.

DIRECTION, in *Mechanics*, the line or path in which a body moves or endeavours to proceed according to the force impressed upon it.

DIRECTION, in *Astrology*, a kind of calculus by which it is pretended to find the time in which any notable accident shall befall the person whose horoscope is drawn.

DIRGE, a song or hymn expressive of grief and mourning, as for the dead. It is a contraction of the Latin *dirige*, the first word in the old formula of the Catholic service for the dead.

DIRIBITORES, in *Roman Antiquity*, officers appointed to distribute the tablets used by the people when they voted in the comitia. Wunder, however, in the preface to his *Codex Erfurtensis*, is of opinion that their office was to divide the votes afterwards, in order to determine the result; and this opinion he founds partly on the etymology of the word *diribere*, from *dis* and *habere*. See COMITIA, vol. vii., p. 183.

DIRIGENT, or DIRECTRIX, in *Geometry*, the line of motion along which the describing line or surface is carried in the genesis of any plane or solid figure.

DIS, a god of the Gauls, the same as Pluto the god of hell. The inhabitants of Gaul supposed themselves descended from that deity; and from that circumstance they reckoned their time by *nights* instead of by days.

DIS, a prefix or inseparable preposition in various words, the effect of which is either to give them a signification contrary to what the simple words have, as *disoblige*, *disobey*; or to signify a separation or detachment, as *distributing*.

DISAFFORESTING, the depriving of forest laws and their oppressive privileges, or the act of reducing from the privileges of a forest to the state of common ground.

DISC or DISK (Lat. *discus, a quoit*), the face of the sun or any planet as it appears to the eye. In optics it denotes the width of the aperture of telescope glasses. In botany it is applied to the central part of a radiate compound flower. It is also used generally for any circular plane surface.

DISCIPLE (from *disco*, *I learn*), a scholar or follower of any teacher or philosopher. The followers of Jesus Christ in general were so called: but in a more restricted sense, the term was used to denote those alone who were the immediate followers and attendants on his person, of which there were seventy or seventy-two. The terms *disciple* and *apostle* are often used synonymously in the Gospel history; but the apostles, as distinguished from disciples, were the twelve selected to be the principal ministers of the Christian religion. The Latins kept the festival of the seventy or seventy-two disciples on the 15th July, and the Greeks on the 4th January.

DISCIPLINE, in a general sense, denotes instruction and government; as military or ecclesiastical discipline.

Book of DISCIPLINE, in the Church of Scotland, is a common order, drawn up by the assembly of ministers in 1650, for the reformation and uniformity to be observed in the discipline and policy of the church. In this book episcopal government is set aside; kirk-sessions are established; the observance of saints' and other holy days is condemned; and other regulations for the government of the church are prescribed. This book was approved by the privy-council, and is called the *First Book of Discipline.* A *Second Book of Discipline*, containing a fuller account of the polity of the Church of Scotland, especially in reference to the civil powers, was drawn up by the Assembly of 1578, and was frequently discussed by the King and Parliament, but did not receive their sanction.

DISCORD, disagreement among persons or things.

DISCORD, in *Music*, disagreement of sounds heard simultaneously; dissonance. See MUSIC, § *Harmony*.

DISCORD, the goddess of, in Pagan theology, is represented by Aristides with fiery eyes, a pale countenance, livid lips, and wearing a dagger in her bosom. It was she who, at the marriage of Peleus and Thetis, threw in the golden apple, on which was written "To the fairest," and which occasioned a contention between the goddesses Juno, Minerva, and Venus, each pretending a title to the apple. She was likewise called *Ate* and *Eris*.

DISCOUNT, in *Commerce*, is commonly applied to the sum allowed by the seller to the buyer for ready money payment, and is generally a deduction of a certain percentage on the principal for the usual term of credit. It is customary for persons in business to take bills or promissory notes for monies due, payable to them or their order at a certain date; and if they have occasion for money before the time is elapsed, they get these bills or notes *discounted* or cashed by a banker before the time of payment. Bills of exchange are also discounted by bankers; and in this consists one article of the profits of banking.

DISCRETE or DISJUNCT PROPORTION is when the ratio of two or more pairs of numbers or quantities is the same, but there is not the same proportion between all the four numbers. Thus, if the numbers 3 : 6 :: 8 : 16 be considered, the ratio between 3 : 6 is the same as that between 8 : 16, and therefore the numbers are proportional; but it is only discretely or disjunctly, for 3 is not to 6 as 6 to 8; that is, the proportion is broken off between 8 and 3, and is not continued as in the following continual proportionals, 3 : 6 :: 12 : 24.

DISCRETE Quantity is such as is not continued and joined together in its parts. Such, for instance, is any number; for its parts, being distinct units, cannot be united into one continuous or continued quantity; for in a continuum there are no actual determinate parts before division, but they are potentially infinite.

DISCRETION (Lat. *discretio*, a *separating; discretus* from *discerno*;) that kind of prudence for discernment which enables a person to judge critically of what is correct and proper, particularly as regards his own conduct in any matter.

DISCUS, in *Antiquity*, a quoit, or circular plate of stone or metal, ten or twelve inches in diameter, which was used by the ancients for throwing to a distance as a gymnastic exercise. Sometimes a kind of quoit of a spherical form was used for the same purpose; and through a hole in its centre a thong was passed, to assist the player in throwing it. (See *Iliad* ii., xxiii. *Od.* viii., xvii.) In the British Museum there is a famous statue of a discobolus in the act of throwing the discus.

DISCUTIENTS (Lat. *discutiens, dispersing*), medicines or applications which disperse tumours, or any stagnating or coagulated fluid in the body.

DISDIACLASTIC CRYSTAL, a name given by Bartholine and others to the mineral more usually called *Iceland crystal*. See MINERALOGY.

DISDIAPASON, in *Music*, the interval of two octaves, or a fifteenth.

DISEASE. See PATHOLOGY, MEDICINE, &c.

DISEMBOGUE (Fr. *emboucher*), to flow out at the mouth, as a river discharges its waters into the ocean. As applied to a ship, it signifies to pass out of a gulf or bay.

DISFRANCHISEMENT (*dis*, and Teutonic *frank, free*), the act of disfranchising or depriving of the rights and privileges of a free citizen, or of some particular immunity.

DISGUISE, a counterfeit habit. Persons doing unlawful acts in disguise are by our statutes subjected to heavy penalties, and in some cases declared felons. By an old statute, commonly called the *black act*, persons appearing disguised and armed in a forest or grounds inclosed, or hunting deer, or robbing a warren or a fish-pond, are declared felons.

DISH, among miners, a trough in which ore is measured, about 28 inches long, 4 deep, and 6 wide.

DISK. See DISC.

DISJUNCTIVE, separating, disjoining. In *Grammar*, a disjunctive conjunction is a word that connects sentences or words in construction, but disjoins the sense; as, I love him, *or* I fear him; I neither love *nor* fear him.

DISLOCATION, the act of moving something from its proper place; applied more particularly to the act of forcing a bone from its socket. This is otherwise termed *luxation*.

DISPART, in *Gunnery*, to set a mark on the muzzle ring of a piece of ordnance, so that a sight-line from the top of the base-ring to the mark on or near the muzzle may be parallel to the axis of the bore.

DISPATCH or DESPATCH (Fr. *dépêcher*, Span. *despachar*, to hasten, to expedite), speedy performance; execution or transaction of business with due diligence, &c. It is hence used to denote a letter on some affair of state or other business of importance, sent or to be sent with care and expedition by a courier express. The word is also applied to the packet or mail that carries such letters.

DISPAUPERED is used of a person suing *in forma pauperis*, if, before the suit be ended, he have any lands or other estate fallen to him, or if he become otherwise disqualified.

DISPENSARY, a house, place, or store, in which medicines are dispensed to the poor, and where they may obtain medical advice gratis. A shop in which medicines are prepared is sometimes called a dispensary or dispensatory.

DISPENSATORY, a book containing the method of preparing the various kinds of medicines used in pharmacy. Such are those of Bauderon, Quercetan, Zwelfer, Charas, Bate, Mesue, Salmon, Lemery, Quincy, and Lewis; but the latest and most esteemed, besides the London and Edinburgh pharmacopœias, is the Edinburgh New Dispensatory, first edited by Dr Duncan, and afterwards by Dr Christison.

DISPERSION (Lat. *dispergo*), the act of scattering, the state of being scattered.

In *Optics*, it denotes the divergency of the rays of light, or rather the separation of the different coloured rays in refraction. The *point of dispersion* is the point from which the refracted rays begin to diverge. See OPTICS.

DISPERSION *of Mankind*, in the history of the world, was occasioned by the confusion of tongues, and took place in consequence of the overthrow of Babel at the birth of Peleg (whence he derived his name); and by the account given of his ancestors (Gen. chap. xi. 10-16), this appears to have happened in the 101st year after the Flood, according to the Hebrew chronology, and by the Samaritan computation in the 401st. However, various difficulties have been suggested by the older chronologists concerning the true era of this event. Sir John Marsham and others, in order to reconcile the Hebrew and Egyptian chronologies, maintain a dispersion of mankind before the birth of Peleg; whilst others, unable to find numbers sufficient for the plantation of colonies in the space of 101 years, according to the Hebrew computation, fix the dispersion towards the end of Peleg's life, thus following the computation of the Jews. Petavius assigns the 153d year after the Flood; Cumberland the 180th; and Usher, though he generally refers it to the time of Peleg's birth, in one place assigns the 131st after the Flood for this event. Mr Shuckford supposes the dispersion to have been gradual, and to have commenced with the separation of some companies at the birth of Peleg, and to have been completed thirty-one

years afterwards. According to the calculation of Petavius, the number of inhabitants on the earth at the birth of Peleg amounted to 32,768; but Cumberland makes them 30,000; Mede estimates them at only 7000 men, besides women and children; and Whiston, who supposes that mankind now double themselves in about 400 years, and that they doubled themselves between the deluge and the time of David in sixty years at a medium, when their lives were six or seven times as long as they have been since, by his computation produces about 2389; a number much too inconsiderable for the purposes of separating and forming distinct nations. This difficulty induced Whiston to reject the Hebrew and to adopt the Samaritan chronology, as many others have done; which, by allowing an interval of 401 years between the Flood and the birth of Peleg, furnishes, by the last-mentioned mode of computation, more than 240,000 persons.

The hypothesis of Dr Bryant on this subject is characterized by his usual acuteness and learning. He recognizes two distinct dispersions,—the one universal, regulated and progressive; the other local, sudden, turbulent, and attended with marks of the Divine displeasure. He maintains that the dispersion, as well as the confusion of tongues, was local, and limited to the inhabitants of the province of Babel; that the separation and distribution recorded to have taken place in the days of Peleg (Gen. x. 25, 31, 32), which was the result of Divine appointment, occasioned a general migration; and that all the families amongst the sons of men were concerned in it. The house of Shem, from which the Messiah was to spring, was particularly regarded in this distribution. The portion of his children was near the place of separation: they in general had Asia to their share, as Japheth had Europe, and Ham the large continent of Africa. But the sons of Cush would not submit to the Divine dispensation. They went off under the conduct of Nimrod, and seem to have been for a long time in a roving state. However, at last they arrived at the plain of Shinar; and, having ejected Ashur and his sons, who were placed there by Divine appointment, seized his dominions, and there laid the foundation of a great monarchy. But afterwards fearing lest they should be divided and scattered abroad, they built the tower of Babel as a land-mark to which they might repair, and probably to answer the purposes of an idolatrous temple, or high altar dedicated to the host of heaven, from which they were never long to be absent. They only, viz. the sons of Cush, or the Cushites, and their associates from other families, who had been guilty of rebellion against Divine authority, and of wicked ambition and tyranny, were punished with the judgment of confounded speech through a failure in labial utterance, and by the dispersion recorded in Genesis; in consequence of which they were scattered abroad from this city and tower, without any certain place of destination. The Cushites invaded Egypt, or the land of Mizraim, in its infant state, seized the whole country, and held it for some ages in subjection; and they extended likewise to the Indies and Ganges, and still farther, to China and Japan. From them the province of Cushan or Goshen in Egypt derived its name.

The following enumeration of nations as constituted by the dispersion, is drawn up by Dr Pye Smith, availing himself of the labours of Bochart, J. D. Michaelis, the younger Rosenmüller, Gesenius, Robinson, and Baumgarten.

I. Sons of JAPHETH, the *Iapetus* of the Greeks.

1. Gomer. This name is traced in the Kimmerii of Homer and Herodotus; the Gomares (Josephus, *Antiq.* i. 6), whence Kelts, Gauls, Galatians; the Kymry; all the Celtic and Iberian tribes, Welsh, Gaelic, Irish, Breton; the Cimmerian Bosporus, Crimea.

Sons of Gomer:—(1.) Ashkenaz. Axeni, inhabitants of the southern coasts of the Euxine Sea, where we find a country Askania and a river Askanius, and a large part of Armenia; the Basques in the north of Spain; the Saxons, as the Jews interpret Ashkenaz, in Jer. li. 27, to be Germany. (2.) Riphath. Rhibii, east of the Euxine; Tobata and other parts of Paphlagonia; Croatia; the Riphæan mountains, a very obscure name in ancient geography (Strabo, Virgil, Pliny, Mela), referring probably to the great chains of mountains from the north of Asia westwards (Hyperboræans, Steph. Byzant.), and therefore including vague knowledge of the Uralian, Hartz, and Alpine regions. (3.) Togarmah. Peoples of Armenia and other parts of the Caucasian region. The Armenian traditions assign as their ancestor Haik, the son of Torgom and grandson of Noah.

2. Magog. In Ezekiel this seems to be used as the name of a country, and Gog that of its chieftain. The Mongoles, Moguls; the great Tartar nation.

3. Madai. The Medes; people of Iran, to whom the Sanscrit language belonged; primeval inhabitants of Hindustan.

4. Javan. The Greeks, Asiatic and European. Iaones (Hom. *Il.* xiii. 685).

Sons of Javan:—(1.) Elisha. Greeks especially of the Peloponnesus; Hellas; Elis, in which is Alisium (*Il.* ii. 617). (2.) Tarshish. The east coast of Spain, where the Phœnician Canaanites afterwards planted their colony. (3.) Kittim. Inhabitants of the isles and many of the coasts of the Mediterranean, particularly the Macedonians and the Romans, and those farther to the west. (4.) Dodanim (Rhodanim, 1 Chron. i. 7). Dodona, a colony from which probably settled at the mouths of the Rhone, Rhodanus. To this Javanian (Ionian) branch is attributed the peopling of the "isles of the nations" (ver. 5), a frequent Hebrew denomination of the western countries to which the Israelites, Tyrians, Egyptians, &c., had access by sea.

II. Sons of HAM. The word signifies *heat* or *hot*, alluding to the climes which the most of his posterity were to occupy: it was also an indigenous name of Egypt.

1. Cush. The Ethiopians, first on the Arabian side of the Red Sea, then colonizing the African side, and subsequently extending indefinitely to the west, so that *Cushite* (Jer. xiii. 23) became the appellative of a negro.

Sons of Cush:—(1.) Seba. Joined with Mizraim and Cush (Isa. xliii. 3), evidently denoting contiguity and affinity. This tribe or class is probably referred to Suba, a native name of Meroe upon the Nile, in the farthest south of Egypt, or the beginning of Ethiopia. (2.) Havilah. Of this word vestiges are found in various names of places in Western Arabia, and the adjacent parts of Africa. It is quite distinct from the Havilah (Gen. ii. 11) in or near Armenia, and probably from another (x. 29) in Arabia, unless we suppose a union of tribes, or one succeeded by the other. (3.) Sabtah. Sabota or Sabbatha is the name of an ancient trading town of Arabia. (4.) Raamah, Sept. *Rhegma* (Alex. *Rhegehma*), which changing *ι* into *η*, is the name of a port which the Ægypto-Greek geographer Claudius Ptolemy places on the Arabian coast of the Persian Gulf. To this place Dr Baumgarten (Kiel, 1843) refers the name—others take it to be Reama, a town of considerable importance in the south-western part of Arabia the Happy, whose inhabitants are remarkably black; mentioned along with Sheba in Ezek. xxvii. 22, as a place of rich Oriental traffic. Two sons of this Raamah are mentioned, Sheba and Dedan. We find these in the subsequent Scriptures distinguished for trade and opulence. They both lie in the western part of Arabia. The queen of Sheba came to the court of Solomon. Dedan is not improbably considered as the origin of Aden, that ancient seaport and island at the mouth of the Red Sea. (5.) Nimrod, who built, besides Babel, his metropolis, three cities or towns in the great plain of Shinar—Erech, Accad, and Calneh. These were probably Aracca or Arecha on the Tigris (some think Edessa); Sacada, near the confluence of the Lycus and the Tigris; and the third (Calno, Isa. x. 9) Chalonitis of the Greeks, afterwards called Ctesiphon; but much obscurity lies upon these conjectures.

2. Mizraim, literally the *two Egypts*, the upper and the lower; each was called *Misr*, a word even now vernacular in that country. Of his descendants seven are specified under *plural* national names, some of which are well ascertained. (1.) Ludim. Ludites, celebrated as soldiers and archers, and in those passages connected with other peoples known to be African. The Ludim probably lay towards Ethiopia. They must not be confounded with the Lydians of Asia Minor (Gen. x. 22). (2.) Ananim. Very uncertain. Bochart supposes them to have been wandering tribes about the temple of Jupiter Ammon, where was an ancient people called Nasamones. (3.) Lehabim. Perhaps inhabitants of a coast-district immediately west of Egypt. Probably the Lubim. (4.) Pathrusim. The people of the Thebaid (Pathros) in Upper Egypt. (5.) "Casluhim, out of whom came Philistim." A people on the north-east coast of Egypt, of whom the Philistines were a colony, probably combined with some of the Caphtorim. (6.) Caphtorim. Inhabitants of the island Cyprus.

3. Phut. This word occurs in two or three passages besides, always in connection with Africa. Josephus and Pliny mention an African river, Phutes. The great modern archæologist and geogra-

pher, Ritter, says that hordes of peoples have been poured out of Futa, in the interior of Africa.

4. Canaan. His descendants came out of Arabia, planted colonies in Palestine, and gradually possessed themselves of the whole country.

His children or posterity :—(1.) Sidon, his first-born, founded the city of that name. (2.) Heth, the ancestor of the Hittites. The remaining *nine* are well known, and are here laid down in the singular of the patronymic, or patrial adjective—the Jebusite, the Emorite (Amorite), the Girgashite, the Hivite, the Arkite, the Sinite, the Arvadite, the Zemarite, and the Hamathite. All are assigned to Palestine, and the boundaries of the country are precisely laid down.

III. Shem, though here introduced last, is declared to be the eldest of the three brothers. The reason of this order evidently is the design of the historian to pursue the line of the favoured people which the Divine Sovereign would raise up in the posterity of Shem, and in which, " when the fulness of the time should come," " all the families of the earth should be blessed."

Children of Shem :—1. Elam. The ancestor of the Elamites or Elymæans, who possessed Elymais, a region between Susiana and Media, now called Khusistan. The Japhetian Persians afterwards entered that region and gained the ascendency, and subsequently they were comprehended under the name of Elam.

2. Ashur, the ancestor of the Assyrians.

3. Arphaxad, a personal name in the Abrahamic line. The word, a remarkable compound, probably denotes *Neighbouring to the Chasdim, i.e.* Chaldæans. The name appears in *Arrhapachitis*, a province in Northern Assyria, the primitive seat of the Chasdim, and near to which, or in it, Abraham was born.

Children of Arphaxad :—These are chiefly personal, and contribute to form the sacred pedigree which leads to the Messiah. In this line are mentioned two grandsons, Peleg, and Eber, from whom is derived the name Hebrew. Joktan is universally acknowledged to be the father of the numerous tribes of Arabs in *Yeman*, or Arabia the Happy. Of the founders of those tribes thirteen are specified. The first is evidently *Modad*, with the Arabic article: the second is *Shaleph;* and Ptolemy mentions a people of interior Arabia, the Salapeni. *Hatzarmaveth* is a fruitful district on the south coast, which still bears exactly the same name. That name signifies the *Enclosure, Gate,* or *Court of Death*, on account of its insalubrity, arising from the great abundance and mixture of powerful odours. Jerach signifies the *moon;* and on the west of this region is a gold-producing tract, in which are the Mountains of the Moon, which yet must be distinguished from a group in East Africa, very imperfectly known, and called also by Orientals the Backbone of the World. *Hadoram*, the Adramites of Ptolemy and Pliny, on the south coast. *Uzal*, mentioned in Ezek. xxvii. 19, which should be translated " Vedan and Javan [perhaps Yemen ?] from Uzal." The ancient name of a principal city of Yemen, now Sanaha. *Obal* (Ebal in 1 Chron. i. 22), unknown. *Abimael*, unknown; the meaning is, *my father Mael*, and Bochart adduces the Mali of Theophrastus and the Minæi of Strabo, a tribe or tribes in Arabia, as possibly intended. *Sheba*, probably indicating an invasion of this tribe upon the Cushite Sheba and Dedan. (Gen. x. 7, and xxv. 3.) From such mixtures much embarrassment often arises in ethnography. Sheba and Seba (x. 7), are often mentioned in the Old Testament as seats of great riches and traffic. *Ophir*, undoubtedly referring to the seaport in South Arabia, so celebrated for its traffic in gold, jewellery, and fine woods. The same name was probably given to places in India and East Africa, to which the mercantile ships of this Arabian Ophir resorted. A part of the south coast of Arabia is called Oman, and in it is a town called *El-Ophir*, with the article. *Havilah;* perhaps the Cushite settlers were invaded by this Joktanite tribe. *Jobab:* Ptolemy mentions a people, *Iobaritæ*, on the east coast of Arabia. The *r* may be a mistake, or a dialectic variety, for *b*. These thirteen tribes seem to have formed the confederacy of the independent and unconquerable Arabs, whose peninsular, desert, and mountainous country defended them from invasion: Ishmael and his descendants were united with them.

Our text concludes with describing a boundary line for the country of these tribes " from Mesha to Sephar." The former is probably the country Maishon or Mesene, at the north-west head of the Persian Gulf; and the latter, on the south-west coast of Arabia, where is found a Mount Sabber.

4. Lud. From him the Lydians in Asia Minor derived their name.

5. Aram. From him the inhabitants of Syria, Chalonitis, and a considerable part of Mesopotamia.

Children or posterity of Aram :—(1.) Uz. In the northern part of Arabia, bordering upon Chaldæa: the land of Job. (2.) Hul. The large flat district in the north of Palestine, through which lies the initial course of the Jordan, even now called the Land of Hûleh, and in which is the Lake Hûleh, anciently Merom, amply illustrated by Dr Robinson (*Researches*, iii. 339-357). (3.) Gether. East of Armenia; Carthara was a city on the Tigris. (4.) Mash. A mountain region branching eastwards from the great Taurus ridge; the Masian mountains of the Greeks and Romans.

DISPLAYED, in *Heraldry*, a term used to express the position of an eagle, or other bird, when it is erect, with its wings expanded or spread forth.

DISPONDEE, in the Greek and Latin poetry, a double spondee or foot; as *cōnclūdēntēs.*

DISPONE, in *Scots Law*, to make over or convey to another in a legal form.

DISQUISITION (from *dis* and *quæro, I seek*), a formal or systematic inquiry into the nature, kinds, and circumstances of any problem, question, or topic, by arguments, or by discussion of the facts and circumstances that may serve to elucidate truth. It is chiefly applied to a written treatise, and is synonymous with *dissertation.*

DISS, a market-town in the county of Norfolk, on the Waveney, 20 miles S.S.W. of Norwich, and 84 miles from London. It consists chiefly of three wide and well-paved streets. The parish church is an elegant edifice of the early English style. Its chief manufacture is that of coarse hempen cloth. Market-day, Friday. Population (1851) 2419.

DISSECTION. See Anatomy.

DISSEISIN, in *Law*, an unlawful dispossessing a person of his lands or tenements.

DISSENTER, one who dissents or differs from another in opinion. In matters of religion, it denotes one who separates from, or does not unite with, any established church. In this sense all seceders are dissenters, though a distinction, rather verbal than real, is sometimes drawn between the two. The word dissident is sometimes used in a similar sense.

DISSIMULATION, the act of dissembling, by means of false appearances or pretensions.

DISSIPATION, in *Physics*, the insensible loss or waste of the minute parts of any body, which fly off, and thus cause its diminution or consumption.

Circle of Dissipation, in *Optics*, the circular space upon the retina which is taken up by one of the extreme pencils of rays issuing from an object.

DISSOLUTION, in *Physics*, a discontinuation or analysis of the structure of a mixed body, by which what was one and contiguous is divided into parts, either homogeneous or heterogeneous. It is a general name for all reductions of concrete bodies into their smallest parts, without any regard either to solidity or fluidity.

DISSOLVENT, anything that has the power of melting or converting a solid into a fluid; or that reduces a solid body into such minute parts as to be sustained in a fluid. The fluid in which anything is dissolved is commonly termed a *menstruum.*

DISSONANCE, in *Music*. See Music, § *Harmony.*

DISSYLLABLE, a word of two syllables.

DISTAFF, an instrument about which flax or wool is tied and from which the thread is drawn in order to be spun.

DISTANCE (Lat. *disto, I stand apart*), an interval between two things, with regard either to time or place.

Accessible Distances, in *Geometry*, such as may be measured by the chain. *Inaccessible Distances*, such as cannot be measured by the chain, on account of a river or other obstruction between one object and another.

Distance, in *Astronomy*. The distance of the sun, planets, and comets, is found only from their parallax, as it cannot be found either by eclipses or their different phases; for, from the theory of the motions of the earth and planets, we know at any time the proportion of the distances of the sun and planets from us; and the horizontal parallaxes are in a reciprocal proportion to these distances. See Astronomy.

DISTEMPER, a morbid condition of an animal body; dis-

ease. It is particularly applied to the diseases of the brute creation. The disease known as *the distemper* in dogs is noticed under the head VETERINARY SCIENCE, § *Influenza.*

DISTEMPER, or DESTEMPER, in *Painting*, a preparation of opaque colour, ground, and mixed with water and size, or with gluten, albumen, or other glutinous matter. It is much employed in decoration and scene-painting. When used on a small scale it is commonly termed *body-colour.*

DISTENSION, the act of stretching in length or breadth, or in every direction; the state of being stretched out or distended; &c.

DISTICH, a couplet; a couple of verses making complete sense; an epigram of two lines.

DISTICHIASIS, in *Surgery*, a disease of the eyelids, when under the ordinary eye-lashes there grows another extraordinary row of hairs, which frequently eradicates the former, and, pricking the membrane of the eye, excites pain, and causes a defluxion. It is cured by pulling out the second row of hairs with nippers, and cauterizing the pores out of which they have been extracted.

DISTILLATION.

This term is applied to the manufacture of ardent spirits, through the agency of heat applied to a vessel called a *still*, which contains the fermented liquor from which the spirit is to be extracted; and the spirit as it is vaporized is condensed in tubes from which it *distils*, or falls in drops, into the vessel placed to receive it. Hence the application of the term distillation. We know little relative to the antiquity of this manufacture. To the nations of antiquity it seems to have been unknown, at least we have no distinct accounts of its preparation. It is commonly supposed to have been invented by the barbarians of the north of Europe as a solace to their cold and humid climate, and to have been made known to the more southern nations by Arnoldus de Villa Nova and his pupil Raymond Lully of Majorca. At the present day there are few nations above the stage of savages who do not manufacture an ardent spirit by a process of distillation. Whether these ardent spirits are prepared from the expressed juices of fruits, from the natural or expressed juices of trees and plants, or from infusions of grains or of roots, chemistry has made known to us that they can alone be prepared from sugar, or from principles which, during the process of infusion and fermentation, are converted into sugar. In this country the great proportion of the ardent spirit is prepared from barley, which in its natural state contains no sugar; but, by the process followed, the large quantity of starch which it contains is converted into sugar; and the saccharine infusion being fermented the sugar becomes converted into alcohol, which is obtained from it by distillation.

Only two of the five species of sugars are of interest to the distiller in this country, viz., cane sugar and grape sugar; the other three, milk sugar, liquorice sugar, and manna sugar, are to the distiller mere curiosities, inasmuch as manna sugar is unfermentable, liquorice sugar is only used in colouring and flavouring porter, and milk sugar, though capable of fermentation and furnishing an ardent spirit on distillation, is not met with in sufficient quantity to be of any value to him.

Cane sugar embraces many varieties, which, though furnished by different plants, are identical in properties and composition. Of these the chief are sugars from the sugar cane, from the palm trees and date (called jaggery) from the maple, maize, and millet. The juices of the plants yielding these sugars are distinguished from those yielding grape sugar by containing very little acid. All these sugars assume regular crystalline forms when fermented; they assume the form of the grape sugars before changing to carbonic acid and alcohol; and the fermented infusions or juices yield on distillation ardent spirits known by the names of rum, arrack, &c.

It is from the *grape sugars*, however, that the great proportion of the ardent spirit used in this country is produced. The grape sugars embrace many varieties procured from different sources, yet having all the same chemical composition. These embrace the sugar of the grape, honey, the sugar of most of our fruits, and the sugar made from starch. All the juices containing naturally grape sugar are more or less acid, and the chemical reason for this is, that acid possesses the property of converting cane sugar into grape sugar, in like manner as it converts starch into grape sugar. These sugars do not crystallize so readily as cane sugar, but they ferment with extreme facility, and furnish on distillation the spirits known by the names of brandy, whisky, gin, &c.

Milk sugar exists in milk, to which it imparts its sweetness. It is readily fermentable, and when distilled furnishes the ardent spirit called *arraca*, in use among the Tartars; while the fermented milk itself is largely used by various nations, and is styled *koumiss* by the Tartars, *leban* by the Arabs, and *yaourt* by the Turks.

When these sugars are dissolved in water, and fermented, as was explained under the article BREWING, they become resolved into carbonic acid gas, which escapes, and alcohol, which remains in the fluid. It is this alcohol (spirit, or spirit of wine) which is the substance producing the stimulant and intoxicating property in all the forms of ardent spirit; and it is the separation of this from the large quantity of water and impurities with which it is mixed in the fermented liquid which constitutes the art of distillation.

The several flavours peculiar to each separate kind of ardent spirit, and which serve to distinguish them from each other, are supposed to be owing to the presence of an essential oil, derived from the ingredients employed in the manufacture; but as yet chemists have only discovered the presence of œnanthic acid, œnanthic ether, and oxyhydrate of amyle, substances which are sufficient of themselves to impart the peculiar odour, without supposing it to be owing to an essential oil whose presence has escaped detection. It is a singular fact, however, that these peculiarities of flavour or of odour are only imparted to the spirit when it is distilled from the fermented juice or sap itself; but when fermented infusions of the sugars prepared from these juices are subjected to distillation, no peculiarity of odour is manifested. Thus the fresh cane juice, when fermented and distilled, yields the high-flavoured spirit called *rum;* but sugar and molasses fermented and distilled in this country yield only plain spirits—whisky.

From whatever ingredient the ardent spirit is to be derived, the processes through which it must pass before being distilled are virtually the same. The saccharine juices or infusions, whether derived from the grape, sugar-cane, date, barley, or other grains, or potato, beet, or other roots, must first be fermented to change sugar into alcohol. The fermented liquor must then be put into a close covered vessel or still, which terminates in a conical head, to which is attached a convoluted tube, or *worm* as it is called, the end of which terminates in a vessel called a *safe*. This worm runs through or is placed in a large vessel called the *worm-tub*, or refrigerator, which receives a constant and plentiful supply of cold water. Fire or steam is then applied to the

still, when the spirit, being more volatile than water, rises as vapour, passes through the worm where it is condensed, and runs in a fluid state through the safe into the receiver.

This is the method adopted by distillers who use the flat-bottomed old stills, and is the mode chiefly used on the Continent. Before a pure spirit of the requisite strength can be got by this plan, the product of the first distillation has to be redistilled once, twice, or even three times; and the use of the safe is to enable the man who works the still to test the quality of the running liquor, the pure being put into a receiver by itself, and the impure by itself to be redistilled.

The other stills in use are termed patent stills, and make the spirit of the proper strength and purity at one distillation. The operation of this kind of still will be explained afterwards.

As in this country the attention of the distiller is almost entirely limited to the manufacture of one kind of spirit, we shall first notice—

Whisky, a corruption of the Irish word usquebaugh. This ardent spirit may be manufactured from barley malt alone, from the raw or unmalted barley mixed with from a third to a ninth of malt, from a mixture of raw barley, wheat, rye, or oats, with from a sixth to a tenth of barley malt, or from a mixture of raw barley, or big, with sugar, or from sugar or molasses alone. When barley malt is alone used, the processes are simple, and the spirit produced has a more agreeable flavour, and is more esteemed; but, in consequence of the heavy duty on malt, distillers have been induced to employ large quantities of unmalted grain, and of late years no small proportion of sugar and molasses, adding merely enough of malt to induce the chemical conversion of the starch in the unmalted grain into grape sugar.

To save reference to what was stated under the article BREWING, it may be recapitulated here, that, during the germination of barley (as in its conversion into malt) a peculiar substance is generated in the grain called *diastase*, which acts chemically on the starch of the grain, converting it first into a kind of gum called *dextrine*, and then into a sweet substance identical in composition with grape sugar. It has been found that this diastase can convert 2000 parts of starch into grape sugar; and it is of this valuable property that the distiller avails himself when he adds malt to his raw grain. To save the more expensive article malt, he uses only so much as experiment has proved will suffice to change the starch of the raw grain into sugar when mixed with it in his mash tun. The distiller, therefore, to prepare the saccharine fluid for his operations, has to go through all the processes of brewing before he gets it ready for the still. The processes followed by him will therefore be shortly described under the heads of *mashing*, *cooling*, *fermenting*, and *distilling*.

Mashing.—The barley, big, rye, oats, or other grains to be used are reduced to a fine meal, and mixed with the proper proportion of malt which has been previously merely bruised. In some Scottish distilleries the following mixture of grains is used, but the proportions and kind of grains vary in each separate distillery:—malt, 42 bushels; oats, 25 bushels; rye, 25 bushels; and barley, 158 bushels. If 40 bushels of barley, and 20 of malt, are the proportions to be used in one process, then 600 or 700 gallons of water, at the temperature of 150° Fahrenheit, are mixed with these in the mash tun, care being taken to break all the masses either by means of hand oars and rakes, or by those worked by machinery. This agitation and mixing is continued for an hour and half or longer; and to keep up the heat of the mass and furnish enough of fluid, additional 500 gallons of water are let in at intervals at a temperature of about 190°. A very superior machine has quite recently been patented, and is now being introduced into breweries and distilleries for the purpose of mashing the grain or malt. It consists of a cylindrical box about a foot in diameter, and six feet in length. Through this passes a strong wooden rod or axle fitted with wooden teeth set on at right angles, and so long as nearly to touch the sides of the cylinder. The bruised grains and hot water are then admitted at one extremity, and the toothed axle being caused to revolve rapidly mixes the grain and water more thoroughly than could be done by manual labour. The machine lies at a gentle slope, so that the mixed mass pours from its other extremity in a continuous stream into the mash tun. The mash is then covered up and allowed to rest for an hour or two. If the mash be tasted when first made, it is found to have little or no taste, but as it stands it becomes sweeter and sweeter, in consequence of the conversion of the starch into the grape sugar under the action of the diastase in the malt. If more care were taken to regulate the temperature of the mash, and keep it at that point which experiment has proved is most favourable to the action of the diastase on the starch (viz. 158° to 167°), and also allow the mash to infuse for a longer time, it cannot be doubted that the yield of saccharine matter would be greater, seeing that at present much of the starch escapes decomposition altogether. The distiller should also consider whether it would not be advantageous for him to expose his raw grain to the heat of 300° on the kiln before mashing it, seeing this heating process would convert the whole starch of the grain into dextrine, and thus facilitate after-operations. When the proportion of raw grain is greater than that indicated above, it is usual to add a quantity of the husks of the oat to the barley meal, in order to prevent it forming hard lumps, and to allow the water to percolate more freely through the mass.

When the mashing is thus finished, it is found that, in consequence of the thickness and adhesiveness of the barley meal, it is impossible to draw off the infusion or *wort* from below, as is done in brewing. It is therefore drawn off from the top, after the grains have subsided, by means of a perforated tube which rises above the grains in the mash tun.

A second, a third, and sometimes even a fourth infusion or mashing is made on the same grains, in order to obtain all the soluble matters from them. The first mash, with the above quantities, rarely yields more than 400 gallons of wort. The second mash, made with 500 gallons of water at the temperature of 190°, after standing an hour and half or two hours, will yield fully that quantity, as the grains, now deprived of much of their starch, part more freely with the water. The third mash is generally made with 800 gallons of boiling water, and when drawn off, is either added to the other to reduce them to the required strength, or is reserved for making the first infusion at a subsequent mashing.

In former days, in consequence of the restrictions imposed by the excise laws, the distiller was obliged to make his wort of great strength; and in those days the third mash was very generally boiled down, and often had various prohibited articles (as sugar and molasses) added to it in order to raise the wort to its required strength; but as these restrictions are now very much removed, and sugar and molasses are allowed to be used, it is found profitable to work with a much weaker wort. By the present excise laws, the distiller in England is bound to run his worts into the fermenting tun not weaker than 1050 of specific gravity, nor stronger than 1090. In Scotland and Ireland the distiller's wort when let into the fermenting tun must not be of lower specific gravity than 1030, nor higher than 1080. At this strength the fermentation is more complete, and the yield of spirit is greater than when the wort is of a higher specific gravity.

Cooling is the next process to which the wort is subjected. In small distilleries it is still customary to cool the wort in wide shallow coolers of wood or of iron, placed in an exposed part of the brewery. But as wort from grain has a much greater tendency to run to acidity than that from malt, it is of great advantage to get the temperature reduced as

rapidly as possible. This is effected either by fitting up blowers or fanners, which throw a brisk current of air over the flat coolers, or, better still, by the employment of refrigerators in which the hot wort is run through tin or copper tubes which pass through cold water. Wherever a full supply of cold water can be obtained, this plan possesses advantages over that of exposing the wort to the open air in the shallow open coolers. As the wort cools, a quantity of starchy matter is precipitated; but all is carefully transferred to the fermenting tun along with the wort, and undoubtedly contributes to increase the production of spirit. During the winter and temperate months the wort is cooled down to a temperature varying from 52° to 65°.

Fermentation of the wort is the most important of all the processes, as on its perfection depends the quantity of spirit which can be extracted from the wort. In former days the slow plan of fermentation used to be very generally followed. In this case it was customary to cool down the wort to 52°, and excite the fermentation by adding yeast, which distillers used formerly to procure from the London porter breweries under the idea it was the strongest and best. The whole yeast was not added at once, but a certain portion used to be added daily for the first three or four days, and the whole process of fermentation was protracted from seven to ten or even twelve days. By this plan of fermentation the wort was rarely reduced below 1002 or 1004 of specific gravity; in fact a very large proportion of the saccharine matter escaped fermentation. This old and slow process of fermentation is therefore now very generally exploded, and the quick process adopted. The wort is by this process poured into the fermenting tun at the temperature of 65° to 76°. Good yeast from any brewery is added, in the proportion of one or one and a half gallons for every 100 gallons of wort, according to the season; and a little more is often added next day if the fermentation does not seem to be going on with sufficient vigour. Active fermentation is thus excited in six or seven hours, and the whole process is finished by the second, and never later than the third day thereafter. By the excise laws relative to distillation, mashing or fermenting, and distillation of the wort, are not allowed to be carried on in the same building during the same days. To show the regularity then with which the modern distillers work, and the advantages of the quick plan of fermentation, it may be stated that in the course of writing this article we visited a distillery and found that for several years they have had, with one exception, 52 mashing periods, and 52 distilling periods annually; the mashes being made, and the fermentation carried through and completed every Thursday, Friday, and Saturday, while the fermented wash was distilled on every Monday, Tuesday, and Wednesday. The first the distillers name their *mashing period*—the second their *distilling period*—and in most well-regulated distilleries the above order is observed, so that they have 52 mashing and 52 distilling periods during the year. The fermentation should always be carried so far as to reduce the wort to the specific gravity of water, that is, 1000. When the wort is made from molasses or sugar, it is often reduced below this gravity, but rarely when the wort is made from a mixture of raw grains. Even by this great attenuation the whole saccharine matter is not thereby converted into alcohol; for the alcohol, as it increases in the wort, gradually arrests the decomposition of the sugar, and at length stops it altogether. Even, therefore, though the specific gravity of the wort be many degrees below that of water it does not indicate that the whole sugar has been converted into alcohol, seeing that the specific gravity of alcohol is so much lighter than that of water, that its presence in the wort reduces the specific gravity below that of water, even though a considerable amount of sugar remains undecomposed. It is the presence of this large quantity of undecomposed sugar in the *spent wash* (wort from which the spirit has been distilled) which gives it its sweet taste, and makes it valuable to the dairyman as an article for feeding his cows. The whole quantity, however, which escapes decomposition (or conversion into alcohol), is a loss to the distiller; but by refermenting the spent wash, or by using it for mashing a fresh quantity of grain, as is done in the manufacture of Hollands and of Rum, a considerable saving would be effected. When the wort is thus fermented, it is styled in the distiller's language the *wash*. If the fermentation flags, or is too long continued, or the temperature rises too high, a considerable loss of spirit is apt to occur in consequence of the alcohol becoming converted into acetic acid (vinegar). This change is known to occur by the wort increasing in density, the specific gravity of acetic acid being so much heavier than that of alcohol; and by the peculiar odour and taste of acetic acid becoming developed.

Distilling the wash is the next process; and the apparatus employed for this purpose is termed the *still*, of which there are many forms. The *still* is a chemical apparatus for separating the more volatile from the less volatile fluids, and it is connected with a part termed the *refrigerator*, in which the volatile vapour raised from the fluid in the *still* is condensed, and drops or distils into a vessel termed the *receiver*. The common still is a flat bottomed close vessel with a high head to prevent the fluid within boiling over. To the top of this head a tube is connected, which is carried in a spiral form round the inside of tubs or barrels filled with cold water, and from its twisted form this tube receives the name of the *worm*. The tube terminates at the bottom of the barrel, passing through it to the outside, and is conducted into the vessel termed the receiver, a stop-cock, or more commonly a vessel termed a *safe*, being usually placed on the tube where it leaves the refrigerator.

When the old excise laws, during the last century, charged the duty of spirit on the probable quantity which a still of a certain size would produce during the year, acting on the supposition that the still could only be emptied once a-week, the distillers, stimulated by the desire to evade a large portion of the duty, improved the forms of their stills, so that they emptied their stills in a few hours, instead of only once a-week. The evasion of duty thereby became at last so notorious, that a committee of the House of Commons was appointed in 1799 to investigate the matter; and the result was, that in Scotland the duty was laid on the distiller on the supposition that he could discharge an 80 gallon still every eight minutes during the whole working season. Stimulated, however, to escape the heavy duties, the distillers, by still further improvements in the form of the still, by lessening its depth, increasing its surface, and heightening its head, so improved it that stills capable of holding 80 gallons could be discharged every $3\frac{1}{2}$ minutes, and those capable of holding 40 gallons in $2\frac{1}{2}$ minutes. In the year 1815 this absurd law, which encouraged fraud, was repealed; and since then the duties have been levied on the quantity of spirit produced, irrespective of the time employed in its manufacture.

By all the old stills such a quantity of watery vapour was carried over along with the alcohol, that the distilled spirit (termed *low wines* and *feints*), had to be subjected to a second process of distillation (termed *doubling*), before it could be sent out of the proper legal strength. One of the greatest modern improvements, therefore, in this art, was the invention of a still which accomplished this end at one operation. This desirable improvement was first effected by a Frenchman, named Edouard Adam, an illiterate workman in a distillery, who, after hearing a chemical lecture on the contrivance known to chemists as the apparatus of Woulfe, applied the principle to the condensation of the vapour of alcohol. The Woulfian condenser was originally intended to impregnate water with gaseous vapours, and consisted of a range of beaked reservoirs or chambers, the beak of

each of which dipped under the fluid contained in the reservoir placed after it. Adam applied this to the condensation of the vapour of alcohol; and by causing the hot vapours to chase the alcohol from chamber to chamber, he obtained in the successive chambers alcohol of any strength and purity. He took out a patent for his invention in 1801, but it was not till after the alteration of the excise laws here in 1815 that any attention could be paid to this form of still in this country. Since that period this form of still has received various important improvements in this country so as to adapt it to the more rapid and larger operations of the British distiller, and Mr Stein's still and Mr Coffey's still are among the most perfect of these. Coffey's still, indeed, is now recognised as the best, and the most economical for preparing ardent spirit of a high per centum above proof at one operation. It may also be called a continuous still, seeing that new wash is continuously supplied as long as the still is kept in operation.

The principle which has guided the improvements in the modern stills is founded on the fact that the boiling point of alcohol varies with its density or strength; the purer it is, it requires the less heat to raise it into the state of vapour, and the more it is diluted with water the greater is the heat required to distil it. Thus alcohol of the specific gravity of ·793 boils at 168°·5 Fahr.; that of strength ·851 at 179°; and that of ·912 specific gravity at 197°. Hence, if we wish alcohol of any specific strength we have merely to keep up the heat to the point at which that spirit boils, and the spirit evaporated will have the desired strength. Such spirit will also be much purer and freer from peculiar odours, seeing that the offensive volatile oils which taint spirits are less volatile than alcohol, and only exist in quantity when the spirit has been subjected to considerable heat and has much watery vapour carried over along with it.

Coffey's *still* brings these principles into play in full perfection. In it the wash is never exposed to the direct heat of the fire, but is exposed in a series of shallow chambers, placed one over the other to the vapour of steam, which rises through the perforated bottoms of each chamber, and carries off the alcoholic vapours into the condenser. This condenser also consists of a series of chambers separated from each other by perforated plates, and is so contrived that the cold wash passing in pipes through these chambers, in its way to feed the other series of chambers, acts as the condenser to the vapour of the alcohol, the wash being gradually heated thereby, as it passes through the successive chambers. The still, therefore, consists essentially of three separate but connected parts, viz., 1st, of a large square receiver at the base, which receives the spent wash after it has been deprived of its alcohol by passing through the series of evaporating chambers; 2d, of a large square upright box, termed "analyzer," containing the series of evaporating chambers, each communicating with the one below by means of a valved tube, which only allows fluid to escape from the upper to the lower chamber, and having the dividing partition of each chamber perforated with fine apertures, to allow the steam which is admitted from below to pass from chamber to chamber through the shallow layer of wash in each. A safety or escape valve is also fitted to each chamber. The already heated wash enters the uppermost of these chambers in a continuous regulated stream, is gradually deprived of its alcohol by the steam as it passes from chamber to chamber, and at last escapes into the lower large receiver, from which it flows off after attaining a certain depth. The third part of the apparatus also consists of a square upright box, termed "condenser," divided into compartments by means of finely-perforated plates, and in each chamber is a link of the tube which carries the cold wash onwards to supply the evaporating chambers just described. The alcoholic vapours escaping from the uppermost of the evaporating chambers are carried by pipes to the lowermost of these chambers, and are partly condensed by each successive chamber being colder than the one below it, in consequence of the wash entering the pipes from above, and only getting gradually heated by contact with the alcoholic vapour as it advances from chamber to chamber. As in the lowest of these chambers the heat is greatest, the alcoholic vapour or the condensed spirit contains a large amount of water; but as the chambers are successively cooler, the alcoholic vapour and condensed spirit at last arrive at a temperature only sufficient to convert spirit of the strength wished into vapour, and by an adaptation of valves, and substituting an impervious partition for the perforated plate, and admitting the alcoholic vapour into the chambers cooled by the passage of the cold wash in its contained pipes, that spirituous vapour is condensed, and the spirit is drawn off at one operation, of the very strength which it ought to have, and of the utmost purity.

The flat-bottomed stills are considered the best for the distillation of malt spirit, as by them the flavour is preserved. Coffey's still, on the other hand, is the best for the distillation of grain spirit, as by it a spirit is obtained almost entirely destitute of flavour, and of a strength varying from 55 to 70 per cent. overproof. Spirit produced of this high strength evaporates at such a low temperature that scarcely any of the volatile oils on which the peculiar flavour of spirits depends are evaporated with it, hence the reason why it is not adapted for the distillation of malt whisky, which requires a certain amount of these oils to give it its requisite flavour. The spirit produced by Coffey's still, is, therefore, chiefly used for making gin and brandy by the rectifiers, or for being mixed with malt whiskies by the wholesale dealers. The old or flat-bottomed stills produce pure spirit at strengths varying from 11 to 45 per cent. overproof.

The distiller from malt should obtain at least two gallons of proof spirit from every bushel of malt used; and whether he procures this quantity or not, the present excise law makes him pay the duty on this quantity. If the yield be higher than this, he pays duty on the quantity produced. On the large scale the highest yield is 20 gallons of proof spirit for every quarter of malt; but 18 or 19 gallons is reckoned a fair average yield. When the yield is so low as 16 gallons per quarter of malt, it shows that the malt has been bad or that the fermentation has been badly conducted.

The maximum quantity of proof spirit obtained on the large scale from raw grain, mixed with from a fourth to an eighth of malt, is 22 gallons from every quarter of grain. From 20 to 21 gallons, however, is reckoned a good average yield in a well-regulated distillery. Mr Sheridan, however, by a particular and expensive process, obtained so high a yield as 28 gallons of proof spirits per quarter of grain. This he effected by getting the whole saccharine matter in the wort thoroughly fermented and converted into alcohol, instead of losing nearly a fifth, as is done by the plans pursued at present. For this purpose he fermented the wash in close tuns, and by attaching to them a powerful air-pump he caused the alcohol to evaporate from the wort nearly as rapidly as it formed. No alcohol being, therefore, left in the wort to arrest the decomposition of the saccharine matter, the fermentation continued until the last particle of sugar was converted into alcohol. His plans, however, were not allowed to come into general use in consequence of the meddling interference of the excise, who do not allow the processes of fermentation and of distillation to be carried on in the same premises during the same day.

In consequence of the alteration in the excise laws, sugar and molasses are now largely used in the distilleries for the manufacture of whisky. They are either used alone, or along with raw grain. From carefully conducted experiments the excise officers estimate that every hundredweight or 112 lbs. of sugar ought to yield $11\frac{1}{2}$ gallons of proof-spirit, and they charge the duty on this supposition. It re-

quires 150 lbs. of molasses to yield the same amount of proof spirit.

The peculiar flavours met with in ardent spirits from different distilleries are given chiefly by the different modes of drying the malt, or rather by the substances used for drying the malt. Thus the peculiar peat smoke flavour of much of the Highland whisky is imparted to it by drying the malt with peats; and the birch oil, or russia leather flavour, by drying the malt with birch wood.

At the end of this article we have appended three instructive tables, which exhibit several important points relative to the manufacture of ardent spirit in this country: the quantities manufactured each year during the last ten years; and the quantities manufactured from malt, from malt and raw grains, from sugar, molasses, &c.

It will render this account more complete if we very shortly notice the other distilled spirits—brandy, gin, rum, &c.

Brandy.—In the wine countries the inferior wines, or those which have been damaged by keeping, as well as the fermented mash of the pressed grapes, are subjected to distillation, and yield an ardent spirit. This spirit is known by the names of *Brandy*, *Eau-de-vie*, *Aguardiente*, &c. As a general rule, brandies are weaker in alcohol than the ardent spirit used in this country. They contain, in fact, more than the half of their weight of water; and, as a necessary consequence, have more flavour from having been subjected to a greater heat, and having more of the flavouring essential oil derived from the husk of the grape carried over with the watery vapour. It is the presence of this essential oil which gives the peculiar flavour to brandies; and the flavour is so different for each kind of brandy, that an experienced dealer can from the flavour alone distinguish the brandies of Cognac, Bordeaux, Armagnac, Naples, &c., from each other. French brandy contains a little acetic acid, acetic ether, and often some astringent matter. Some chemists think that the flavouring matter of the brandies chiefly resides in the extremely small proportions of œnanthic ether and oxyhydrate of amyle, which are met with in all spirits, but seem to have peculiar odours in each. The colour is imparted to brandy by burnt sugar.

Gin.—The Dutch have been long famous for their manufacture of an ardent spirit flavoured with juniper, and known in this country by the names of *Hollands*, *Scheidam*, *Gin*, and *Geneva*; the last being derived from the word "*genièvre*," the juniper berry, and the word gin being a contraction thereof. The distillers at Scheidam seem for the last sixty years at least to have followed very much the same practice in the manufacture of this spirit, most of the accounts published during that period by individuals who have gone over to study the manufacture agreeing in the details.

Generally 112 lbs. of malt of big, weighing about 37 lbs. per bushel, and 228 lbs. of best unmalted rye from Riga, weighing about 54 lbs. per bushel, are mashed in about 100 gallons of water of the temperature of 162°. The tun is then carefully covered and left undisturbed for about two hours. The contents are then well stirred up, when the clearest part of the spent wash of a previous distillation, and as much cold water as will reduce the strength of the wort to about 33 of Dicas's hydrometer, and lower the temperature to about 80° are added. About half a gallon of good yeast is then added; active fermentation is thus excited, the temperature rises to 90°, and the whole is over in two days. The whole wort (grains and all) is then transferred to the still, and the distillation is continued till spirit ceases to come over. A very weak spirit is thus obtained, as used to be the case in this country with the old form of still. This, or the *low wines* as it is termed, is subjected to a second distillation after having mixed with it some juniper berries and hops. Old juniper berries are preferred for this purpose, and they are added in the proportion of 2 lbs. of berries to the 100 gallons of low wines; a quarter pound of salt, and a handful of hops, are often also added. These ingredients give the spirit that peculiar flavour which has led it to be styled genievre—geneva—gin. The quantity of spirit obtained varies from 18 to 21 gallons per quarter of grain, a quantity fully as great as is yielded by the best conducted distilleries in this country.

Rum is the name given to a spirit manufactured in the West Indian Islands from molasses and the skimmings of the sugar boilers diluted with water, then fermented, and distilled. We know nothing about the origin of the word *rum*, or the time at which the manufacture of the spirit commenced. At present the manufacture is chiefly carried on in the islands belonging to Great Britain. Dr Ure states that in Jamaica the wort is made by adding together 120 gallons of molasses, 1000 gallons of the spent wash of a former distillation, 720 gallons of the skimmings of the sugar boilers, and 160 gallons of water; so that there is in the wort nearly 12 per cent. of solid saccharine matter. Other proportions, however, are used, bringing the proportion of saccharine matter up to nearly 15 per cent.; as, for instance, 100 gallons of molasses, 300 gallons of skimmings, 200 gallons of spent wash, and 400 gallons of water. The proportions vary in almost every estate, so that no certain rule can be laid down. The fermentation is in general conducted very slowly (apparently very unnecessarily so), occupying from 9 to 14 days. The saccharine matter is therefore very imperfectly converted into alcohol, and the yield of spirit is usually so low as 115 gallons of proof spirit for every 1200 gallons of wash. On some estates, and depending on the price of sugar in the market, the greater proportion of the sugar is converted into rum; and the same imperfect fermentation being followed, the average yield is said to be only 200 gallons of rum for every 3 hogsheads of sugar, whereas the proportion ought to be very nearly double.

It is from the skimmings, which are rich in aroma, that the peculiar flavour of rum is derived; for it is a curious fact, that sugar and molasses distilled in this country yield a spirit entirely destitute of all rum flavour, and in nothing distinguishable from the ordinary spirit derived from grain. Any depth of colour may be given to the rum by the addition of molasses or caromel, though it is commonly but erroneously stated that the colour of the rum is derived from the oak casks.

A spirit not to be distinguished from the ardent spirit, or whisky, manufactured in this country, is largely prepared on the Continent from the potato, but is purest and freest from peculiar flavour when manufactured from the pure potato starch. In the latter case the starch is previously converted into soluble grape sugar by subjecting it to the action of sulphuric acid, the sulphuric acid being afterwards removed as an insoluble sulphate by the addition of chalk. It is found that 1 lb. of commercial sulphuric acid (vitriol) mixed with 600 lbs. of water will convert 100 lbs. of starch into grape sugar in three hours, if the temperature be raised by pressure to 250°. After the removal of the insoluble sulphate the infusion is fermented and distilled, and yields a spirit of great purity.

Table showing the Total Number of Gallons of Proof Spirit distilled in England, Scotland, and Ireland respectively, during the year ending 5th January 1854.

	From Malt only.	From a Mixture of		From Sugar.	From Molasses.	Total Number of Gallons.
		Malt with unmalted Grain.	Sugar or Molasses with unmalted Grain.			
England	...	6,319,660	989,010	...	...	7,308,670
Scotland	5,330,714	4,113,581	915,631	...	...	10,359,926
Ireland	9,726	8,759,230	4,005	...	...	8,772,961
United Kingdom	5,340,440	19,192,471	1,998,646	...	...	26,441,557

Table showing the number of Gallons of Proof Spirit on which Duty was paid for Home Consumption, in each of the three Kingdoms, with the rate per Gallon, and the Amount of such Duty, for the Year ending 5th Jan. 1854.

	Gallons made from: Malt only.	A Mixture of Malt with unmalted grain.	Sugar or Molasses with unmalted grain.	Sugar.	Molasses.	Total Gallons.	Rate per Gallon.	Amount of Duty.
							s. d.	£ s. d.
England	878,370	8,452,105	1,019,811	21	...	10,350,307	7 10	4,053,870 4 10
Scotland	1,102,955	627,382	96,684	...	...	1,827,021	3 8	1,433,400 3 0
	2,558,659	1,772,604	376,364	...	...	4,707,627	4 8	
Ireland	6,780	2,471,778	8,694	...	...	2,487,252	2 8	1,273,151 18 8
	13,574	5,621,636	13,876	24	...	5,649,110	3 4	
United Kingdom	4,560,338	18,945,505	1,515,429	45	...	25,021,317		£6,760,422 6 6

Table showing the Total Number of Gallons of Proof Spirit distilled in England, Scotland, and Ireland respectively, during certain years, from 1831 *to* 1854.

YEARS ended 5th January.	ENGLAND. Number of Gallons of Proof Spirits Distilled from Grain, or Grain and Malt Mixed, or other Ingredients.	ENGLAND. Malt only.	ENGLAND. Total.	SCOTLAND. Number of Gallons of Proof Spirits Distilled from Grain, or Grain and Malt Mixed, or other Ingredients.	SCOTLAND. Malt only.	SCOTLAND. Total.	IRELAND. Number of Gallons of Proof Spirits Distilled from Grain, or Grain and Malt Mixed, or other Ingredients.	IRELAND. Malt only.	IRELAND. Total.	
1831	4,656,443	...	4,656,443	3,861,829	6,021,584	9,883,413	8,542,807	151,935	8,694,742	1831
1835	4,652,838	...	4,652,838	3,198,468	5,994,623	9,193,091	9,307,448	62,895	9,370,343	1835
1840	5,685,698	...	5,685,698	3,208,453	6,663,200	9,871,653	10,156,906	97,685	10,254,591	1840
1845	5,433,843	...	5,433,843	2,232,908	6,088,398	8,321,306	6,813,016	65,227	6,878,243	1845
1846	5,866,593	...	5,866,593	2,741,784	6,676,879	9,418,663	8,292,992	104,467	8,397,459	1846
1847	5,624,868	...	5,624,868	2,857,163	6,878,140	9,735,303	8,619,213	39,666	8,658,879	1847
1848	5,356,794	...	5,356,794	2,916,430	5,625,789	8,542,219	5,713,142	24,545	5,737,687	1848
1849	5,503,238	...	5,503,238	3,589,047	6,011,274	9,600,321	8,091,610	34,897	8,126,507	1849
1850	5,573,411	...	5,573,411	4,788,548	6,058,086	10,846,634	8,269,327	85,756	8,355,083	1850
1851	5,913,424	...	5,913,424	5,048,226	6,590,203	11,638,429	8,181,173	111,861	8,293,034	1851
1852	6,127,181	...	6,127,181	4,656,814	5,724,158	10,380,972	7,891,621	143,883	8,035,504	1852
1853	6,363,276	...	6,363,276	4,665,952	5,276,266	9,942,218	8,107,652	10,056	8,117,708	1853
1854	7,308,670	...	7,308,670	5,029,212	5,330,714	10,359,926	8,763,235	9,726	8,772,961	1854

(J. H—K.)

DISTINCTION, in *Logic*, an assemblage of two or more words, by means of which disparate things or their conceptions are denoted.

DISTRAIN, to make seizure of goods for debt. See DISTRESS.

DISTRESS, in its ordinary acceptation, denotes calamity, misery, or suffering.

DISTRESS, in *English Law*, the seizing or distraining of the cattle or goods of an alleged defaulter or wrong-doer, for the purpose of compelling him (through the inconvenience or loss resulting from such procedure) to perform the act in which he is a defaulter, or to make compensation for the wrong which he has committed.

The most usual injury for which a distress is resorted to is the non-payment of rent, including rents-seck, rents of assize, and chief rents, as well as rents reserved upon lease. Distress is also resorted to for damage done (*damage feasant*), as when injury is sustained from cattle or goods being wrongfully upon property, and causing damage there, either by treading down grass or the like, or by merely incumbering such property. It may also be taken for neglecting to do suit to the lord's court, or other certain personal service, for amercements in a court leet, and also for the several duties and penalties imposed by special acts of parliament, for the relief of the poor, &c.

All chattels personal, as a general rule, are liable to be distrained, with the following exceptions: animals *feræ naturæ;* whatever for the time is in the *personal* use or occupation of a man; things delivered to a person exercising a public trade, to be carried, wrought, or managed for his customer; things in the custody of the law; whatever cannot be returned in as good condition as when distrained; fixtures; growing corn; beasts used at the plough; the instruments of a man's trade or profession, provided a sufficient distress can be found otherwise.

The effect of this distress is to compel the party either to institute an action against the distrainer, or to oblige him to make satisfaction for the debt or duty for which the distress was made; and in statute distresses, and under various acts of parliament, in distresses for rent, a power of sale is given, after notice, to effectuate the remedy. (R. M—M.)

In Scotch law the term equivalent to distress is poinding. The word *distress* is, however, colloquially used in Scotland in the same sense as in England, and it is frequently the term made use of in revenue and other statutes for the seizure of a defaulter's goods.

DISTRIBUTION, the act of dividing among numbers: a dealing into parts or portions: the division and disposition of the parts of anything; as the parts of a building, according to a plan or the rules of art.

In *Rhetoric*, it denotes a kind of description by which a division and enumeration are made of the several qualities

of a subject;—as "Their throat is an open sepulchre; they flatter with their tongues; the poison of asps is under their lips; their mouth is full of cursing and lies; and their feet are swift to shed blood."

In *Printing*, it signifies the taking a form asunder, separating the letters, and disposing each in its proper compartment in the cases.

DISTRINGAS, in *Law*, was a writ commanding the sheriff or other officer to distrain a person for debt to the king, &c., or for his appearance at a certain day; and it was necessary, in order to enable a plaintiff to enter an appearance for the defendant in an action, whereon to proceed to judgment and execution. This proceeding is now abolished by sect. 24th of the 15th and 16th Vict., cap. 76, and the plaintiff, upon affidavit showing efforts to serve the writ of summons, &c., may obtain an order to proceed as if personal service had been effected. The process against a body corporate is, however, still by *distringas* in the Court of Chancery.

DISTRINGAS, *Juratores*, a writ directed to the Sheriff, by which he commanded to distrain upon a jury to appear and to return issues on their lands, &c., for non-appearance. This writ of *distringas judicatores* issues for the sheriff to have their bodies in court at the return of the writ, or to distrain them by their lands and goods. This writ is now abolished by the 15th and 16th Vict., cap. 76, sec. 104, and the jurors are summoned for the commission day in virtue of a precept issued to the sheriff by the judges of assize.

Formerly also, in an action of detinue after judgment, the plaintiff was entitled to a distringas to compel the defendant to deliver the goods by repeated distresses of his chattels; but now, under the 17th and 18th Vict., cap. 125, sec. 78, the court is empowered to order the specific delivery of chattels. (R. M—M.)

DITCH, a trench made in the earth by digging, either for an inclosure or for draining land.

In *Fortification*, otherwise called *fosse*, and *moat*, a trench dug round the rampart or wall of a fortified place between the scarp and counterscarp.

DITHYRAMBUS, in *Ancient Poetry*, a hymn in honour of Bacchus, full of transport and poetical rage.

This kind of poetry owes its birth to Greece, and to the transports of wine. Horace and Aristotle tell us that the ancients gave the name to those verses in which none of the common rules or measures were observed. Of this species of writing we have no remains.

DITONE, in *Music*, an interval of two whole tones, or a major third.

DITRIHEDRIA, in *Mineralogy*, an old term expressive of crystals with *twice three sides* or six planes, and which are formed of two trigonal pyramids joined base to base without an intermediate prism or column.

DITTEAH, a town and fortress of Hindustan, province of Bundelcund. It is populous and well built, about a mile and a half long, and nearly as much in breadth. The houses are chiefly constructed of stone, and covered with tiles. It is surrounded by a stone wall, and furnished with gates. Without the town is the rajah's palace, standing on an eminence, and commanding a very extensive prospect, including a fine lake. It is an ancient place, having been in the rajah's family for several centuries. The raj or territory of which Ditteah is the chief place, lies between Lat. 25. 32.—26. 18.; Long. 78. 15.—78. 54. Area, 850 square miles; pop. 120,000. The rajah pays no tribute. He maintains a military force of 5000 infantry and 1000 cavalry. On the cession of Bundelcund by the peishwa to the British in 1804 the rajah of Ditteah joined the British standard, and a treaty was concluded with him, by which he was confirmed in the possession of his ancient inheritance. The town of Ditteah is distant N.W. of Calcutta 755 miles. Lat. 25. 40.; Long. 78. 31 (E. T.)

DITTO, contracted into Do. in books of accounts, &c., is a corruption of the Italian *detto*, *i.e. the said*, and signifies *the aforesaid*, or *the same*.

DITTON, HUMPHRY, an eminent mathematician, was born at Salisbury, May 29, 1675. At his father's request he entered on the study of theology, and was for some years a dissenting minister at Tunbridge, where he married. On the death of his father, however, he was induced to relinquish the clerical profession; and at the persuasion of Mr Whiston and Dr Harris he devoted himself to the more genial study of mathematics. Through the influence of Sir Isaac Newton, he was elected mathematical master in Christ's Hospital, where he continued till his death in 1715.

Ditton was the author of the following treatises:—*Of the Tangents of Curves*, &c., *Phil. Trans.* vol. xxiii.; *A Treatise on Spherical Catoptrics*, published in the *Phil. Trans.* for 1705, from which it was copied and reprinted in the *Acta Eruditorum*, 1707, and also in the Memoirs of the Academy of Sciences at Paris; *General Laws of Nature and Motion*, 8vo, 1705. (Wolfius commends this work, as illustrating and rendering easy the writings of Galileo, Huygens, and the *Principia* of Newton. It is also noticed by La Roche, in the *Mémoires de Littérature*, vol. viii. p. 46.) *An Institution of Fluxions, containing the first Principles, Operations, and Applications of that admirable method, as invented by Sir Isaac Newton*, 8vo, 1706. In 1709 he published the *Synopsis Algebraica* of John Alexander, with many additions and corrections. In his *Treatise on Perspective*, published in 1712, he explained the mathematical principles of that art; and anticipated the method afterwards elaborated by Dr Brook Taylor. In 1714 Ditton published his *Discourse on the Resurrection of Jesus Christ*; and *The New Law of Fluids, or a Discourse concerning the Ascent of Liquids in exact Geometrical Figures, between two nearly contiguous Surfaces*. To this was annexed a tract to demonstrate the impossibility of thinking or perception being the result of any combination of the parts of matter and motion; a subject much agitated about that time. There was also added an advertisement from him and Whiston concerning a method for discovering the longitude, which it seems they had published about half a year before. This attempt probably cost our author his life. Although approved by Sir Isaac Newton before being presented to the Board of Longitude, and the method had been successfully practised in finding the longitude between Paris and Vienna, the board determined against it. This disappointment, together with some sarcastic lines written by Dean Swift, affected Ditton's health to such a degree that he died in the following year.

In an account of his life, prefixed to the German translation of his Discourse on the Resurrection, it is said that he had published, in his own name only, another method for finding the longitude. This Whiston denied. However, Raphael Levi, a learned Jew, who had studied under Leibnitz, informed the German editor that he well knew that Ditton and Leibnitz had corresponded upon the subject; and that Ditton had sent to Leibnitz a delineation of a machine he had invented for that purpose, and which Leibnitz highly approved of for land use, but doubted whether it would answer on board a ship on account of the motion.

DIU, a once celebrated island and fortress of Hindustan, in the peninsula of Kattywar. It is $6\frac{1}{2}$ miles long by $1\frac{1}{2}$ broad, is nearly barren, and contains no good water, excepting what is collected in ponds during the rainy weather. In 1515 the Portuguese gained possession of Diu. They immediately commenced fortifying it, and in ten years rendered it impregnable against all the powers of India. It soon became a place of great trade and commerce, and was the harbour in which the fleets were laid up in winter. But with the decline of the Portuguese power it fell into decay, and was plundered by the Arabs of Muscat in 1670. It

has since dwindled into insignificance, and has now little or no commerce. The trade in slaves formerly carried on in this island has been discontinued under orders from the Portuguese government in Europe. E. Long. 71.; N. Lat. 20. 43. (E. T.)

DIVAL, in *Heraldry*, the herb nightshade, used for sable or black by such as blazon by flowers and herbs instead of colours and metals.

DIVALIA, in *Antiquity*, a festival celebrated by the Romans on the 21st of December, in honour of the goddess Angerona; whence it was called *Angeronalia*. On this day the pontifices performed sacrifices in the temple of Volupia, the goddess of pleasure, who, according to some, was the same as Angerona.

DIVAN (Arabic *diwan*), among the Arabs, Persians, and Turks, is a word that bears very various significations. It primarily denoted a book of accounts, a muster-roll of troops, &c.; and hence came to be applied to a collection of lyric poems (called *gazelles*) arranged in a kind of alphabetical order. Thus we have the *Diwan of Sadi*, the *Diwan of Hafiz*, &c.; a practice which has been imitated by Goethe in his *Westöstlicher Divan*—a collection of poems in the Oriental style. The word among the Orientals denotes also a council-chamber, a tribunal of justice, and in like manner is applied to the general council of state. Under the khaliffs of Baghdad, the diwan was a court of justice over which the khaliff presided in person. At Constantinople in the present day the term is used to denote the great council of the empire. It is also a common appellation among the Turks for a saloon or chamber of reception, or in which business is transacted, or used as a place of occasional repose. The divan more properly is a kind of stage, raised about a foot above the floor of the saloon, covered with rich tapestry, and furnished with a number of embroidered cushions leaning against the wall; and on this the master of the house is seated when he receives visitors. Hence the word is frequently applied by other nations to a kind of public coffee-room, furnished in a manner somewhat similar.

DIVERGENT or DIVERGING, separating or receding from each other, as lines which proceed from the same point; a term of frequent use in mathematics and optics. It is opposed to convergent. A convex lens renders the rays of light convergent; a concave lens, divergent. A convex mirror makes the rays diverge; a concave one, converge. A diverging series in mathematics is a series of which the terms increase more and more the further it is continued.

DIVERSIFYING, in *Rhetoric*, a mode of varying a subject, which may be done, says Vossius, in the six following ways: 1. By enlarging on what was briefly mentioned before; 2. by a concise enumeration of what had been insisted on at length; 3. by adding something new to what is repeated; 4. by repeating only the principal heads of what had been said; 5. by transposing the words and periods; 6. by imitating them.

DIVERSION, in *War*, the act of drawing the attention and troops of the enemy from the point where the principal assault is intended to be made, by an attack or alarm in another quarter.

DIVESTING signifies literally the stripping off a vestment or garment, in contradistinction to investing. In law it is used for the act of surrendering or relinquishing one's effects.

DIVIDIVI, the commercial name of the pod of the *Cæsalpinia coriaria*, which is pretty extensively used for its astringent qualities in tanning, and also as a mordant in dyeing. It yields a large quantity of tannin.

DIVINATION, a general term descriptive of the various illusory arts anciently practised for the discovery of things secret or future. In those countries and ages where ignorance of physical laws has combined with superstition to debase the human mind, it has sought to gratify its innate disposition to pry into futurity by looking for presages in things between which and the object of its anxiety no connection existed but in the diviner's imagination. Scarcely a single department of nature but was appealed to, as furnishing, on certain conditions, good or bad omens of human destiny; and the aspect of things, which, perhaps by the most casual coincidence, marked some event or crisis in the life of one or two individuals, came to be regarded as the fixed and invariable precursor of a similar result in the affairs of mankind in general. By such childish and irrational notions was the conduct of the heathen guided in the most important, no less than in the most ordinary occurrences of life; and hence arose the profession of augurs, soothsayers, *et hoc genus omne* of impostors, who, ingrafting vulgar traditions on a small stock of natural knowledge, established their claims to the possession of an occult science, the importance and influence of which they dexterously increased by associating it with all that was pompous and imposing in the ceremonies of their religion.

This pretended science was divided into various branches, each of which had its separate professors. In a general view, divination may be considered as either natural or artificial; the first being founded on the notion that the soul possesses, from its spiritual nature, some prescience of futurity, which it exemplifies particularly in dreams, and at the approach of death: the second, resting on a peculiar interpretation of the course of nature, as well as on such arbitrary observations and experiments as superstition introduced. The different systems and methods that were anciently in vogue are almost incredible; as, for instance, Aëromancy, divining by the air; Arithmomancy, by means of numbers; Capnomancy, by the smoke of sacrifices; Chiromancy, by the lines on the palms of the hands; Hydromancy, by water; Pyromancy, by fire, &c. It is beyond our limits to enter upon the enumeration and explanation of the various arts of divination that were practised by the ancients. These the reader, curious in such inquiries, will find detailed at length by Cicero (*De Divinatione*), and Cardan (*De Sapientiâ*).

Egypt, the cradle of arts and sciences, if she did not give it birth, seems to have encouraged the practice of divination at an early age; and it is well known that at the time of the Hebrew exodus there were magicians in that country whose knowledge of the arcana of nature, and dexterity in the practice of their art enabled them, to a certain extent, to rival the miracles of Moses. By what extraordinary power they changed their rods into serpents, the river into blood, and introduced frogs in unprecedented numbers, is an inquiry that has perplexed many learned men. Some have ascribed their performances to jugglery and legerdemain; the serpents, the frogs, &c., having been secretly provided and dexterously produced at the proper moment. Others prefer the supposition that these conjurors were aided by infernal agents, with the Divine permission, in the performance of their wonderful feats. See DÆMON.

But it was Chaldæa to which the distinction belongs of being the mother-country of diviners, and especially of judicial astrologers. Such a degree of power and influence had they attained in that country, that they formed the highest caste and enjoyed a place at court; nay, so indispensable were they in Chaldæan society, that no step could be taken, not a relation could be formed, a house built, a journey undertaken, a campaign begun, until the diviners had ascertained the lucky day and promised a happy issue.

DIVINE, pertaining to the true God; or to a false god among the heathens. The word is also applied figuratively to anything superexcellent, extraordinary, or that seems to surpass the power of nature and the capacity of man.

DIVING.

DIVING is the art of descending under water to considerable depths, and of remaining there some time, so as to be able to collect valuable, articles, such as pearls, sponges, coral, and other submarine productions, from the bottom of the sea or rivers, or property from the sunken wrecks of vessels.

Difficulties of diving, from want of air in the lungs.

This art is one of great utility, but is attended with peculiar difficulties, owing to the very limited powers which man naturally possesses within the liquid element. On the surface he may no doubt continue a long time floating or swimming, and hence arises the wonderful art of navigation. But the moment he plunges within the mass he is cut off from the vital air, and life is speedily extinguished. The necessity of a constant supply of air for the support of life is shown by simply attempting to withhold it by shutting the mouth and nostrils. No one can continue holding in the breath in this manner much longer than a minute or a minute and a half. If we begin to hold after having made an expiration, we cannot do it longer than a quarter of a minute; but if we take a large inspiration, and fill the lungs, this supply is found to last longer; so that we can readily hold breath a full minute, and, with practice and great exertion, some may even continue to do so two minutes. Now this is exactly what the diver must do to remain alive under water; and accordingly we find that in general a person cannot remain longer than half a minute without the danger of suffocation, and the most practised divers not above two minutes; such is the necessity for fresh air continually present in the lungs.

Necessity of air, cause of.

The nature and cause of this necessity for air has been illustrated by the discoveries of modern chemistry. These have proved that it arises from a certain chemical action which the atmosphere exerts on the blood as it passes through the lungs, and which is continually going on, and cannot for a moment be intermitted. The nature of this action is not yet exactly understood, but the object of it undoubtedly is to purify the blood, as it becomes vitiated by circulating through the system. For this purpose, the air inspired into the lungs, and coming there into contact with the blood, imparts to it its oxygen, a small portion of which is supposed to combine with the blood, and to give it renewed vigour; but by far the greater portion combines with the carbonaceous matter of the blood, and carries off this impurity in the shape of carbonic acid at each expiration. This is proved by a very simple experiment. Let a person, for instance, respire by means of a pipe into a bag or bladder of air of the capacity of a gallon or more; he will breathe freely enough at first, but in a very short time with great difficulty, and at last will feel the sense of suffocation the same as in holding the breath in the ordinary way. If the air in the bladder be now examined, it will be found to have entirely changed its nature; it will no longer support the flame of a candle, but extinguish it the moment it is immersed, thus showing the loss of oxygen. Hence arises that sense of closeness and oppression which is felt in crowded assemblies, where, as generally happens, the ventilation is imperfect. The same air being breathed again and again, becomes unfit for respiration, and produces those unpleasant sensations which are usually felt. A very curious and interesting set of experiments on respiration were made by Messrs Allen and Pepys, and narrated in the *Philosophical Transactions* for 1808. The following bears particularly on the present subject.

"Three hundred cubic inches of common air contained in one of the mercurial gasometers were respired. In less than a minute it became necessary to take deeper and deeper inspirations, and at last the efforts were so violent that the glass was in danger of being broken. A great sense of oppression and suffocation was now felt in the chest, vision became indistinct, and after the second minute the attention of the operator seemed to be withdrawn from surrounding objects, and fixed upon the experiment. A buzzing in the ears took place, as in breathing nitrous oxide; and after the third minute there was left only sufficient recollection to close the gasometer after an expiration; after which he became insensible, having made thirty-five inspirations. The expired air contained ten per cent. of carbonic acid, four of oxygen, and eighty-six of azote."

Quantity of air necessary; mode of increasing.

With 300 cubic inches of air, then, in the gasometer, the operator began to be insensible in the space of two minutes; and if we suppose that the lungs, which were in their natural state at the commencement of the operation, contained 100 cubic inches of atmospheric air, then it would follow that 200 inches each minute would be necessary to support life, so as to remain at the same time quite sensible. Hence, supposing the lungs to contain, with a full inspiration, 250 cubic inches, which is a pretty large allowance, it would follow that a man might hold breath, or remain under water, a minute and a quarter, which agrees very well with what occurs in ordinary cases. But a very curious fact has been mentioned to us by Professor Faraday of the Royal Institution, London, and was first noticed to him by a gentleman connected with the Asiatic Society, a fact which may often be of great importance, not only in diving, but in cases of fire, and of accidents in brewers' vats, &c. The lungs in their natural state are charged with a large quantity of impure air, being a portion of the carbonic acid gas which is formed during respiration, but after each expiration still remains lodging among the involved passages of the pulmonary vessels. In proof of this, it is only necessary to breathe by a small pipe, or roll of paper, into a common water bottle, throwing away the first portion of the expiration, and propelling the last into the lower parts of the vessel. Then insert this over a taper, and it will be instantly extinguished. Now, by breathing hard for a short time, as one does after taking any violent exercise, this impure air is expelled, and its place is filled up with atmospheric air. The consequence is, that if we then take a full inspiration, the breath can easily be held for two minutes. This experiment any one can make. On trying it in the ordinary way, we could hold breath for about three quarters of a minute, but this with great difficulty. We then made eight to ten forced respirations, and on closing the mouth and nostrils felt no inconvenience even on the first trial, till after a minute and a half, but continued, however, to the end of the second minute. The knowledge of this fact might be of essential use in diving, and, we have no doubt, might often be the means of saving life; for if in the ordinary way we can only remain a single minute under water, of what importance is it to be capable of doubling the time? A single minute in these cases must be invaluable. Whether the professed divers are aware of this circumstance or not, we do not know; but it is probable, at any rate, that in many cases the exertion induced by swimming may have the effect of clearing the lungs. Another curious fact illustrative of the same principles occurred to Mr Bruneli in descending to examine the breach which the river had made in the Tunnel under the Thames. Having lower-

Diving.

ed the diving-bell nearly thirty feet to the mouth of the opening, this was found too narrow to admit the bell, so that no further observation could be made on the state of the Shield and other works, which were perhaps eight or ten feet deeper. Brunell, therefore, laying hold of the end of a rope, left the bell, and dived himself down the opening; his companion in the bell being alarmed at the length of his stay, now about two minutes, gave the signal for pulling up; and the diver, unprepared for the signal, had hardly time to catch hold of the rope which he had let go, and was surprised on coming up to find that so much time had elapsed. On descending again, he found that he could with ease remain fully two minutes under water. The reason evidently was, that the atmosphere in the bell being condensed by a column of water nearly thirty feet in height, contained nearly double the quantity of air in the same bulk, and thus nearly a double supply in the lungs.

Difficulty from the pressure of the water.

Besides the difficulty of holding the breath, another arises in diving, particularly at considerable depths, from the external pressure of the fluid on the chest, and on every cavity of the body. On the chest this tends to compress it together, and to expel the air out of it, and thus increases greatly the difficulty of holding the breath. At each foot of descent this pressure will increase upwards of sixty lbs. on every square foot of the body; and if we suppose the chest to expose half a square foot, we have, at the depth of fifteen feet, a force equal to the weight of 450 lbs. loading the chest, and tending to propel the included air. A very great muscular exertion, therefore, will evidently be required to resist this enormous strain; nor is it practicable, by any breastplate or other contrivance, to defend the chest from this pressure, as this, to do any good, would require to be so large, and of such strength, as greatly to obstruct the free motions of the diver. It is this pressure of the deep water, and the violent exertion necessary to overcome it, that causes, in divers who go down frequently, the eyes to become blood-shot, and brings on a spitting of blood.

Marvellous accounts of divers.

The art of diving having always in it, and particularly during the infancy of science, something of the marvellous, the most extraordinary accounts have been given, by different authors, of the feats of some of the most noted divers. The most singular of these is that given by Kircher, of the Sicilian diver *Nicolo Pesce*, taken, as he states, from the archives of the kings of Sicily.

Sicilian diver.

"In the times of Frederick king of Sicily," says Kircher, "there lived a celebrated diver, whose name was *Nicholas*, and who, from his amazing skill in swimming, and his perseverance under water, was surnamed the *fish*. This man had from his infancy been used to the sea, and earned his scanty subsistence by diving for corals and oysters, which he sold to the villagers on shore. His long acquaintance with the sea at last brought it to be almost his natural element. He was frequently known to spend five days in the midst of the waves, without any other provisions than the fish which he caught there, and ate raw. He often swam over from Sicily into Calabria, a tempestuous and dangerous passage, carrying letters from the king. He was frequently known to swim among the gulfs of the Lipari islands, noway apprehensive of danger.

"Some mariners out at sea one day observed something at some distance from them, which they regarded as a sea monster; but upon its approach it was known to be Nicholas, whom they took into their ship. When they asked him whither he was going in so stormy and rough a sea, and at such a distance from land, he showed them a packet of letters which he was carrying to one of the towns of Italy, exactly done up in a leather bag, in such a manner as that they could not be wetted by the sea. He kept them thus company for some time in their voyage, conversing and asking questions; and after eating a hearty meal with them, he took his leave, and, jumping into the sea, pursued his voyage alone.

"In order to aid these powers of enduring in the deep, nature seemed to have assisted him in a very extraordinary manner; for the spaces between his fingers and toes were webbed, as in a goose; and his chest became so very capacious that he could take in, at one inspiration, as much breath as would serve him for a whole day.

"The account of so extraordinary a person did not fail to reach the king himself, who commanded Nicholas to be brought before him. It was no easy matter to find Nicholas, who generally spent his time in the solitudes of the deep; but at last, after much searching, he was found and brought before his majesty. The curiosity of this monarch had been long excited by the accounts he had heard of the bottom of the Gulf of Charybdis; he now therefore conceived that it would be a proper opportunity to have more certain information. He therefore commanded our poor diver to examine the bottom of this dreadful whirlpool, and, as an incitement to his obedience, he ordered a golden cup to be flung into it. Nicholas was not insensible of the danger to which he was exposed, dangers best known only to himself, and therefore he presumed to remonstrate; but the hopes of the reward, the desire of pleasing the king, and the pleasure of showing his skill, at last prevailed. He instantly jumped into the gulf, and was as instantly swallowed up in its bosom. He continued for three quarters of an hour below, during which time the king and his attendants remained on shore anxious for his fate; but he at last appeared, holding the cup in triumph in one hand, and making his way good among the waves with the other. It may be supposed he was received with applause when he came on shore; the cup was made the reward of his adventure; the king ordered him to be taken proper care of; and, as he was somewhat fatigued and debilitated by his labour, after a hearty meal he was put to bed, and permitted to refresh himself by sleeping."

The diver then, according to the account, gave a narrative of the wonders he had seen, which so excited the curiosity of the monarch, that he again tempted the diver to a second and fatal descent. After plunging into the whirlpool, he was never more heard of.

Authentic statements of the power of divers.

But to return to more authentic statements, these on the whole agree very well with the views already stated. Among the pearl divers at Ceylon and other parts of the East, instances have been known of a diver remaining six minutes under water; but these are very rare; the ordinary time seldom exceeds a minute, and sometimes it is a minute and a half, or two minutes. There are generally ten divers in each of the boats belonging to the fishery; five descend into the sea at a time, and the other five remain above to recruit their strength. In order to hasten their descent, a large stone is used, with a rope attached to it, which the diver seizes with the toes of his right foot, while he grasps a bag of net-work with those of the left. He then seizes another rope with his right hand, and keeping his nostrils shut with his left, plunges into the water, and soon reaches the bottom. Then hanging the net round his neck, he speedily collects the oysters, and resuming his former position, he makes a signal to those in the boat, and is immediately hauled up, and the stone which assisted his descent is pulled up afterwards.

The divers are all Indians, who are accustomed to this seemingly dangerous occupation from their infancy, and who fearlessly descend to considerable depths. They will frequently make from forty to fifty plunges in a day; but the exertion is so extremely violent, that in coming up they

Diving.

discharge water, and sometimes blood, from their mouths, ears, and nostrils. Some of them rub their bodies with oil, and stuff their ears to prevent the water from entering; but the greater part use no precautions whatever. They take no food while in the boats, nor till they return on shore and have bathed themselves in fresh water. The only danger to which they are exposed is from meeting, while at the bottom, with the ground-shark, which is a common inhabitant of those seas, and of which the divers are under dreadful apprehensions; some of them indeed are so expert as to avoid this enemy, even when they remain under water for a considerable time; but the uncertainty of escaping is so great, that, in order to avert the danger, they consult, before they begin, their priests or conjurors, in whom they place implicit confidence.

Florida Indian divers.

Dr Halley relates, as a remarkable circumstance, that he observed a Florida Indian diver at Bermudas, who could remain two minutes under water. He states, that the divers for sponges in the Archipelago are in the practice of taking down in their mouths a piece of sponge dipped in oil, and by this are enabled to dive longer than others who have none. It is not easy to conceive how this can assist the diver's breathing; for the introduction of any foreign substance into the mouth must necessarily diminish the quantity of air he can take down. But it has been lately said that the real object of taking oil in their mouth is to calm those small waves on the surface of the sea which prevent the light being so steadily transmitted to the bottom as is necessary to enable the divers to find the small objects they search for without delay. By ejecting a little oil from their mouths, it rises to the surface, and spreading upon it, calms the waves in a most remarkable manner, and gives a brilliant light at the bottom.

Use of sponges.

South Sea divers.

Many nations, and particularly the savages in the South Sea and other islands, are remarkable for the expertness they acquire by habit in diving and moving about in the water. Being accustomed to it from their infancy, the element becomes so natural to them that they seem to have the use of all their faculties in the water the same as on the dry land. According to the accounts of voyagers, they are such expert divers, that when a nail or other piece of iron was thrown overboard, they would instantly jump into the sea after it, and never fail to recover it. On one occasion a smith's anvil is said to have fallen overboard. Not being able to bring this up, the islanders notwithstanding contrived to bring it ashore, by descending a great many times to the bottom, and rolling it over and over till it reached the land.

Apparatus for aiding the divers.

Such is the length to which diving has been carried by the natural powers of the body alone. But from the curious and difficult nature of the object, and the many important purposes to which the art might be employed, ingenious men were led to the invention of various contrivances for the use of the diver, which have greatly extended his powers and the usefulness of the art. A multitude of these contrivances of different descriptions have been brought forward by mechanical projectors for the last two hundred years. They all resolve themselves into three different kinds.

1*st*, Water-tight armour or dresses for the body, so strong as to protect it from the external pressure of the fluid; and, along with this, the means of supplying the diver with fresh air, so as to enable him to remain any time under water.

2*dly*, Water-tight vessels of metal for inclosing the diver, and of such capacity as to contain a supply of air for a limited period of perhaps half an hour or an hour or more, and giving him also the use of his hands and arms externally by a sort of flexible sleeves.

3*dly*, The diving-bell, which, from its simplicity, safety, and perfect efficiency, has now almost entirely superseded every other, though there is no doubt that in many cases these may still be of considerable utility in subservience to the bell.

Diving.

Water-tight armour.

In regard to dresses or armour, a number of different plans of this kind are detailed in Leopold's *Theatrum Machinarum Hydraulicarum*. At depths of twelve or fifteen feet these may often be of essential use; but beyond this they become inapplicable, owing to the great pressure on the limbs of the diver, which must either be exposed, or covered only with a flexible material, not to impede his motions; and in that case the pressure, acting on all sides like a ligature, is liable to obstruct the circulation of the blood in the limbs, and to drive it from these into those parts of the body within the armour, causing extreme pain. In any great depth, also, the necessary strength of the armour renders it unwieldy; and it is extremely difficult, if not impracticable, to fit it tightly on every part; while the smallest opening, by admitting water, may endanger the life of the diver.

Klingert's armour.

One of the best of these contrivances is perhaps that proposed by M. Klingert, and described in a pamphlet published at Breslau in 1798. The harness or armour is made of strong tin-plate, in the form of a cylinder, with a round end to inclose the head and body, and, for the convenience of putting it on, is made in two parts, the head-piece or helmet, and the body. Besides this, there is a leather jacket, with short sleeves, and a pair of drawers of the same, which are made water-tight, buttoned on the metal part where they join, and made tight with brass hoops, going round the leather and the metal upon the outside. The chief peculiarity in this machine is the mode in which fresh air is supplied, and respiration effected. This is done by two distinct flexible pipes proceeding from the inside of the helmet to the surface of the water; the one is for inhaling the air, and terminates in an ivory mouth-piece, which the diver may embrace with his lips and inhale the air; the other enters the helmet at the same place, and opens merely into the inside of the machine, so as to allow the foul air to be discharged. The diver, therefore, draws in the fresh air by the mouth, and discharges it into the helmet by the nostrils; and from the interior of the machine it is propelled by the act of inspiration, the expansion of the chest contracting the space between it and the armour, and forcing out exactly as much air as is drawn in, keeping up always a due equilibrium. This is certainly a very ingenious arrangement; for, if there were no second pipe to discharge the air, the expansion of the chest would compress the air round the body of the diver, and, unless this were of large capacity, which would be inconvenient, would create a difficulty in the operation. The construction of the apparatus will be understood from the drawing, fig. 1, Plate III., which is a front view of the diver, and by the following description: A is the helmet-piece, fifteen inches in height, and the diameter adapted to the size of the body of the diver; BB is the lower part of the cylinder, of the same diameter, and of such a height as to meet the other at the dotted line C; *dd*C is the jacket, and *ff*E the drawers; these are attached to the cylinder by buttons, as seen; and *a*, *a*, *bb* are the three brass hoops fitted over each joint to make it water-tight; the hoops are made of brass-plate, with their ends turned up, and fitted with screws, by means of which they can be drawn very tight upon the leather. The cylinder has holes for the arms, one half in the upper piece and one half in the lower; and when the jacket is fastened on, it binds the upper and lower parts of the cylinder together. It is fastened at the arms with brass screw hoops, *dd*, and the

Diving. drawers by similar ones at *ff*; *k h* represent the breathing pipes, the first for drawing in the air, the second for discharging it; these are united to a little metal cylinder, which screws on the helmet at the aperture *g*; this is shown more particularly at fig. 2, where a partition will be observed in the cylinder dividing the fresh air compartment from the other, the one terminating in the ivory mouth-piece *v*, the other just entering the machine at *t*. W is a small reservoir at the lower part of the pipes, for condensing any air, or receiving what may penetrate through the pipes. To resist the external pressure of the water on the limbs, the leather drawers have a framing of iron within them, represented at fig. 3; this consists of a semicircular piece *ll*, also seen at *ll*, fig. 1, extending between the legs of the diver, and fastened to the lower extremity of the cylinder at the front and back; also two irons *nn* outside the thighs, which are jointed to the cylinder, and extend down to *f*, where they are attached to a hoop surrounding the thigh; there is another hoop for each thigh farther up at *q*; these hoops are farther connected by irons, which at the upper end are fitted to slide upon the semicircular hoop, as at *t*; and by this means, though the frame-work is very strong, the diver is at liberty to walk. *ww* are weights hooked on the cylinder, to keep the diver down. P is a small pump for discharging any leakage water which may penetrate through the joints.

When the different parts of the machine have been fitted to the body of the diver, and the proper weights are attached, he enters the water till it rises as high as his eyes, while the end of the pipe is held by an assistant above the surface; and if he finds that he can breathe freely, and no water is forced into the pipe, he may venture to go deeper; and, stopping for some time, to ascertain whether respiration be not inconvenient from the want of fresh air, he may advance to still greater depths, while he makes the proper signals by means of the rope which is secured to one of his arms, or by speaking through the pipe. By this kind of exercise for some time, the diver acquires confidence and ease for conducting the necessary operations. When he is desirous of ascending he has only to unhook the weights attached to the apparatus, or to fix them to a rope let down for the purpose, that they may not be lost, and as he is then lighter than the same bulk of water, he rises to the surface.

By following these directions, any one may be able to use the apparatus, and dive to moderate depths, in a very short time. In one of the trials upon the Oder, near Breslau, the diver was a huntsman taught by the author; the water was of considerable depth, and the current strong, and there were a great number of spectators present. He sawed through the trunk of a tree which was lying at the bottom; he showed also that he could have fastened sunk bodies to a rope in order to be drawn up, and that in case any impediment should prevent the use of the saw, the trunks of trees might be hewed to pieces by an axe. On the whole, this apparatus, or one similar, might certainly be of great use in many cases, particularly in hydraulic works, where the diving-bell and the machinery connected with it might not be attainable. The water-proof cloth of Mackintosh might also be substituted with good effect for the leather.

Apparatus by Tonkin. Another mode of supplying air to the diving apparatus has been adopted in some cases. This consists in forcing the fresh air into the machine by a bellows or pump, till its elastic force is equal to the pressure of the water. The foul air may in this case be suffered to escape into the water through a valve, or may be conducted to the surface by a pipe. Of this kind is the apparatus contrived by Mr Tonkin, and employed for some time in raising parts of the wreck of the Abergavenny East India ship, which was unfortunately lost off Weymouth in 1804. It consisted of a body of copper with iron boots, put together and jointed in the manner of coats of mail; the whole is then covered with leather, and afterwards with canvass to distinguish it under water. The arms are made of strong water-proof leather; and the place for sight is about eight inches diameter, glazed over with a plate of glass an inch thick. The diver is sunk in this machine by means of weights, fastened equatorially round the waist of it; and he is suspended by a rope, by means of which his situation is changed at pleasure. A flexible air-tube communicates with an air-vessel in the boat above. Through this tube the diver gives his instructions and obtains his supply of fresh air. This machine was used with very good effect in a depth of water of near seven fathoms, and enabled the diver to direct the operations of several curious machines, such as saws for clearing away the ship's decks, and making sufficient openings to give him access to the treasure below, as well as tongs, &c. for taking up the heavy goods by tackle in the vessel above.

Borelli's diving bladder. In regard to the second kind of diving machines, that proposed by Borelli is only curious as showing the low state of physical knowledge in his time. He proposed to have a copper vessel, or vesica as he terms it, about two feet diameter, to contain the diver's head, and to be fixed to a habit of goat skin for the body. Within the vessel there were pipes contrived to produce a circulation of air, by which Borelli supposed that the objections to other diving machines from the want of air would be obviated; "the moisture," as he says, "by which it is clogged in respiration, and by which it is rendered unfit for the same use again, being taken from it by its circulation through the pipes, to the sides of which it would adhere, and leave the air as free as before." It also contained an air-pump, by means of which the diver could raise or lower the apparatus, by condensing or rarefying the air, on the principle of the air-bladder of fishes.

Leather diving chest. Mr Martin, in his *Philosophia Britannica*, mentions an apparatus contrived by an Englishman, consisting of strong leather, so prepared that no air could pass through. It fitted to his arms and legs, and had a glass window placed in the fore part of it. When dressed in this apparatus, which was large enough to contain half a hogshead of air, he could walk on the ground at the bottom of the sea, and enter the cabin of a sunk ship to take out the goods. The inventor is said to have himself used this machine very extensively in recovering wrecks, and with such success as to have acquired considerable property by it. We are not informed of the depths to which he descended.

Klingert's diving chest. Mr Klingert, the inventor of the water armour, also contrived a diving chest, of the form of a hollow cylinder, to be used along with it. This contained fifty-eight cubic feet of air, which, he estimated, would last two hours. It was suspended from a boat, but could be raised and depressed independently of this by a pump compressing or dilating the included air. Thus the ballast is so adapted to the size of the machine, as to make it sink so far that only a cubic foot of it remains above water. In this state an additional weight of a hundred pounds will depress it below the surface, or make it sink to the bottom. The effect of adding extra weights is produced by diminishing the volume of contained air, by condensing it into a smaller space. To accomplish this, a large cylinder is applied in the bottom of the vessel, and provided with a piston, which, by a rack and pinion, can be moved from one end of the cylinder to the other, when the diver turns a handle, coming through the side of the machine, and communicating motion by a worm and wheel to the pinion of the rack before mentioned. The lower end of the cylinder is open to the water, and the upper end opens

within the machine; therefore, when the diver turns the handle in the direction to raise up the piston in its cylinder, it necessarily diminishes the bulk of the included air, and the machine will sink; but on depressing the piston in the cylinder, it will ascend again. The inventor proposed to furnish the machine with two small oars to move it in the water, and an anchor or grapnel to make it fast whilst the diver walks about on the bottom, within the limits of the length of the pipe, to examine sunk bodies, and discover the best mode of raising them. To prevent danger from any accident happening to the machine, the diver is to be provided with the means of quickly detaching the pipes from the machine, and retaining a sufficiency of air in the armour to carry him to the surface when he throws off the weight suspended from his girdle.

Rowe's diving chest.

Another diving machine or chest was invented by Mr Rowe in 1753, and is represented in Plate CCV., fig. 4. It consists of a trunk or hollow copper vessel AB, soldered or riveted together with strength proportioned to the depth of water where it is to be fixed. It contains the diver's body, and also a sufficiency of air for the time he intends to dive. He enters with his feet first at the open end A, which is then closed by a lid or cover screwed on by a number of screw bolts passing through the flanches. The vessel is bent at F, for the bearing of the diver's knees, and has a sufficiency of leaden ballast at B to sink it in the right position. There are two hoops surrounding it, which, at the same time that they strengthen it, afford points of suspension by a bar, which is attached to them, and is pierced with several holes to admit a span upon the rope, which is so adjusted as to suspend the whole, with the diver in it, nearly in the position of the figure, when he will be in a convenient posture for working with his arms, which come through openings C in the vessel, to which sleeves E, of very strong leather, are attached by a hoop or ring, screwed to the vessel with the leather between them. The sleeves are lined with cloth, and the edges round the holes are defended by soft quilting, from hurting the diver's arms by the pressure, as well as to prevent the sleeves and his arms being thrust inwards. D is an aperture covered by a strong lens, for the diver to see through. At H and G are two other openings in the upper part of the vessel, covered by screw caps, which are removed when fresh air is to be introduced into the machine by the nose pipe of a pair of bellows being applied to force fresh air into one, and drive out the foul air at the other. The lower opening is also of use to pump out any water which may leak through at the joints, though this is as much as possible prevented by fitting leather into the joints of the cover and the caps before they are screwed tight. The mass of lead F is fastened to the lower side of the vessel in a line between the diver's arms, by means of hoops. On this the whole rests if it comes to the ground, and remains in a proper position for the diver to work, and fasten ropes to any thing which is to be drawn up, as shown in fig. 5.

If the water be very deep, the diver must wear a kind of saddle on his back, which, having a ridge touching the top part of the vessel withinside, enables him to keep his arms properly out of the apertures, otherwise he would not have strength to resist the pressure acting upon the surface of the arms and sleeves, which forces them into it with a weight proportional to the quantity of surface exposed, and to the depth of water. The diver gives his instruction to those above by a small line, which is laid through a staple at the side of the machine, and has a handle always hanging in reach of the diver's hand. The upper part of this line is held by a person in the boat or ship above, to whom any signal is given, by the diver snatching or twitching the line a certain number of times, as has before been agreed upon. This is immediately felt by the person above, who gives orders accordingly. The size of the vessel is such that he can continue at the bottom about half an hour, without any pipes or other supply, and will be enabled to do many things very readily, such as recovering moorings, chains lost in rivers or harbours, hooking ropes for weighing up lost anchors, or any other purpose where there is free access to the object sought; though in entering and searching the wrecks of ships, it would be less convenient than some others which we shall describe.

Diving machine to move under water.

Besides the above, several other projects of a similar kind have been proposed, not only with means within itself of raising and lowering the vessel, but with contrivances in the shape of screw arms for moving it when under water in any direction; but none with much success. This is said to have been tried in the reign of King James I. by a famous English projector, Cornelius Drebell, who, we are told by Mr Boyle, made a submarine vessel, which would carry twelve rowers besides the passengers; and that he had also discovered a liquid which had the singular property of restoring the air when it became impure by breathing. This last circumstance, with the number of persons inclosed in the machine, and the imperfect state of mechanics at the period alluded to, render the whole story extremely improbable, though it shows clearly that the idea had been entertained, and perhaps some attempt made. The celebrated Bishop Wilkins, in his *Mathematical Magic*, takes up the scheme of Drebell, and, with all the sanguine facilities of a projector, describes the benefits of these submarine enterprises. The submarine vessel of Mr Bushnell of Connecticut, in America, constructed in 1787, though very complex, appears to have been a curious and ingenious machine, and to have promised success if persevered in, according to the accounts published of it. It was intended to act chiefly as an engine of war, by advancing under water towards an enemy's ship, and fixing in the bottom of it a magazine of powder, which, by peculiar contrivances, was intended to take fire after the machine had got to a sufficient distance to be out of danger. But if this be the only use of such a machine, its failure need not be regretted. Let us now turn, then, to the most important of all diving machines yet contrived, namely,

The Diving-Bell.

General principles.

The principle of the diving-bell is extremely simple. Let any one insert a wine glass in a tumbler of water; on sinking it to the bottom, the inside of the glass will be observed to remain nearly full of air, so that any small object within the glass will remain perfectly dry, the included air being confined on all sides, and by its impenetrability excluding the water from its place. If this experiment be made with a pretty large bell-glass, inverted over a taper floating on the surface of the water in a still larger vessel, the taper will be observed to descend with the glass to the bottom; and though surrounded on all sides with water, it will be found to remain perfectly dry, and to continue burning for some time. Conceive then a vessel of wood or metal, in the shape of a wine-glass or truncated cone, but so large as, when inverted, to admit several persons within it, sitting, for instance, on a board along one of the sides. Let the whole then be suspended by a rope or chain over the side of a vessel, with a jib pulley and crane, to lower or raise the machine at pleasure. Then, on the machine being lowered and loaded with sufficient weight to sink it, the persons may all descend to a great depth in the sea, without being wetted in the small-

Diving-Bell. History.

est degree; and there is nothing to prevent them remaining any time in this situation, and moving about and doing operations at great depths.

The above, then, was the original construction of the diving-bell; and the great advantage of it, and what distinguishes it above every other similar invention, and renders it vastly superior, is, that being perfectly open below, the divers can get out and in with the utmost facility. This invention, according to Professor Beckmann, is generally assigned to the sixteenth century; and "I am of opinion," says he, "that it was little known before that period. We read, however, that in the time of Aristotle divers used a kind of kettle, to enable them to continue longer under the water; but the manner in which it was employed is not clearly described. The oldest information which we have of the use of the diving-bell in Europe is that of John Taisnier, who was born in Hainault in 1509, and had a place at court under Charles V., whom he attended on his voyage to Africa. He relates in what manner he saw, at Toledo, in the presence of the emperor and several thousand spectators, two Greeks let themselves down under water, in a large inverted kettle, with a burning light, and rise up again without being wet. It appears that this art was then new to the emperor and the Spaniards, and that the Greeks were caused to make the experiment in order to prove the possibility of it."

"When the English in 1588 dispersed the Spanish fleet called the Invincible Armada, part of the ships went to the bottom, near the Isle of Mull, on the western coast of Scotland; and some of these, according to the account of the Spanish prisoners, contained great riches. This information excited, from time to time, the avarice of speculators, and gave rise to several attempts to procure part of the lost treasure. In the year 1665, a person was so fortunate as to bring up some cannon, which, however, were not sufficient to defray the expenses. Of these attempts, and the kind of diving-bell used in them, the reader will find an account in a work printed at Rotterdam in 1669, and entitled *G. Sinclari Ars nova et magna gravitatis et levitatis.* In the year 1680, William Phipps, a native of America, formed a project for searching and unloading a rich Spanish ship sunk on the coast of Hispaniola; and represented his plan in such a plausible manner, that King Charles II. gave him a ship, and furnished him with every thing necessary for the undertaking. He set sail in the year 1603; but being unsuccessful, returned again in great poverty, though with a firm conviction of the possibility of his scheme. By a subscription, promoted chiefly by the Duke of Albemarle, the son of the celebrated Monk, Phipps was enabled, in 1687, to try his fortune once more, having previously engaged to divide the profit according to the twenty shares of which the subscription consisted. At first all his labour proved fruitless; but at last, when his patience was almost entirely exhausted, he was so lucky as to bring up, from the depth of six or seven fathoms, so much treasure, that he returned to England with the value of L.200,000. Of this sum he himself got about sixteen, others say twenty thousand, and the duke ninety thousand pounds. After he came back, some persons endeavoured to persuade the king to seize both the ship and the cargo, under a pretence that Phipps, when he solicited for his majesty's permission, had not given accurate information respecting the business. But the king answered, with much greatness of mind, that he knew Phipps to be an honest man, and that he and his friends should share the whole among them, had he returned with double the value. His majesty even conferred upon him the honour of knighthood, to show how much he was satisfied with his conduct. We know not the construction of Phipps's apparatus; but of the old figures of a diving-machine, that which approaches nearest to the diving-bell is in a book on fortification by Lorini; who describes a square box bound round with iron, which is furnished with windows, and has a stool affixed to it for the diver. This ingenious contrivance appears, however, to be older than that Italian; at least he does not pretend to be the inventor of it.

"In the year 1617, Francis Kessler gave a description of his water-armour, intended also for diving, but which cannot really be used for that purpose. In the year 1671, Witsen taught, in a better manner than any of his predecessors, the construction and use of the diving-bell; but he is much mistaken when he says that it was invented at Amsterdam. In 1679 appeared, for the first time, Borelli's well-known work *De Motu Animalium;* in which he not only described the diving-bell, but also proposed another, the impracticability of which was shown by James Bernoulli. When Sturm published his *Collegium curiosum* in 1678, he proposed some hints for the improvement of this machine, on which remarks were made in the *Journal des Sçavans.*" The diving-bell, as hitherto used in the above simple form, is liable to two great defects, viz.

1. The elasticity of the included air prevents it from resisting entirely the entrance of the water into the lower part of the bell. The water, by the universal law of fluids, presses the bell on all sides, in proportion to the depth of the immersion. This pressure therefore it exerts upwards on the bottom of the bell, and against the included air; but the air being extremely compressible, yields to the pressure, and is contracted into a smaller volume, allowing the water to enter and occupy the lower portion of the bell. Such is the effect of this pressure, that at the depth of thirty-three feet the air becomes compressed into half its volume, and the bell fills half full of water; and the same proportion at every other depth. But,

2. The air within the bell, by continued respiration, becomes speedily unfit to support life; and the whole apparatus therefore must be raised from time to time, to receive a fresh supply. Suppose that only two persons descend in the bell at a time, we have seen that a supply of two hundred cubic inches of air per minute is absolutely necessary for each person to keep in life and sensibility. But in order to breathe freely, at least double that quantity would be required; say for two persons half a cubic foot per minute. If then we have a bell six feet long, and four feet average diameter, this would contain about seventy cubic feet, and would last upwards of two hours. So that for at least one hour or more respiration might be carried on with all manner of freedom.

Effects of pressure.

At great depths, such as twenty, thirty, forty, and sixty feet, where the usual pressure on the body from the atmosphere above is doubled and tripled, amounting in the latter case to nearly forty pounds in every square inch, one would imagine that respiration, and indeed the whole system of the body, would be deranged under so thick and confined an atmosphere. But experience proves that no great inconvenience arises from this circumstance; and the reason is, that the air pressing into every cavity within the body, as well as externally, the pressure is exactly balanced; so that the effect of the actual increase is rendered nearly insensible. The only particular sensation felt in descending in the bell is some pain in the ears, particularly at first. This increases a little as we descend, but, after resting at the bottom, goes entirely off. It arises from the effect of the condensed air acting externally on the tympanum of the ear, before the air within the tympanic cavity has acquired the same density to counterbalance it. The tympanum on the outside communicates directly with the atmosphere, the pressure of which therefore acts instantaneously. But on the inside the tympanum bounds

Pain in the ears.

the tympanic cavity; and this has no communication with the external air, excepting by the Eustachian tube, which leads from the cavity into the mouth. Through this tube, therefore, the condensed air must pass from the mouth, to supply what is necessary within the cavity for restoring the same equilibrium within and without. But the Eustachian tube is a long and narrow passage; at its commencement in the ear it has a bony structure, but towards its termination in the mouth, behind the nostrils, it becomes soft and fleshy, so as readily to close the passage, particularly with any pressure acting externally. It admits therefore an easy passage from the ear to the mouth; but when any pressure arises in the opposite direction, it acts in some degree like a valve, shutting the passage, until the increasing pressure again forces it open. Some time then elapses before all this can be accomplished; and during this time the external air pressing with full force on the tympanum, produces the pain which is felt. When the Eustachian tube opens, it is generally all of a sudden, and with a slight explosion or pop, which is followed by instant relief from the pain. This relief may often be produced by filling the mouth, or gulping the air and pressing it into the tube.

Different accounts have been given of this effect on the ears in the diving-bell; but the above seems the most accurate, and what really takes place. The effect, indeed, may be shown experimentally by shutting the mouth and nostrils, and exhausting the air from them by the action of the lungs. The air in the tympanic cavity immediately rushing through the Eustachian tube into the mouth, the external air acts on the tympanum, and produces a slight sensation of deafness, such as is felt in the bell. But, instead of exhausting the air, attempt to compress it, and force it through the tube into the internal ear; at first no effect is produced: but after exerting a considerable pressure, a slight pop is felt, and a little pain in the ear, which is just the sudden opening of the tube.

The great inconveniences of the diving-bell already mentioned were completely removed by the labours of the celebrated and ingenious philosopher Dr Halley, who about the year 1715 introduced the grand improvement of supplying it with fresh air for any length of time without raising the bell out of the water. This he effected by letting down from the vessel from which the bell was suspended, barrels of fresh air, which, by means of pipes, discharged their contents into the bell; while the foul air escaped by a small cock in the top of the bell. In this manner the air within the bell was kept perfectly fresh, and for any length of time. Another remarkable advantage arose from this plan. The force of the air in the barrels was made to discharge the whole of the water out of the bell, which the elasticity of the included air had hitherto allowed to enter and partially to fill the cavity. This was easily done by stopping the cock at the top, and letting down the barrels below the level of the bell, by which means the air included in them received a sufficient preponderating pressure to enter the bell and drive out the water. In this manner the whole cavity of the bell became available for working; and, what was of still more importance, the diver could with ease descend and walk on the bottom of the sea, the feet being only slightly immersed. The following is the interesting account which Dr Halley gives of his arrangements:

"The bell I made use of was of wood, containing about sixty cubic feet in its concavity, and was of the form of a truncated cone, whose diameter at the top was three feet, and at the bottom five. This I coated with lead so heavy that it would sink empty; and I distributed the weight so about its bottom, that it would go down in a perpendicular direction, and no other. In the top I fixed a strong but clear glass, as a window, to let in the light from above; and likewise a cock to let out the hot air that had been breathed; and below, about a yard under the bell, I placed a stage, which hung by three ropes, each of which was charged with about one hundredweight to keep it steady. This machine I suspended from the mast of a ship by a sprit, which was sufficiently secured by stays to the mast head, and was directed by braces to carry it overboard clear of the ship's side, and to bring it again within board, as occasion required.

"To supply air to this bell when under water, I caused a couple of barrels, of about thirty-six gallons each, to be cased with lead, so as to sink empty; each of them having a bung-hole in its lowest parts to let in the water as the air in them condensed on their descent, and to let it out again when they were drawn up full from below. And to a hole in the uppermost part of these barrels I fixed a leathern trunk or hose well liquored with bees-wax and oil, and long enough to fall below the bung-hole, being kept down by a weight appended; so that the air in the upper part of the barrels could not escape, unless the lower ends of these hose were first lifted up.

"The air-barrels being thus prepared, I fitted them with tackle proper to make them rise and fall alternately, after the manner of two buckets in a well; which was done with so much ease, that two men, with less than half their strength, could perform all the labour required; and in their descent they were directed by lines fastened to the under edge of the bell, which passed through rings on both sides of the leathern hose in each barrel; so that, sliding down by these lines, they came readily to the hand of a man who stood on the stage on purpose to receive them, and to take up the ends of the hose into the bell. Through these hose, as soon as their ends came above the surface of the water in the barrels, all the air that was included in the upper parts of them was blown with great force into the bell, whilst the water entered at the bung-holes below, and filled them; and as soon as the air of one barrel had been thus received, upon a signal given, that was drawn up, and at the same time the other descended, and, by an alternate succession, furnished air so quick, and in so great plenty, that I myself have been one of five who have been together at the bottom in nine or ten fathom water, for above an hour and a half at a time, without any sort of ill consequence; and I might have continued there as long as I pleased, for any thing that appeared to the contrary. Besides, the whole cavity of the bell was kept entirely free from water, so that I sat on a bench which was diametrically placed near the bottom, wholly dressed, with all my clothes on. I only observed that it was necessary to be let down gradually at first, as about twelve feet at a time; and then to stop and drive out the air that entered, by receiving three or four barrels of fresh air before I descended further. But being arrived at the depth designed, I then let out as much of the hot air that had been breathed as each barrel would replenish with cool, by means of the cock at the top of the bell; through whose aperture, though very small, the air would rush with so much violence as to make the surface of the sea boil, and to cover it with a white foam, notwithstanding the weight of the water over us.

"Thus I found that I could do any thing that required to be done just under us; and that, by taking off the stage, I could, for a space as wide as the circuit of the bell, lay the bottom of the sea so far dry as not to be over shoes thereon. And, by the glass window, so much light was transmitted, that when the sea was clear, and especially when the sun shone, I could see perfectly well to write or read, much more to fasten or lay hold on any thing under us that was to be taken up. And, by the re-

turn of the air-barrels, I often sent up orders written with an iron pen, on small plates of lead, directing how to move us from place to place as occasion required. At other times, when the water was troubled and thick, it would be as dark as night below; but in such cases I have been able to keep a candle burning in the bell as long as I pleased, notwithstanding the great expense of air necessary to maintain flame. This I take to be an invention applicable to various uses, such as fishing for pearls, diving for coral or sponges, and the like, in far greater depths than has hitherto been thought possible. Also for the fitting and placing of the foundations of moles, bridges, &c. in rocky bottoms, and for the cleaning and scrubbing of ships' bottoms when foul, in calm weather, at sea. I shall only intimate, that by an additional contrivance, I have found it not impracticable for a diver to go out of an engine to a good distance from it, the air being conveyed to him with a continued stream, by small flexible pipes; which pipes may serve as a clue to direct him back again when he would return to the bell."

Plate CCV., fig. 5, represents the construction and operations of Dr Halley's bell as thus described.

In 1721, shortly after the above experiments were made, Dr Halley contrived additional apparatus, to enable the diver to go out from the bell to a considerable distance, and stay a sufficient time in the sea, and walk about on the bottom, with full freedom to act as occasion required. Considering that the pressure being greater on the surface of the water in the bell than on any other surface which was higher than that in the bell, the air would pass by a pipe from the bell into any cavity for air; where the surface of the water was higher, he concluded that a man, by putting on his head a bell or cap of lead, made sufficiently heavy to sink empty, and in form resembling the bell itself, might keep his head dry, and might receive a constant stream of air from the great bell, so long as the surface of the water in the cap was above the level of that in the bell, by means of a flexible pipe which he would carry coiled on his arm.

In pursuance of this idea he procured pipes to be made, which answered all that was expected from them. They were secured against the pressure of the water by a spiral brass wire, which kept them open from end to end, the diameter of the cavity being about the sixth part of an inch. These wires being coated with thin glove leather, and neatly sewed, were dipped into a mixture of hot oil and bees-wax, which, filling up the pores of the leather, made it impenetrable to water; several thicknesses of sheep's entrails were then drawn over them, which, when dry, were covered with paint, and then the whole defended with another coat of leather to keep them from fretting. Several of the pipes were as much as forty feet long, the size of a half inch rope. One end of a pipe being fixed in the bell at some height above the water, the other end was fastened to a cock which opened into the cap. The use of the cock was to stop the return of the air whenever there was occasion to stoop down or go below the surface of the air in the bell, which occurred as often as there was occasion to go out or return into the machine. The diver, therefore, when he has descended to the bottom in the great bell, puts on his cap with the pipe hanging on his arm like the coil of a rope. As soon as he leaves the bell, he opens the cock in the pipe, and walks on the bottom of the sea, giving out the coils of his pipe as it is required; and this serves as a clue to direct him back again to the great bell, from whence he derives his supply of air by means of the pipe.

The weight of a man being very little more than that of his bulk in water, he could not act with any strength, nor stand with any firmness, especially if there is any current, without a considerable addition of weight; the leaden caps were therefore made to weigh about half a hundredweight, to which was added a girdle for the waist, formed of large weights of lead nearly of as great weight in the whole; also two clogs of lead for the feet, of about twelve pounds each. With this accession of weight Dr Halley found a man could stand well in an ordinary stream, and even go against it. It is necessary for the diver to be provided against the cold of the water, which, though it could not be removed so that a man could endure it long, yet it was much eased by wearing a waistcoat and drawers made close to the body, of that thick woollen stuff of which blankets are made. This becoming full of water, would be a little warmed by the heat of the body, and keep off the chill of new cold water coming on.

When the water is not turbid, things are seen sufficiently distinct at the bottom of the sea; but a small degree of thickness makes perfect night in a moderate depth of water. To obtain an open view from the leaden caps, which, from their use, the doctor called caps of maintenance, he at first used a plain glass before the sight, but soon found that the vapour of the breath made such a dew on the surface of the glass that it lost its transparency. To remedy this, he found it necessary to prolong that side of the cap which was before the eyes, and thereby enlarge the prospect of what was beneath.

Another plan of the diving-bell was proposed by Mr Martin Triewald, F. R. S. and military architect to the king of Sweden, which, for a single person, is in some respects thought to be more eligible than Dr Halley's, and is constructed as follows. AB, fig. 6, is the bell, which is sunk by lead weights DD hung to its bottom. This bell is of copper, and tinned all over in the inside, which is illuminated by three strong convex lenses P, with copper lids to defend them. The iron ring or plate below the bell serves the diver to stand on when he is at work, and is suspended at such a distance from the bottom of the bell by the chains, that when the diver stands upright, his head is just above the water in the bell, where the air is much better than higher up, because it is colder, and consequently more fit for respiration. But as the diver must always be within the bell, and his head of course in the upper part, the inventor has contrived, that even there, when he has breathed the hot air as well as he can, he may, by means of a spiral copper tube *bc*, placed close to the inside of the bell, draw the cooler and fresher air from the lowermost parts; for which purpose a flexible leather tube, about two feet long, is fixed to the upper end of the copper tube; and to the other end of this tube is fixed an ivory mouth-piece, by which the diver draws in the air, at the same time expiring by the nostrils. This bell may be supplied with fresh air by barrels, the same as Dr Halley's.

The next improvements introduced in the construction of the diving-bell were those by Mr Spalding of Edinburgh, and for which the Society of Arts voted him a reward. These are certainly deserving of attention, although they do not appear to have afterwards been adopted in practice. Mr Spalding had, in the two preceding years, acquired considerable experience in the management of a bell on Dr Halley's plan, which he had constructed in the hopes of recovering part of a considerable property which had been lost in a ship wrecked on the Scares, or Fern Islands, in 1774, in the night, when all the crew perished. Some of the light goods were thrown on shore, and it was proposed to recover the rest by diving, the remainder of the owners giving up the management of the whole to Mr Spalding. His first experiments were made in depths of five, six, and eight fathoms, in Leith Roads; and having in these made his apparatus

Spalding's trials in Dr Halley's bell.

tolerably perfect, he sailed for Dunbar, thirty miles distance, in an open long boat, sloop-rigged, and of about six or eight tons burthen. By a mistaken account he had been informed the bottom of the Fox ship of war lay there; but upon his arrival, the oldest seaman in the place could give him no intelligence; and as that vessel had perished in the night with all on board, somewhere in Dunbar Bay, and by storms, so long before as thirty years, it was thought to be sanded up. In order to gratify the curiosity of some friends there, he still determined to descend where it might be thought probable her bottom lay; but in seven and eight fathoms water he found nothing but a hard sandy bottom, from which he was led to conjecture that the proprietors of the valuable effects which were on board that vessel might have found their account in sweeping for her. Being informed that a vessel, which was thrown up by accident in the river Tay, near Dundee, with a large quantity of iron, lay within two fathoms of the surface at low water, he determined to make trial there, and accordingly sailed across the frith to that place, about forty-five miles distant from Dunbar. Here he went down three different times, changing the ground at each going down, and at last fell in with a stump of the wreck, sunk five fathoms deep at low water to a level with the soft bed of the river, which is composed of a light sand intermixed with shells. The principal parts of this wreck were supposed to have been carried away by an immense body of ice the year before. He found that the muddiness of the river occasions a darkness at only two fathoms from the surface that cannot be described; and from the smallness of his machine, which contained only forty-eight English gallons, it was impossible to have a candle burning in it, which would consume the air too quickly for any man to be able to work, and at the same time pay attention to receiving the necessary supplies of air.

These trials were only preparatory to his views at the Scares, hoping to acquire experience which would enable him to surmount the dangerous difficulty of the unequal rocky bottom which he expected to meet with; but in the preceding trials, and different alterations of the machinery, so much time had been lost, that the weather became stormy, and he was obliged to wait at Bamborough Castle some time till the weather became more favourable. He then sailed to the Scares with his brother, three sailors, and two pilots. It was four in the afternoon, about high water, when he went down at a small distance from the place where he judged the wreck to lie. The depth was about ten fathoms. He fortunately alighted on a flat part of the rock, within a small space of a dreadful chasm, and had just gone two steps with his machine, when the terror of the two pilots was so great, that, in spite of his brother, they brought him up very precipitately, before he had in any degree examined around him. On coming into the boat, they remonstrated on the danger of the machine being overturned either on the wreck or the rocks, and also on the impossibility of raising any of the weighty goods with so small a purchase in an open boat, and in a place where, at this season, no large vessel would venture to lie, as the nights were then so long, and only two passages for a small vessel to run through, in case of a gale of easterly or southerly wind; one of the passages being extremely narrow, and both of them dangerous.

"Convinced from this," says Mr Spalding in his account, "that with an open boat nothing could be accomplished, and that, except in June and July, no man would risk himself with me in a sloop, to continue a few days and nights at anchor there, I was obliged to abandon my project; yet I determined to take a view of the guns of a Dutch ship of war lost in the year 1704; and as they lay two or three miles nearer the land, I could execute this design with less difficulty, especially as the weather continued still favourable. Having procured all the intelligence possible, we went to the place, where I went down four different times, but could find no marks of any wreck, notwithstanding my walking about in five and six fathoms water, as far as it was thought safe to allow the rope to the bell, continuing generally twenty minutes each time at the bottom. On this occasion I was obliged to carry a cutting hook and knife, and clear away the sea weeds, which at this place are very thick and strong; without this method I could not move about. At the fifth going down, each trial being in a different place, I was agreeably surprised to find a large grove of tall weeds, all of them from six to eight feet high, with larg tufted tops, mostly in regular ranges, as far as the eye could reach, a variety of small lobsters and other shell-fish swimming about in the intervals." He then discovered the place where one of the cannons lay; but was too much exhausted, by having been down at intervals for near three hours, to attempt bringing it up.

In these descents Mr Spalding found out two very serious dangers attendant on the use of the bell on Dr Halley's plan. These are, 1. By Dr Halley's construction, the sinking or rising of the bell depends entirely upon the people who are at the surface of the water; and as the bell, even when in the water, has a very considerable weight, the raising of it not only requires a great deal of labour, but there is a possibility of the rope breaking by which it is raised, and thus every person in the bell would inevitably perish. 2. As there are, in many places of the sea, rocks which lie at a considerable depth, the figure of which cannot possibly be perceived from above, there is danger that some of their ragged prominences may catch hold of one of the edges of the bell in its descent, and thus overset it before any signal can be given to those above, which would infallibly be attended with the destruction of the people in the bell, especially as it must always be unknown, before trial, what kind of a bottom the sea has in any place.

Spalding's improvements.

To obviate these defects, Mr Spalding introduced a balance-weight suspended below the bell, and which, when it reached any rocky or uneven ground, settled down first, and then the bell being made too light to sink without the weight, remained suspended and free from danger; and for the purpose of raising or levelling the bell without aid from above, he divided with an air-tight partition the upper portion of the bell from the lower. The former was capable of being filled either with water or air at pleasure, and of thus increasing or diminishing the buoyant effect at pleasure, on the same principle as the air-bladder in fishes.

Plate CCV., fig. 7, represents these arrangements, which will be understood from the following description: ABCD represents a section of the bell, which is made of wood; *ee* are iron hooks, by means of which it is suspended by ropes QBF*e*, and QAER*e*, and QS, as expressed in the figure; *cc* are iron hooks, to which are appended lead weights, that keep the mouth of the bell always parallel to the surface of the water, whether the machine, taken altogether, is lighter or heavier than an equal bulk of water. By these weights alone, however, the bell would not sink; another is therefore added, represented at W, and which can be raised or lowered at pleasure by means of a rope passing over the pulley, and fastened to one of the sides of the bell at M. As the bell descends, this weight, called by Mr Spalding the *balance-weight*, hangs down a considerable way below the mouth of the bell. In case the edge of the bell is caught by any obstacle, the balance-weight is immediately lowered down, so that it

may rest upon the bottom. By this means the bell is lightened, so that all danger of oversetting is removed; for, being lighter without the balance-weight than an equal bulk of water, it is evident that the bell will rise as well as the length of the rope affixed to the balance-weight will allow it. This weight, therefore, will serve as a kind of anchor, to keep the bell at any particular depth which the divers may think necessary; or, by pulling it quite up, the descent may be continued to the very bottom.

By another very ingenious contrivance, Mr Spalding rendered it possible for the divers to raise the bell, with all the weights appended to it, even to the surface, or to stop at any particular depth, as they might think proper; and thus they could still be safe, even though the rope designed for pulling up the bell was broken. For this purpose the bell is divided into two cavities, both of which are made as tight as possible. Just above the second bottom EF, are small slits in the sides of the bell, through which the water entering as the bell descends, displaces the air originally contained in this cavity, which flies out at the upper orifice of the cock GH. When this is done, the divers turn the handle G, which stops the cock; so that if any more air was to get into the cavity AEFD, it could no longer be discharged through the orifice H, as before. When this cavity is full of water, the bell sinks; but when a considerable quantity of air is admitted, it rises. If, therefore, the divers have a mind to raise themselves, they turn the small cock *g*, by which a communication is made between the upper and under cavities of the bell. The consequence of this is, that a quantity of air immediately enters the upper cavity, forces out a quantity of the water contained in it, and thus renders the bell lighter by the whole weight of the water which is displaced. Thus, if a certain quantity of air is admitted into the upper cavity, the bell will descend very slowly; if a greater quantity, it will neither ascend nor descend, but remain stationary; and if a larger quantity of air is still admitted, it will rise to the top. It is to be observed, however, that the air which is thus let out into the upper cavity must be immediately replaced from the air-barrel; and the air is to be let out very slowly, or the bell will rise to the top with so great velocity that the divers will be in danger of being shaken out of their seats. But, by following these directions, every possible accident may be prevented, and people may descend to great depths without the least apprehension of danger. The bell also becomes so easily manageable in the water, that it may be conducted from one place to another by a small boat with the greatest ease, and with perfect safety to those who are in it.

Instead of wooden seats used by Dr Halley, Mr Spalding made use of ropes suspended by hooks *bbb*, and on these ropes the divers may sit without any inconvenience. I and K are two windows made of thick strong glass, for admitting light to the divers. N represents an air-cask with its tackle, and NP the flexible pipe through which the air is admitted to the bell. In the ascent and descent of this cask the pipe is kept down by a small weight appended, as in Dr Halley's machine. F is a small cock by which the hot air is discharged as often as it becomes troublesome. Fig. 5 is a representation of the whole diving apparatus, which it is hoped will be readily understood without any further explanation. Two air-barrels are represented in this figure; but Mr Spalding was of opinion that one air barrel capable of containing thirty gallons is sufficient for an ordinary machine.

An improvement has been suggested on Mr Spalding's plan of raising or lowering the bell, by shutting up the upper bell entirely, and forming it into a magazine of condensed air, which being charged by two air-pumps within the bell, could be let off at pleasure, and filling the lower bell, would displace the water and increase the buoyancy.

Last great improvement in introduction of an air-pump by Smeaton.

The last great improvement on the diving-bell, and what stands next in importance to that of Halley, and has brought the machine to that perfect state in which it is now so successfully employed, was introduced by the celebrated engineer Mr Smeaton. This consisted in substituting for the air-barrels of Halley a forcing air-pump, by which a continued stream of air was poured into the bell without any farther trouble or apparatus than a man or two to work the pump. It was about the year 1779, in the repairs of the foundations of Hexham Bridge, that Mr Smeaton first tried the use of the diving-bell; and this was the first attempt indeed to introduce it into the operations of engineering, where it has since rendered such essential service. The piers of the bridge having been undermined by the violence of the current sweeping away the gravel from under the floor timbers of the caissons by which they were founded, it occurred to Smeaton that by means of the diving-bell the cavities under the foundations might be filled up with rough stones, rammed and wedged firmly together. His diving-bell consisted of a square box or chest of wood, three and a half feet long, two feet broad, and four feet high. The pump for supplying it with air was fixed on the top of the bell, and worked by a handle at one side. The depth of the river being small, it was not intended to go down so as to cover the whole of the bell, else the air-pump would have required to be removed; it was only necessary to sink the mouth of the bell down to the level of the caisson bottom. With the assistance of this machine Mr Smeaton succeeded in underpinning the foundations of some of the piers. The calamitous accident which followed in 1782, when the whole structure was carried away by a sudden and violent flood, only proved the great insufficiency of the natural bed of the river.

Trial at Hexham Bridge.

Operations at Ramsgate harbour.

In 1788 Mr Smeaton constructed a second diving-bell, for the operations contemplated at Ramsgate harbour, on a much more substantial and improved plan; and this is the model on which all the succeeding diving machines have been formed. Instead of the usual form of a bell or conical inverted tub of wood, sunk by weights attached to the outside, this consisted of a square chest of cast iron, four and a half feet long, four and a half feet high, and three feet wide, affording sufficient room for two men at a time to work under it. Instead of the weights applied externally, the bell itself was cast of such thickness, particularly at the bottom, that its own weight, viz. fifty cwt., was more than sufficient to sink it when full of air. The pump also for supplying fresh air was placed in a boat by itself, on which several hands were stationed, to keep the pump continually in action. The air from the pump was conveyed to the machine by a flexible tube, which allowed the bell to be moved up or down, or in any direction, independent of the motion of the boat. From the above dimensions, the bell would always contain about fifty cubic feet of air, which, from what we have already shown, would be sufficient to support life for two persons for about an hour, independent of any supply from above; so that any idea of danger from this source is completely removed. It was in clearing the foundations for the advanced pier at Ramsgate that it occurred to Mr Smeaton the operation might be facilitated by the diving-bell. A large quantity of stones had been thrown in, to secure the old pier head; and it seemed doubtful whether they could be got up in nine and ten feet water by the usual method of tongs from the barges. The diving-bell was found to answer completely the object intended. In the course of two months the foundations were cleared; and it was computed that of 160 tons of stone raised out of the foun-

dation, about 100 stones, many of them above a ton each, were brought up by the diving-bell, without which a full season would have been lost.

The pier, which was afterwards built on the foundation thus cleared, was founded by caissons, but in the course of years was found to require renewal in some places, and in others to be protected by an apron or outside wall of regularly-built masonry; and here a new application of the diving-bell arose in the building of this wall under water. For this purpose the bell is suspended by powerful tackle to the extremity of a long wooden frame, which rests on the top of the pier, the one end projecting over the pier, and the other running back and turning on a centre pin, which is fixed in a heavy stone on the pier. The frame thus sweeping with a long radius, and the weight of the whole being borne by a roller running along near the edge of the pier on a cast-iron plate or rail in the segment of a circle, the bell is capable of having a considerable motion right or left along the wall, and the block of the tackle being moveable along the frame, the bell is by this means shifted out or in from the wall at pleasure; and by these two motions can be set in any required position within the sweep of the apparatus. The directions for moving it are given by the divers, and communicated to those who have charge of the apparatus above, by merely striking with a hammer on the inside of the bell. From the great facility with which water conducts sound, the strokes of the hammer are heard at a great distance, and have a peculiar character, which is not easily mistaken for any other. To convey various directions, the divers have established a sort of language from the number of blows of the hammer. One blow, for instance, denotes more air; two, stand fast; three, heave up; four, lower down; and so on. The first operation in the building is to clear and level the foundation. If this be loose materials, they are removed by dredging, in the usual manner; but wherever rock occurs, it is done by the bell, with two men in it, being let down to the bottom, which, at Ramsgate, is a hard chalk rock. When it stands thereon, it lays the chalk dry to the level of the bottom edge of the bell; but if the surface is uneven, the bell cannot descend so low but that it will leave six or eight inches of water on the bottom. The surface of this water is the level they work to, and by cutting away every eminence which rises above the water, they soon obtain a perfectly level surface. They work with a small pick, made something like a narrow adze, for this purpose; and the work proceeds rapidly, for the chalk is not very hard. When they have accumulated as much rubbish as becomes inconvenient, they give three knocks on the bell to order the people to draw it up, till they, standing on the bottom, find themselves knee deep; then two knocks to stand fast. They now take in a shallow basket which has been previously let down from above, and fill the rubbish into it, then snatch it to order it to be drawn up, and strike four times on the bell, that they may be lowered down to proceed with their work. Having in this manner hewed away the surface till the water, standing equally all over it, shows it to be a perfect level plane, they give orders to be removed to a new situation, yet at such a small distance that part of the surface they before levelled is still beneath the bell, in order that both may be brought to one plane. Thus continuing the work, they get all the rock prepared for the stone-work, without any other level than the water.

The foundation being thus levelled, the stones are in the mean time all prepared and jointed, either square or with dovetails. These are first hoisted from the pier by means of a crane, and let down to their places in the work, as nearly as can be done, by the crane. As each stone is thus laid, the divers direct themselves right or left, up or down, until they be exactly over the stone; then making fast a strong chain to the lewis of the stone, the other end of which is attached to a ring in the top of the bell, they give the signal to heave, and the bell, with the stone under it, are both suspended by the tackle, and being moved right or left until it cover exactly over its place in the wall, it is then let down, and the chain being detached, the operation proceeds with another stone in the same manner, until the wall be completed. No cement is generally used to unite the stones; their own weight, and the accuracy of the joints, being sufficient to hold them together

Diving-bell employed in other places.

Since the completion of Ramsgate harbour, the diving-bell has been applied with great success to various other operations of a similar kind in different parts of the kingdom, and particularly at Dublin, Donaghadee, and other harbours in Ireland, and at Holyhead and Portpatrick on this side the channel. Plate CCIV. contains drawings of the bell and machinery used for the harbour of Howth, near Dublin, under the direction of the late eminent Mr Rennie, and with which the foundations of the pier wall were laid with success at very considerable depths below water.

Account of bell and machinery at Houth near Dublin.

Fig. 1 is a section showing the machine and the bell viewed in the direction of the length of the wall which is to be erected, and fig. 2 is an elevation of the same as it appears when viewed from the sea. A is the bell, which is made of cast iron. It is suspended by strong chains passed through eyes *rr*, fig. 5, and through the ring *m* of a tackle B. FF, figs. 1 and 2, are strong beams supported in a horizontal position by cross beams G, resting at one end on the shore, and the other ends supported by a scaffolding L of piles firmly braced. On the beams F two iron railways are laid for the wheels of two carriages to run upon; one of these carriages contains the tackle which suspends the bell, and the other has a similar tackle to hoist the large stones, which are to be laid on the wall X. Each carriage runs with four wheels *aa* upon the railways F, and has a smaller or upper carriage running upon it in a transverse direction; and this upper carriage contains the windlass purchase tackle, by which the bell or the stone is raised. Thus F′ is the timber frame of the principal carriage, on the top of which are railways for the wheels *dd* of the upper carriage, of which D is the frame; and C is the roller or barrel to wind up the rope or fall of the great purchase tackle B, which is suspended from the frame of the carriage, and bears the weight of the bell. On the end of the barrel is a large cog-wheel M, which is turned round by a pinion fixed on the axis N of a second wheel O, and this is turned by a pinion, to which the handles H are applied. By turning these, two men can raise or lower the bell with ease. In order to move the bell in either direction, the wheels *aa* of the lower carriage E are provided with cogs at one edge, and pinions *b* work in the teeth of these; both pinions *b* are fixed on the same axis, which extends across the frame; and wheels *c* are also fixed on each extremity of the axis. These wheels have holes or mortises in them to receive handspikes or levers, by which they can be turned round, and will then move the lower carriage and the bell along the railways FF, in the direction of the length of the wall, which is to be built as shown by X. In like manner the wheels *dd* of the upper carriage are provided with cogs and pinions *e*, on the end of which are the capstan head *f* to receive handspikes, when it is required to move the upper carriage and the bell in a transverse direction. By means of these two motions in transverse directions, the bell or the stone can be suspended over any required spot in the wall, and lowered down thereupon as the men in the bell direct. Fig. 5 is a section of the bell, and fig. 6 a

plan to show the apertures *nn* for the lenses which give light. Two men descend together, a seat *s* being fixed across on each side of the bell. The air-pipe is screwed on at *k*, and proceeds to the air-pump as shown in fig. 1 The pump is placed on the top of the scaffold G; it has two barrels I I, which are worked by a lever K, by one or two men; they act as forcing pumps, and the air which is thrown down escapes from the lower edge of the bell, and rises up through the water in bubbles. By this means the air in the bell is at all times quite fresh and pure.

The stones which are to be used in building the wall are prepared on shore, and fitted to each other. When all is prepared, these stones are lowered down the bank by a capstan to the position *w*. The rope of the machine is then attached, and by the aid of both ropes the stone is lowered down upon the wall. The divers then descend in the bell, and the two carriages are brought close together, by which means the bell will hang partly over the stone W, fig. 2, so that the men can guide it into its place on the wall X, and make signals to those above to direct them which way to move the stone, and where to lower it. The bell was also employed, in the first instance, to clear the foundation for the walls. It was then lowered quite down on the bottom, and the men worked the rock to a level surface. In many parts it was requisite to blast it with gunpowder. The divers bored the hole in the rock, and placed the powder in a tin cartridge, which was well secured in the hole, by running in small fragments of stone. A small tin pipe was affixed to the canister, long enough to reach up above the surface of the water. When all was prepared, the bell was drawn up out of the way, and a nail or other small piece of iron heated red hot was dropped into the tin pipe, thereby to descend to the powder.

Figures 3 and 4 represent a vessel which was fitted up under the direction of Mr Rennie, to carry a diving-bell of cast iron. This vessel was used in Plymouth Sound, and the bell was swept over the bottom to discover and take up old anchors, &c. The bell A is suspended over the bow of the vessel, by a strong tackle *q*, from the extremity of a pair of shears; that is, two masts DB, DB, fig. 4. The fall or rope of the tackle *q* is drawn up by a windlass at C. There is also another strong tackle GH, extended between the head of the mast I and the top of the shears D. This is drawn by the windlass F. The use of this is to raise the shears upright, and bring the bell on board. A platform S is fixed on the deck to lower it upon when out of use.

Diving-bells on the Clyde.

The diving bell has lately been employed with success in improving the navigation of the Clyde between Glasgow and Greenock, by raising up and removing out of the bed of the river a number of large stones which obstructed the channel, and could not be so readily got out by any other means. The bell is constructed similarly to that in fig. 3, but instead of being let down at the end or side of the barge, has a well constructed in the middle of the vessel itself, in which it is made to rise and fall by strong chains, tackling, and cranes. Recently a second barge and bell have been constructed, and are now employed on the river for the same purpose. The management of the vessel and bell requires six or seven hands. The whole can be moved with great facility to different parts of the river, and moored wherever their assistance is required.

Such, then, is an account of the construction and uses of the different diving machines, and particularly the diving-bell; and we have no doubt that the principle, as it is susceptible of it, may yet be still more extensively applied, and in various other ways. The only disadvantage attending the machine in its present form is the expense and cumbrous nature of the apparatus, which prevents its use in many cases where it might be of real service; so that it is only in some great and extensive public work that it can ever be thought of. It is to be hoped, therefore, that the skill and ingenuity of our mechanicians may yet succeed in introducing the machine in a more accessible and manageable form.

See Halley, *Phil. Trans.* 1716, vol. xxix. p. 492, also vol. xxxi. p. 177; Triewald, *Phil. Trans.* 1736, vol. xxxix. p. 377; Spalding, *Transactions of the Society of Arts*, vol. i. p. 220; Klingert, *Phil. Mag.* vol. iii. p. 172; Lawson, *Phil. Mag.* vol. xx. p. 362; Bushnell, *Transactions of the American Philosophical Society*, vol. iv. p. 303; *Repertory of Arts*, vol. xv. p. 383; Nicholson's *Journal*, vol. iv. p. 229; Healy, *Phil. Mag.* vol. xv. p. 9; Robertson, *Phil. Trans.* 1757, p. 30; Franklin's *Works*, letter lv.; Leopold's *Theatrum Pontific.* tom. i. ii. xxvi.; Borelli and Mersenne, in Hooke's *Phil. Collections*, No. ii. p. 36; Bachstrom's *Kunst zu schwimmen*, Berlin, 1742; Bazin, *Hamb. Mag.* i. iii. and xxi.; Gelacy, *Mém. de l'Acad. Par.* 1757; and Coulomb, *Recherches sur les moyens d'exécuter sous l'eau Travaux Hydrauliques.* (G. B.)

DIVINITY, Deity, godhead; the Deity; the nature or essence of God. It likewise denotes any celestial being; and among the pagans was applied to their false gods. Divinity also signifies the science of divine things, and hence is used as synonymous with theology.

DIVISIBILITY, that general property of bodies by which their component parts or particles are capable of separation.

All bodies that possess sensible extension are divisible; for since no two particles of matter can exist in the same place, it follows that they are really distinct from each other; which, indeed, is all that is meant by being divisible. In this sense the least conceivable particle must still be divisible, since it consists of parts which are really distinct. To illustrate this by a familiar instance, let the least imaginable piece of matter be conceived lying on a smooth plane surface; it is evident the surface will not touch it everywhere, and those parts, therefore, which it does not touch may be supposed separable from the others.

All that is supposed in strict geometry, says Mr Maclaurin, concerning the divisibility of magnitude, amounts to no more than that a given magnitude may be conceived to be divided into a number of parts equal to any given or proposed number. It is true that the number of parts into which a given magnitude may be conceived to be divided is not to be fixed or limited, because no given number is so great but a greater may be conceived and assigned; but there is not, therefore, any necessity for supposing the number of parts actually infinite; and if some have drawn very abstruse consequences from such a supposition, yet geometry ought not to be loaded with these.

How far matter is actually capable of being divided, may in some measure be conceived from this, that a piece of wire gilt with so small a quantity as eight grains of gold, may be drawn out to a length of 13,000 feet, the whole surface of it still remaining covered with gold. We have also a surprising instance of the minuteness of some parts of matter in the nature of light and vision. Let a candle be lit and placed in an open plain, it will then be visible for about two miles round; and consequently, were it placed two miles above the surface of the earth, it would fill with luminous particles a sphere four miles in diameter, and this before it had lost any sensible part of its weight. A single grain of blue vitriol will communicate an azure tinge to five

gallons of water; consequently it will be divided into as many parts as there are visible portions of matter in that quantity of water. There are perfumes which, without a sensible diminution of their quantity, will fill a very large space with their odoriferous particles: these must therefore be of an inconceivable smallness, since there is a sufficient number in every part of that space sensibly to affect the organ of smelling. Dr Keill demonstrates, that any particle of matter, how small soever, and any finite space, how large soever, being given, it is possible for that small particle of matter to be diffused through all that space, and to fill it in such a manner as that there shall be no pore in it whose diameter shall exceed any given line.

The chief objections against the divisibility of matter *ad infinitum* are, that an infinite cannot be contained by a finite; and that it follows from a divisibility *ad infinitum*, either that all bodies are equal, or that one infinite is greater than another. But the answer to these objections is easy; for the properties of a determinate quantity are not to be attributed to an infinite considered in a general sense; and who has ever proved that there could not be an infinite number of infinitely small parts in a finite quantity, or that all infinites are equal? The contrary is demonstrated by mathematicians in innumerable instances.

DIVISION, in general, is the separating a thing into two or more parts.

Mechanical DIVISION signifies that separation which is occasioned in the parts of a body by the aid of mechanical instruments, such as a mortar and pestle, a mill, &c.

DIVISION, in military language, signifies generally a certain portion of an army, consisting of infantry and cavalry, either together or separately. The divisions of an army are the several brigades and squadrons of which it is composed. The divisions of a battalion are the several platoons into which a regiment or battalion is divided. The term is also applied to any number of men on military duty detached from an established body; as a division of artillery, a division of pioneers, &c.

DIVISION, in the Royal Navy, a select number of ships in a fleet or squadron, under a commander, and distinguished by a particular flag or pendant. A squadron is commonly ranged into three divisions, that of the commanding officer being in the centre.

DIVISION, in *Algebra*, and in *Arithmetic*. See ALGEBRA, and ARITHMETIC.

DIVORCE (Lat. *divortium*), a breach or dissolution of the bond of marriage.

Both among the pagans and the Jews a great latitude was allowed of in divorce. At Athens and at Sparta, the only Greek states of whose laws on this subject we have any certain information, a divorce might be effected either by the husband or the wife; though in the woman's case it was a matter of some difficulty. The husband, on the other hand, was permitted by the Athenian law to divorce his wife by a very summary process—namely, by turning her out of his house. This was usually done in the presence of witnesses; but the husband was bound to restore her portion, or in lieu of it to pay her the interest on it at the rate of nine oboli per drachma every month, besides an allowance for alimony. A woman could only sue for a divorce by appearing in person before the archon, and delivering up a memorial stating the grounds upon which she sued for a divorce. The terms expressing the separation of men and women were different; the man being said ἀποπέμπειν, *to dismiss his wife*, and the woman ἀπολείπειν, *to leave her husband*. At Sparta, according to Herodotus, a man might divorce his wife on the plea of barrenness. The Cretans, again, are said to have permitted a man to divorce his wife if he was afraid of having too great a number of children.

Among the Romans, the ordinary causes of divorce were sterility, old age, bodily disease, insanity, and banishment; to which were afterwards added by Justinian a vow of chastity and the profession of the monastic life—with a view to conciliate his Christian subjects. Divorce always existed in the Roman polity, and appears to have been permitted on very slight grounds, since either party might declare his or her intention to dissolve the marriage on the plea of the absence of conjugal affection—abiding consent being considered essential to the continuance of the connection. The dissolution of the marriage might be effected without any judicial process. According to Plutarch (Romulus, c. 22), the husband alone originally was able to effect a divorce; but his authority on this point is questionable. The earliest instance of a divorce at Rome is said to have occurred under the consulship of M. Attilius and P. Valerius, about the year B.C. 234, when Sp. Carvilius Ruga put away his wife on the plea of barrenness; but it would appear that his behaviour was much censured.

Divorces were of comparatively rare occurrence at Rome till towards the latter end of the republic; and under the emperors they became very common. Doubtless the state of the law tended greatly to multiply divorces, since either party was at liberty to contract a new marriage. Pompey divorced his wife Mucia on the charge of adultery; Cicero divorced his aged wife Terentia and married a young woman; Cato the younger lent his wife Marcia to his friend Hortensius, or in other words he divorced her that his friend might marry her and have children by her; and Julius Cæsar divorced Pompeia because she was suspected of intriguing with Clodius. As a general rule, the portion (*dos*) of the wife was returned to her when divorced by the husband, or when they separated by mutual consent. Their offspring in all cases remained at the disposal of the father. A constitution of Diocletian and Maximian, however, empowered a competent judge to declare whether the father or the mother should be entrusted with the care of the children. In certain cases, a sixth part of the wife's portion might be retained by the husband; as, for example, when the wife had been convicted of infidelity.

It was necessary, in proceeding to effect a divorce, to make a distinct notice or declaration of the intention to separate. The term *repudium* is said to differ from *divortium*, in that the former properly applies to a marriage only contracted; but these terms appear to be sometimes used indifferently. In the time of Augustus an attempt was made to restrain the facilities for divorce, by the *Lex Julia de Adulteriis* and the *Lex Pappia—Poppæa*.

"The law of Moses," observes Archdeacon Paley, "for reasons of local expediency, permitted the Jewish husband to put away his wife; but whether for every cause, or for what cause, appears to have been controverted amongst the interpreters of those times. Christ, the precepts of whose religion were calculated for more general use and observation, revokes this permission, as given to the Jews 'for their hardness of heart,' and promulgates a law which was thenceforward to confine divorces to the single cause of adultery in the wife: 'Whosoever shall put away his wife, except it be for fornication, and shall marry another, committeth adultery; and whoso marrieth her which is put away, doth commit adultery.'"

By the law of Scotland, a divorce may be obtained on the ground either of adultery or of wilful desertion. Neither of these grounds, however, dissolves the marriage *ipso jure*; and if a process of divorce be not instituted, the marriage subsists, notwithstanding the adultery or desertion. Until recently the action of divorce proceeded before the commissaries of Edinburgh; and in every such action, whether founded on adultery or desertion, the pursuer must make oath that the action is not collusive. The legal effect of divorce on the ground of desertion is, that the offending party loses the "tocher," as it is called, and the *donationes*

Divorce.

propter nuptias; that is, the offending husband is bound to restore the dowry, and to pay or make good to the wife all her provisions, legal or conventional; and the offending wife forfeits her dowry, and all that would have come to her had the marriage been dissolved by the predecease of her husband. It is now held that recrimination is not a good defence against divorce for adultery; yet, as the mutual guilt may affect the patrimonial interests of the parties, it may be stated in a counter action. But *lenocinium*, or the husband's participation in the profits of his wife's prostitution, nay, even the husband's connivance in her guilt, is a good defence to the wife against an action of divorce on the ground of adultery. The statute 1600, cap. 20, declares marriages contracted between the adulterer and the person with whom he or she may be found by the sentence of divorce to have committed the crime, to be null and unlawful, and the issue of such marriages to be incapable of succeeding to their parents; but the act, nevertheless, has not the effect of bastardizing such issue. The right to institute a divorce is personal to the husband or wife; but if, after the action has been raised, either party die before the decree of divorce becomes final, it has been argued that the natural dissolution of the marriage by death supersedes and definitively closes all proceeding commenced for dissolving it on any other ground. The natural dissolution, it has been contended, is the first effectual one, and that which is to regulate all questions as to the *status* of the survivor. How far litiscontestation in such a case renders it transmissible to representatives, has not yet, we believe, been decided.

Divorce in England.

The following is the substance of the inquiries and recommendations of the commissioners appointed by Her Majesty in December 1850 to inquire into the law of divorce. Divorces in England are of two kinds—the one partial, and the other total. Partial divorces are called divorces *à mensâ et thoro*, because they separate the married parties from each other's society without dissolving the marriage union. Total divorces are called divorces *à vinculo matrimonii*, because they dissolve that union altogether, either on the ground of some antecedent incapacity which rendered the contract void from the beginning, or on the ground of some supervenient cause, which having arisen subsequently to the marriage justifies the parties in desiring to put an end to it.

Divorces *à mensâ et thoro* are little more in the eye of the law than simple separations; they only last until the parties think fit to be reconciled; and they are granted at the suit of the husband or wife, when the gross misconduct of either of them—such as cruelty, adultery, or the like—have rendered it impracticable for them to live together; but so careful is our law to encourage reconciliations, that an express clause to that effect ought always to be inserted in the sentence of divorce.

The common law of England, which follows in this case the canon law of the church, "deems so highly, and with such mysterious reverence, of the nuptial tie," that the causes of divorce are purposely limited to a few extreme and specific provocations; and the preservation of that union, so long as it can be secured, is so manifestly essential to the best interests of society, that before it can be dissolved it must be clearly established by the strictest proof that the offence has been committed; that there is no contrivance by which the parties are endeavouring to escape from their solemn obligations to themselves and their children; that they cannot discharge their mutual duties by continuing any longer to cohabit with each other; and that the party complaining is free from guilt.

A divorce *à mensâ et thoro* will neither bar the wife of her dower, nor deprive the husband of his marital rights in respect of her property. Nor will it enable either of the parties to marry again; nor will it exempt them from the censure of the ecclesiastical court for living incontinently. Nor will it bastardize the subsequent born issue; but during the separation the court will decree a competent allowance to the wife for her maintenance under the name of alimony. This allowance depends on the innocence or delinquency of the parties, and is measured by the means and circumstances of the husband.

Before the Reformation, marriages were liable to be set aside on the ground of some antecedent incapacity which rendered it in reality void from the beginning; upon proof of precontract with some other person; or because the connexion was within the degrees of consanguinity or affinity prohibited by the canon law, which was far more restrictive than the law of God.[1] But since the Reformation these rules have been altered on account of the inconveniences which resulted from them; for, to use the language of an old statute, "Marriages were brought into such uncertainty thereby, that none could be surely knit and bounden, but it should be in either of the parties' power and arbiter (casting away the fear of God by means and compasses) to prove a precontract, a kindred and alliance, or a carnal knowledge, to defeat the same." The only grounds, therefore, since the passing of that statute, for nullifying and absolving the marriage contract by reason of some antecedent incapacity, are relationship within the forbidden degrees, a previous marriage, corporal imbecility, or mental incompetency.

In cases of this description the ecclesiastical courts do not exercise, nor do they possess, a rescinding power.

The effects of a sentence nullifying a marriage are, first, that the wife is barred of her dower; secondly, that the issue are illegitimate; and thirdly, that the parties so divorced may marry again.

By the law of England the marriage contract is indissoluble; and when once it has been constituted in a legal manner, there are no means of putting an end to it in any of our courts. Nevertheless, the actual dissolution of such a contract, when adultery has been committed, is so con-

[1] Every one knows how much it was the policy of the Roman Church to multiply impediments to matrimony; the power of granting dispensations having been in all ages a fruitful source of ecclesiastical revenue. Not only were marriages with cousins interdicted, but the relation of affinity was held to be contracted by mere commerce between the sexes. Thus, if a man had connection with one sister, though not married to her, it would have been incestuous in him to marry, or to have sexual intercourse with the other sister, or even with her relatives, by consanguinity or affinity, to the eighth degree! Thus, on the death of James IV. of Scotland, his widow Margaret Tudor married the Earl of Angus. In 1524 she procured (by collusion with her husband) a sentence of divorce *à vinculo matrimonii* upon proof of his having been "precontracted." Sentence of nullity (that is, in the ecclesiastical phraseology, divorce *à vinculo matrimonii*) was thereupon pronounced; and the queen, freed from her fetters, gave her hand to Lord Methven, whom, however, she very soon dismissed by another suit in the ecclesiastical court, upon evidence that Methven was cousin, eight degrees removed, to her former husband, Angus; this constituting an affinity by the laws of holy church, and a just impediment to matrimony. In another case, Janet Betoun (the Lady Buccleugh of the "Lay of the Last Minstrel,") having married Simon Preston of Craigmillar, sued a divorce against him in the ecclesiastical court, not on the ground of any misconduct on his part, but on the ground that before their marriage she, the plaintiff, had had sinful intercourse with Walter Scott of Buccleugh, and that Buccleugh and Preston were within the prohibited degrees. On proof of these allegations, a sentence of divorce *à vinculo matrimonii* was pronounced. (Riddell's *Exposition of Ancient Consistorial Law*, Edinburgh, 1842.) These cases show most clearly what the law was in the Roman Catholic times on the points in question. Lord Coke tells, that there was a time in England when divorce *à vinculo matrimonii* might be had "because the husband had stood godfather to his wife's cousin." It was not by the axe that Henry VIII. extinguished his marriage with Anne Boleyn. He first carried her into the ecclesiastical court, and got a sentence against her, for an alleged precontract with Northumberland, and for his own criminal intercourse with her sister Mary. In the Roman Catholic times, the same ecclesiastical law prevailed throughout the island, and, indeed, governed the entire Christian world.

sonant to reason and religion, that, where the general law has failed to give a remedy, parliament has stepped in to provide one specially by passing a particular law in favour of those who can make out a case which will warrant its interference. The origin of this is important and instructive.

In Roman Catholic times marriage was regarded as a sacrament by the canon law; and being a sacrament it was deemed indissoluble. But at the Reformation the courts denounced, amongst other opinions of the Romish Church, the doctrine of a sacrament in marriage; "retaining the idea of its being of Divine institution in its general origin," but considering it in the light of a civil contract, which for its full completion had always required, in England at least, some religious solemnity. The character of marriage was thus materially altered; for since it was no longer to be deemed a sacrament, there was nothing, on that account, to render it indissoluble; and as the Reformers were about to revise the whole body of the canon law—which had become unsuitable to a Protestant country—they did not omit the matrimonial code. With this view, thirty-two commissioners were appointed to order and compile such laws ecclesiastical as should be thought convenient.[1] "A work was according composed for this purpose by Cranmer, and translated into Latin by Sir John Cheke and Dr Haddon, two of the restorers of classical literature in England." This work, having never received the royal confirmation, is not indeed law, but it is of great authority. It has been published under the title of "Reformatio Legum Ecclesiasticarum," and the articles on the subject of marriage and divorce are peculiarly interesting, as containing, in a short compass, the opinions of our first Reformers on matters which affect the civil rights of all men, as well as the highest of all the moral interests of society.

By these articles, when the husband or wife had committed adultery, a divorce was allowed, and the unoffending party might marry again. But if both were guilty, since both must fall under the same condemnation, the first marriage was not to be dissolved. Absolute desertion, protracted absence, mortal enmities, and lasting cruelty, were all adjudged to be lawful grounds of divorce. But reconciliation was inculcated wherever it could be obtained; and separations from bed and board were entirely abolished. It was, moreover, recommended that adultery should be punished by perpetual imprisonment or transportation for life; and if the offender were the husband, he was to return to the wife her fortune, and add to it one-half of his own; or if the wife, she was to forfeit her jointure, and all the advantages which by law, custom, settlement, or promise, &c., she might have otherwise derived from her marriage.

It is supposed that the regulations contained in this code on the subject of divorce were occasioned by the case of Parr, Marquis of Northampton, who had divorced his wife, Anne Boucher, for adultery, in the ecclesiastical court. For, according to the custom which then prevailed, it is probable that divorces had no certain and immediate effect beyond that. But since this statute was repealed by a law passed in the following reign,[2] "nothing is left of these proceedings except the advised and lasting belief of Cranmer, and his associates in reformation, that a more extensive liberty of divorce ought to be allowed."[3]

Apparently, in fact, it was allowed for more than half a century. For it has been observed by Sir John Stoddart, that from the year 1550 until the year 1602, marriage was not held by the church, and therefore was not held by the law, to be indissoluble.

The church, however, was still anxious to discourage as much as possible a second marriage after divorce; and accordingly it requires by the 109th canon that "in all sentences pronounced only for divorce and separation *à thoro et mensâ*, there shall be a caution and restraint inserted in the said sentence that the parties so separated shall live chastely, and neither shall they, during each other's life, contract matrimony with other person."

Mr Serjeant Salkeld lays it down that "divorce for adultery was anciently *à vinculo matrimonii*; and therefore, in the beginning of the reign of Queen Elizabeth, the opinion of the Church of England was, that after a divorce for adultery the parties might marry again. But in Foljambe's case, he adds, anno 44th Elizabeth, in the Star Chamber, *that opinion was changed*. And Archbishop Bancroft (it should be Whitgift) upon the advice of divines, held that adultery was only a cause of divorce *à mensâ et thoro*." The doctrine of indissolubility was thus not only re-established, but it operated in this country with a rigour unknown in Roman Catholic times; the various fictions and devices in the shape of canonical degrees and alleged precontracts, which then afforded so many loopholes of escape from its severity, having been each and all put an end to at the Reformation.

It may be reasonably doubted whether the decision in Foljambe's case was assented to by the Church of England as a body, for the Chamber of Convocation in the succeeding year re-enacted, word for word, the ecclesiastical constitutions of 1597. These, as subsequently confirmed by James I., are now a substantive part of the ecclesiastical law of this kingdom, being in fact the well-known canons of 1603, which have never been repealed or disturbed.

How far the conduct of the laity may have been affected by these proceedings, it is difficult to conjecture. What was the practical rule respecting second marriages in the reign of James I., or in that of his son, or during the time of the Commonwealth, we are but little informed. Mr Spence has conjectured that, in early times, the Court of Chancery, under its clerical chancellors, exercised jurisdiction to decree a divorce *à vinculo matrimonii*. There is no authority, however, for this, except some loose entries in Tothill's Transactions of the Court of Chancery. The first case which answered the double purpose of bastardizing the issue and enabling the parties to marry again is that of Lord Roos, in the reign of Charles II. The facts were shortly these. In the year 1666, an act was passed, bastardizing the children of Lady Ann Roos, by reason of her adultery; and thereupon her husband, Lord Roos, followed up this proceeding by obtaining from the spiritual court a sentence of divorce *à mensâ et thoro*. But these proceedings were incomplete for his purpose: and since "there was no probable expectation of posterity to support the family in the male line, but by the said John Manners Lord Roos," a bill was brought in entituled "An act for Lord Roos to marry again," and it enabled him to do so, and gave to the children born in such wedlock the character of legitimacy, and the capacity of inheriting.

According to the historians Burnet and Ralph, this bill was passed on political grounds, and with a political object, viz., to form a precedent which would enable Charles II. to separate from his first wife, by whom he had no children,

[1] 35th Hen. VIII. cap. 16, authorizes the king to name thirty-two persons, viz., sixteen spiritual and sixteen temporal, to examine all canons, constitutions, and ordinances, provincial and synodal, and to establish all such laws ecclesiastical as shall be thought by the king and them convenient to be used in all spiritual courts.

3d & 4th Edw. VI. cap. 11. An act that the King's Majesty may nominate and appoint two-and-thirty persons to pursue and make ecclesiastical laws.

[2] This is a private act, 5th & 6th Edw. VI., and consequently it is not printed in the authentic or common collection of the statutes.

[3] See Mackintosh's *History of England*, pp. 275, 276; and see an account of all the proceedings in Burnett's Reformation, vol. ii., pp. 90, &c., and 306; and Macqueen's *Practice of the House of Lords*, pp. 468, 792.

and to marry a second wife, after that separation, for the purpose of excluding the Duke of York from the throne. However that may be, unquestionably the bill was contested stoutly; seventeen bishops opposed, and three only supported it. But amongst those who supported it, was Bishop Cozens, whose masterly argument on this subject was afterwards published in a pamphlet, and is now preserved in "The State Trials."

The first example of an actual dissolution of the nuptial tie by parliament was in the case of the notorious mother of Savage, the *Countess of Macclesfield*. In that case the aid of the legislature was sought, because, in consequence of the skilful opposition set up by the countess in the spiritual courts, and the narrow maxims which there prevailed, she contrived to baffle all her husband's efforts to obtain a sentence of divorce *à mensâ et thoro*. The circumstances of the case, however, were so scandalous and flagrant, that it would have been an outrage upon every principle of justice to withhold relief; at the same time, it was so novel a proceeding to pass a bill of that nature, where there was not a sentence of divorce first obtained in the spiritual court, that a protest was entered against it by Lords Halifax and Rochester, because, as they said, they looked upon it as an ill precedent, and which might be of ill consequence in the future.

The next instance of a legislative dissolution of marriage was in the *Duke of Norfolk's case*. There also a sentence of divorce was refused by the ecclesiastical court, although the duke tried the experiment more than once. He recovered damages, however, at law, from the adulterer, Sir John Jermayne. And after his bill had been repeatedly rejected by the Lords, it became at last, in a new state of circumstances, successful in 1700. The leading counsel for the duchess (Sir Thomas Powys) complained that this was the first instance where an attempt had been made to obtain a divorce by act of parliament, without any sentence being previously obtained at Doctors' Commons. And the duchess herself protested against it in these emphatic terms:—"My lords," she said, "I had rather stand charged for high treason before your lordships than with this ignominious crmie. In the charge for high treason, the manner of trial and the ways of the proceeding are known, and so is the punishment. But your lordships are now creating new ways of proceedings, and a new law to punish me, and this for a crime supposed and alleged to be committed seven years past, in another reign, and after public indemnities in many sessions of parliament."

Such are the cases in which application was made to parliament before the commencement of the eighteenth century, to get rid of the consequences of a prior marriage.

By these means the right to obtain a divorce *à vinculo* was definitively established. It was established, however, in the rudest and most inconvenient manner; for the proceeding was a judicial one by a legislative process, and it had all the inconveniences which necessarily result from the discussion of such a question in a mixed and popular assembly. At first only a few divorce bills were passed—not more than five were carried through parliament before the accession of the House of Hanover. From 1715 to 1775 their number was sixty, that is to say, they averaged about one a-year. From 1775 to 1780 they had increased to seventy-four, that is to say, upon an average, to about three a-year: and from 1800 to 1852, they amounted to 110. Two of these, viz., *Lady Macclesfield's* and the *Duke of Norfolk's cases*, were without any sentence ecclesiastical: and several were without any previous verdict at law; for no standing orders of either house of parliament required the institution of these parliamentary proceedings until the year 1798.

In that year Lord Chancellor Loughborough called the attention of the House of Lords to the propriety of laying down certain general rules, which should precede the consideration of every case, and with which all parties who came before them to seek a divorce should be bound to comply. Accordingly he framed a series of resolutions; and by these resolutions it was not only required that a sentence of divorce *à mensâ et thoro* should have been pronounced before soliciting the bill, but that the entire proceedings in the ecclesiastical court should be delivered in upon oath at the bar of the House of Lords. They further required that the petitioner should attend the house, in order, if necessary, that he might be examined as a witness with reference to connivance or collusion, and also with reference to another point which has always been deemed of primary importance in judging of divorce bills, namely, whether he was, or was not, at the time of the adultery, living apart from his wife, and whether he had not, by deed or otherwise, released her from her conjugal duty by withdrawing his marital authority and protection. These resolutions, which were passed soon afterwards, had the effect of introducing a stricter practice than had previously obtained upon bills of this nature. By a subsequent order it was provided that no bill to disallow a marriage on the ground of adultery shall be received without a clause prohibiting the marriage of the offending parties. But this clause is struck out in committee or on the report, except in very peculiar cases. In *Dr Campbell's case*, where the adultery was incestuous, a provision to that effect was inserted in the Lords; but the Commons refused to ratify it.

Since the passing of Lord Loughborough's orders, all applications for divorces *à vinculo* have been supported by ecclesiastical sentences; and all have been supported by verdicts at law, or accompanied by circumstances which justified or explained the want of such verdicts.

Divorce bills in the Commons were originally determined in the whole house. But that unseemly and inconvenient practice was put an end to on the motion of Mr Labouchere in the year 1840, when the house referred them to a select committee of nine members, of whom three are a quorum. An instruction is given to the committee that they do hear counsel and examine witnesses for the bill; and also that they do hear counsel and examine witnesses against the bill, if the parties concerned think fit to be heard by counsel or produce witnesses. The proceedings in the Commons have acquired by this change a more judicial character; but it seems absurd that a case which has been already proved three times should be proved again.

Under ordinary circumstances a divorce bill may be obtained at the suit of the husband, but not at the suit of the wife. It may be obtained almost as a matter of right at the suit of the husband, when the wife is convicted of infidelity, and the conduct of the husband is irreproachable. But it cannot be obtained at the suit of the wife except in cases of aggravated enormity, such, for instance, as incestuous intercourse with the wife's relations, which precludes the possibility of future reconciliation.

The provisions of a divorce bill are in the discretion of parliament; and in this respect there is some advantage in bringing these questions under the jurisdiction of the legislature, as other courts are bound by rules. Parliament may mould and adapt its relief according to the facts and exigencies of the case. In former times, it was asked to provide, by express enactment, that the divorced wife should not be left in a state of destitution. According to the modern practice, this is a matter that is ordinarily effected by private arrangement; but it is never neglected. "There is in the House of Commons," Mr Macqueen observes (and the observation is perfectly correct), "a functionary called 'The Ladies' Friend' (an office generally filled by some member distinguished for his attention to the private business of the House), whose duty it is to see that the husband petitioning for divorce makes some suitable but moderate

provision for the divorced wife." This he attends to on all occasions; not by inserting the intended provision in the bill itself, for fear it should be rejected by the other House of Parliament, but by taking care that it is legally secured to her, before the bill has passed through committee.

It has sometimes been urged that cruelty should have a more extended signification; that other causes of divorce, or at least of separation from bed and board, should be allowed, such as mutual dislike, incompatibility of temper, neglect, severity, and repeated provocation; and that these separations might even be voluntary, if the parties were forbidden to seek such a dissolution of the marriage contract as would leave them at liberty to marry again. We cannot assent to these suggestions. The arguments against them are put so forcibly by Lord Stowell, and Hume and Paley, that they are absolutely unanswerable. "To vindicate the policy of the law," says Lord Stowell, "is no necessary part of the office of a judge; but if it were, it would not be difficult to show that the law in this respect has acted with its usual wisdom and humanity, with that true wisdom, and that real humanity that regards the general interests of mankind. For though, in particular cases, the repugnance of the law to dissolve the obligations of matrimonial cohabitation may operate with great severity upon individuals; yet it must be carefully remembered that the general happiness of the married life is secured by its indissolubility. When people understand that they *must* live together, except for a very few reasons known to the law, they learn to soften by mutual accommodation that yoke which they know they cannot shake off; they become good husbands and good wives, from the necessity of remaining husbands and wives; for necessity is a powerful master in teaching the duties which it imposes. If it were once understood that upon mutual disgust married persons might be legally separated, many couples who now pass through the world with mutual comfort, with attention to their common offspring, and to the moral order of civil society, might at this moment have been living in a state of mutual unkindness, in a state of estrangement from their common offspring, and in a state of the most licentious and unreserved immorality. In this case, as in many others, the happiness of some individuals must be sacrificed to the greater and more general good."

Our laws, while allowing divorces *à mensâ et thoro* in causes of adultery and outrageous cruelty, have wisely denied the like privileges to mere dislike, contrariety of temper, severity, neglect, or voluntary arrangements.[1] There is another cause, however, which so entirely frustrates all the objects of the marriage union that it may reasonably be doubted whether it should not be put on the same footing as cases of cruelty. We allude to wilful and obstinate desertion. Our old Reformers considered that this was so gross a breach of all the obligations, human and divine, which the husband and wife owe to each other, that in that case they would have allowed the deserted party to enter again into fresh nuptials. At the same time they were so impressed with the importance of keeping the contract unbroken, that before the complainant could obtain a dissolution of it, every kind of means was previously to be exhausted, exhortation and counsel, and even punishment, to bring the offender back to his duty; and in case of his absence an interval was prescribed of two or three years for the chance of his return, that nothing might be done with levity or rashness. In other Protestant countries that offence, when properly established, is considered a scriptural ground of divorce, even *à vinculo matrimonii*. In Scotland, also, if it be wilfully persevered in for four years, followed by a judicial requisition of conjugal rights on the part of the complainant, it warrants a dissolution of the marriage contract. In England, desertion must be coupled with cruelty before it can entitle the abandoned party to a sentence of separation; but in reason, in principle, and in its moral consequences, it can hardly be distinguished from cruelty itself.

Divorces *à mensâ et thoro* should, for the causes above adverted to, be allowed to the wife as well as to the husband, and desertion should entitle the wife to a remedy by way of alimony; but whether divorces *à vinculo* should be granted at the suit of the wife with the same facilities as at the suit of the husband, is a question which has elicited much difference of opinion. There are four instances in which wives have succeeded in procuring divorces *à vinculo* from parliament; but in these the husbands were guilty of other offences besides adultery, which were held either to preclude or absolve the complainants from further cohabitation.

For trying and determining questions of divorce three tribunals must now be resorted to—a court of law for damages against the adulterer; an ecclesiastical court for a divorce *à mensâ et thoro*, and the imperial parliament for a dissolving statute. The great expense and the long delay of these proceedings is a grievous hardship and oppression to individuals, and they amount in many cases to a denial of justice. Even in an unopposed suit the minimum expense of obtaining a sentence of divorce in the consistory court of London would vary from L.120 to L.140 at the least, and the case would occupy about two months. If it were opposed the expense would range from L.300 to L.500 and upwards (in heavy cases to much more), and it would take from one to two or three years before it was decided. The proceedings also do not terminate here; but there is an appeal to the court of arches, and from thence to the judicial committee. The expense of an action-at-law will depend in a great measure on the nature of the case, and the extent to which it is contested. The expenses in parliament, exclusive of counsel's fees, charges for witnesses, and solicitor's own bill, which amount, no doubt, to a considerable sum, average about L.200. With the other charges they would possibly be doubled; so that the total cost, under the most favourable circumstances, of obtaining

[1] Lord Brougham says, finely and justly, that "*all systems are supposed* to agree in this, that no dissolution of the nuptial union should be allowed upon the mere agreement of the parties to terminate their connection." (*Speeches*, vol. iii., p. 446.) And yet there were two periods in which the system was tried and failed,—one, in the corruption of manners, which hastened the decline of the Roman Empire; the other, in the utter subversion not only of manners but of law, morality, reason, and religion, which marked the French Revolution. In the former case the Romans adopted the motto, "that marriage, like other partnerships, might be dissolved by the abdication of one of the associates." But the historian tells us that "The specious theory was confuted by this free and perfect experiment, which demonstrates that the liberty of divorce does not contribute to happiness and virtue." (Gibbon, c. 44.) "The abuse of this privilege was justly held up to scorn and indignation by the Roman philosophers, poets, and satirists." (Seneca de Benef. iii. 16; Martial, vi. 7, lib. ix. epig. 16; Juvenal, Sat. vi. 223.) In the latter case the experiment was again attempted in France, and what was the result? "In the three first months the number of divorces in Paris, in 1793, amounted to 562, while the marriages were 1880; so that the proportion of divorces to marriages was not much less than one to three!—And in two years and three months 6000 are said to have taken place." (Quarterly Review, No. lvi., p. 509.) "Other legislatures," says Burke, "knowing that marriage is the origin of all relations, and consequently the first element of all duties, have endeavoured by every art to make it sacred. The Christian religion, by confining it to the pair, and by rendering that relation indissoluble, has, by these two things, done more towards the peace, happiness, settlement, and civilization of the world, than by any other part in the whole scheme of Divine Wisdom." (Letters on a Regicide Peace, Works, vol. viii., p. 174.) In many of the States of America, divorces may be obtained with comparative facility. But Chancellor Kent observes "that it is very questionable whether that facility has not been productive of more evil than good;" and he states that he has had reasons to believe, in the exercise of a judicial cognizance over numerous cases of divorce, that adultery was sometimes committed on the part of the husband for the very purpose of the divorce. (See Comment., vol. ii., p. 105.)

a divorce *à vinculo matrimonii* can hardly be less than L.700 or L.800; and when the matter is much litigated, it would probably reach some thousands. In Scotland, the average cost of rescinding a marriage is said to be L.20, and that when there is no opposition L.20 will suffice. In Scotland, also, it is not a privilege for the rich, but a right for all; and it is not unworthy of notice that out of ninety-four cases between November 1836 and November 1841 the parties litigant were almost all of the lower classes.

The three tribunals which are thus rendered necessary by parliamentary regulations for a divorce *à vinculo* would not be required provided these questions could be submitted to a court in which the country has confidence. One tribunal which can satisfy itself of the proper relief to be given or withheld, is better than three which distrust each other. The verdict at law is practically valueless; and if the proceedings before the legislature were as regular and searching as those in a court of justice, the ecclesiastical sentence would be so too.

The commissioners, therefore, recommend that applications for divorce *à vinculo matrimonii*, and all causes matrimonial, should be submitted in future to a new tribunal, consisting of a vice-chancellor, a common law judge, and a judge of the ecclesiastical court, and that they should sit for the purpose of trying these questions at specified times in different parts of the year. We would also recommend that there should be no appeal from their decision except to the House of Lords; and we think there would be convenience in directing that divorces *à mensâ et thoro* should likewise be referred to the same tribunal.

The commissioners add, "We cannot bring this report to a close without adverting to two questions of immense importance which are closely connected with the subject, though they do not fall within the terms of the inquiry proposed for our consideration. The one is, whether here, as in Scotland, the parties whose guilt has occasioned the divorce *à vinculo matrimonii* shall be restrained from intermarrying? The other, whether a Scotch divorce, upon grounds not allowed by the laws of England, shall operate as a dissolution for all purposes of an English marriage? With regard to the former question there is a standing order of the House of Lords which makes it imperative on any person petitioning for a bill for a divorce *à vinculo* to insert a provision in it prohibiting the person whose marriage with the petitioner shall be dissolved to intermarry with any offending party on account of whose adultery such marriage shall be dissolved; but this clause, notwithstanding many struggles to have it retained, is usually struck out without resistance in the committee. With regard to the latter question, a Scotch divorce of an English marriage, where the parties are *bonâ fide* domiciled in Scotland, will be binding and valid in the courts of that country upon any question of Scotch law affecting themselves, their children, or their property; but the courts of England will not recognise in some cases the binding validity of a Scotch divorce, since an English marriage, being a contract which, like other personal contracts, must be interpreted according to the law of the country in which it was made, cannot be dissolved by any proceeding in the courts of any other country for *English purposes*. The anomalies[1] arising from this conflict between the law of the two countries are strange and distressing to many families, and a remedy, if possible, ought speedily to be provided for them. We feel, however, that both these questions involve so many and such important considerations of national policy, and they relate to matters which in some respects are so far removed from the scope of our inquiry, that we forbear to do more than call attention to them."

Having considered the law of divorce in its different bearings, the commissioners sum up briefly the alterations and improvements which they think may be made in it with prudence and safety.

DIVUS, Diva, in *Antiquity*, appellations given to men and women who had been deified. Hence it is that upon medals struck on the consecration of an emperor or empress, the title of *divus* or *diva* is added; as DIVUS JULIUS, DIVO ANTONINO PIO, DIVO PIO, DIVO CLAUDIO, &c.

DIXMUDE (Flemish *Dixmuyden*), a town of Belgium, province of West Flanders, on the Yser, 12 miles N. of Ypres. Pop. (1851) 3984. It has an active trade in butter, which is said to be the best in Flanders.

DIZIER, St, a town of France, department of Haute Marne, arrondissement of Vassey, and 9 miles N. of the town of that name. It stands on the right bank of the Marne, which is here crossed by a bridge and begins to be navigable. St Dizier is surrounded by old walls, and is a handsome town. It has an elegant town-hall of recent construction, a hospital, a ruined castle, ship-building yards, iron foundries, cotton factories, and a considerable trade in wood. In 1544 it sustained a memorable siege by Charles V.; and here in 1814 the French forces twice defeated a part of the allied army. Pop. 6450.

DJEBAIL, Jebail or Gibyle (the ancient Byblus), a town of Syria, situated on an eminence near the sea at the foot of Lebanon, 30 miles S.W. of Tripoli. It is walled on the three sides towards the land, but open towards the sea, and is about a mile and a half in circuit. Nearly one-half of the space within the walls is occupied by gardens, and the population probably does not exceed 2000. It has an old castle built of stones of vast size, an old Maronite church, and a mosque. Its artificial harbour was destroyed during the time of the crusades. "The land of the Giblites," with "all Lebanon," was assigned to the Israelites by the original appointment; but it does not seem that they ever had possession of it. It was celebrated for the birth and worship of Thammuz, the Syrian Adonis. Djebail was taken possession of by the crusaders in 1100, and, after some vicissitudes, remained subject to them during their sway in the East.

[1] Lord Brougham says, in *Warrender* v. *Warrender* (2 Cl. & Finn. 540):—"The resolution in *Lolley's case* was that an English marriage could not be dissolved by any proceeding in the courts of any other country for English purposes; in other words, that the courts of this country will not recognise the validity of a Scotch divorce, but will hold the divorced wife dowable of an English estate, the divorced husband tenant thereof by the courtesy, and either party guilty of felony by contracting a second marriage in England. Upon the force and effect of such divorce in Scotland, and for Scotch purposes, the judges gave and indeed could give no opinion, and as there could be nothing legally impossible in a marriage being good in one country which was prohibited by the law of another, so if the conflict of the Scotch and English law be complete and irreconcilable, there is nothing legally impossible in a divorce being valid in the one country which the courts of the other may hold to be a nullity." Lord Lyndhurst, in his judgment in the same case, says:—"It must be admitted that the legal principles and decisions in England and Scotland stand in strange and anomalous conflict on this important subject. As the laws of both now stand, it would appear that Sir G. Warrender may have two wives; for having been divorced in Scotland he may again marry in that country, he may live with one wife in Scotland most lawfully, and with the other equally lawfully in England; but only bring him across the border, his English wife may proceed against him in the English courts, either for restitution of conjugal rights, or for adultery committed against the duties and obligations of the marriage solemnized in England; again, send him to Scotland, and his Scottish wife may proceed in the courts in Scotland for breach of the marriage contract entered into with her in that country. Other various and striking points of anomaly, alluded to by my noble and learned friend, are also obvious in the existing state of the laws of both countries; but however individually grievous they may be, or however apparently clashing in their principles, it is our duty as a Court of Appeal to decide each case that comes before us according to the law of the particular country whence it originated, and according to which it claims our consideration, leaving it to the wisdom of parliament to adjust the anomaly, or get rid of the discrepancy, by improved legislation."

DJIDDA, a seaport-town of Arabia. See Jidda.

DMITROV, a town of Russia, capital of a cognominal circle in the government of Moscow, 46 miles N. of the city of that name. Pop. 3000.

DMITROVSK, a town of Russia, capital of a cognominal circle in the government of Orel, and 56 miles S.W. of the city of that name on the Nerussa. Pop. 4000.

DNIEPER, a large river of Europe. See Russia.

DNIESTER, a large river of Europe. See Russia.

DOAB. This term in Hindustan means any tract of country included between two rivers. Thus, in the Punjaub there are five Doabs lying between the Indus and the Sutlej, and the tributaries of these rivers. The tract of territory, however, usually implied in the general term "the Doab," is that portion of the great political division of India known as the North-Western Provinces, which lies between the Jumna and the Ganges. This vast tract extends from Allahabad in the south to Saharunpore in the north, and is situated between Lat. 25. 20. and 30. 20. The soil is fertile, and produces millet, sugar cane, and barley, and is peculiarly adapted for indigo, which grows here in a wild state. The opium-poppy and tobacco have also been introduced. The territory contains many thriving and populous towns, and the whole country has been brought into a high state of cultivation by means of a magnificent plan of irrigation, comprising the main line of the Ganges Canal, which flows from Kurdwar through the centre of the Doab, with branches extending to almost every town in the province. The climate during the rainy season is hot, but during the winter is cool. By a treaty concluded with Scindia in 1803, the forts and territories of the Doab between the Jumna and the Ganges were ceded to the British; and the southern part of the Doab was ceded in 1801 by the reigning nabob of Oude. (E.T.)

DOBBERAN, a market-town and watering-place in the grand duchy of Mecklenburg-Schwerin, pleasantly situated in a valley, on a small river about a mile from the Baltic. Pop. about 3000. It is much frequented for its sulphurous springs and baths, and for sea-bathing. The grand duke has a summer residence here.

DOBELN, a town of Saxony, on an island formed by the Mulde, 32 miles E.S.E. of Leipzig. Manufactures—woollen and linen goods, fustians, hats. Pop. (1849) 7158.

DOBROUSCHA, a district of European Turkey. See Danube.

DOBSCHAU, or Dobsina, a town of Hungary, county of Gomör, on the Dobsina, 26 miles N. of Gomör. The inhabitants, amounting to about 4000, are mostly German. In the vicinity are rich mines of iron, copper, cobalt, and mercury.

DOBSON, William, an English portrait and historical painter, born at London in 1610. He served an apprenticeship to one Peck, a stationer and picture dealer; and while in his employment he began to copy the pictures of Titian and Vandyck, whose manner he ever after retained. Vandyck, happening to pass a shop in Snow Hill where one of Dobson's pictures was exposed, sought out the artist, and presented him to Charles I., who took Dobson under his protection, and not only sat to him several times for his own picture, but caused the Prince of Wales, Prince Rupert, and many others, to do the same. After the fall of Charles, Dobson was reduced to great poverty, and fell into dissolute habits. He died at the early age of 36.

DOBUNI, or Boduni, an ancient people of Britain, who possessed the territory which now forms the counties of Oxford and Gloucester. Both names seem to have been derived from the low situation of a great part of the country which they inhabited; for both *Duvn* and *Bodun* signify deep or low in the ancient language of Gaul and Britain. The Dobuni are not mentioned among the British nations who resisted the Romans under Julius Cæsar; and before the invasion of Claudius they had been so much oppressed by the Cattivellauni, that they cheerfully submitted to the Roman yoke. Cogidunus their prince was confirmed by Claudius in the government, and fewer garrisons were stationed in his dominions than in those of the other native princes. Consequently there are comparatively few Roman remains in that part of the country. The Durocornovium of Antoninus, and the Corinium of Ptolemy, are believed to have been the capital of the Dobuni at Cirencester, where there are still many marks of a Roman station. Clevum or Glevum, in the thirteenth *iter* of Antoninus, stood where the city of Gloucester now stands; and Abone, in the fourteenth *iter*, was probably situated at Avinton on the Severn.

DOCETÆ (from δόκειν, *to appear*), a name applied to those heretics in the early Christian church who held that Christ, during his life, had not a real or natural, but only an apparent or phantom body. From this circumstance they were also called Phantasiastæ, Phantasiodocetæ, Opinarii, and Opinati. The origin of this opinion is to be sought in the Greek, Alexandrine, and Oriental philosophizing about the imperfection or rather the essential impurity of matter. Traces of a Jewish Docetism are to be found in Philo; and in the Christian form it is combated in the writings of John, and more formally in the epistles of Ignatius. It differed much in its complexion according to the points of view adopted by the different authors. Among the Gnostics and Manichæans it existed in its worst type, and in a milder form it is to be found even in the writings of the orthodox teachers. The bolder docetæ assumed the position that Christ was born without any participation of matter; that his eating and drinking, and even his crucifixion, was a mere phantasm. They denied, accordingly, the resurrection and the ascent into heaven. Some held that another man was crucified instead of Christ. To this class belonged Dositheus, Saturninus, Cerdo, Marcion, and their followers, the Ophites, Manichæans, and others. The other, or milder school of Docetæ, attributed to Christ an ethereal and heavenly instead of a truly human body. Amongst these were Valentinus, Bardesanes, Basilides Tatianus, and their followers. They varied considerably in their estimation of the share which this body had in the real actions and sufferings of Christ. Clement and Origen, at the head of the Alexandrian school, took a somewhat subtle view of the incarnation, and Docetism pervades their controversies with the Monophysites. Docetic tendencies have also been developed in later periods of the church's history, as for example by the Priscillianists and the Bogomiles, and also since the Reformation by Jacob Böhm, Menno Simonis, and a small fraction of the Anabaptists.—(Niemeyer *De Docetis*, Halle, 1823–4.)

DOCIMASIA, or Dokimasia, in *Antiquity*, a probationary trial to which every Athenian citizen was subjected when he was appointed, either by lot or suffrage, to any public office. The docimasia consisted in a scrutiny into the character and qualifications of the individual, and was performed in public before certain judges: when, among other interrogations, it was asked whether he had been dutiful to his parents, had served in war, and if he were in possession of a competent estate.

DOCIMASTIC (δοκιμάζω, *to test*), assaying, proving by experiments. The docimastic art is otherwise called metallurgy. It is the art of assaying minerals or ores, in order to determine the nature and quantity of the metallic substances they contain.

DOCIMENUM Marmor, a name given by the ancients to a bright and clear white marble obtained from the quarries near Docimenos, a town in Phrygia. It was much used in building temples and other sumptuous edifices at Rome, and was accounted little inferior to the Parian in colour, but inferior in the compactness of its grain; and hence it was seldom used by statuaries.

DOCK,

Dock. An inclosed space for the reception of ships, either for their security or for the convenience of building or giving them repairs. This word has been derived by some, absurdly enough, from the Greek δεχομαι, to receive. That we had it, along with almost the whole of our sea-terms, from the northern continental nations, is sufficiently obvious. Thus in Flemish it is *dok;* Teutonic, *dock;* Swedish, *docka;* Suio-Gothic, *docka;* perhaps originally from *dekken*, to cover, protect, secure, inclose. The *dock* for inclosing the prisoner in a court of justice is evidently from the same origin.

Docks for the reception of ships are of two kinds, *wet* and *dry*.

A *wet dock* may either have gates to retain the water in it, so that ships shall constantly remain afloat, or be left open for the tide to flow into and ebb out of it at pleasure, either leaving it dry at low water, or with a certain depth of water remaining in it, according to its construction and situation with regard to the low-water mark, and to the ebbing of the sea at spring or neap tides. A wet dock without gates is generally distinguished by the name of a *basin*, which, however, is sometimes indiscriminately applied to a wet dock whether with or without gates.

A *dry dock* either becomes dry by the ebbing of the tide when the gates are left open, or by shutting the gates at low water, and pumping out whatever water may remain in it at that time, by the power of men, horses, wind, or, which is now most commonly performed in the Queen's dock-yards, by the steam-engine.

A *wet dock*, therefore, may be defined to be "a basin of water, in which ships may be kept afloat at all times of the tide;" a *dry dock*, a "receptacle in which every part of a ship can be examined, and its defects repaired." Ships may also be conveniently built in dry docks, and floated out by opening the gates; though in all dock-yards there are places set apart for this purpose, under the name of *slips*. A wet dock is called by the French *un basin;* a dry dock, *une forme;* and a slip, *une calle.*

The digging out the earth, and building the surrounding walls of masonry to prevent the sides falling in, and the preparation of the mortar and puzzolana, in the construction of a wet dock, are attended with great labour and expense. The two wet docks or basins of Cherbourg (see BREAKWATER), which are among the finest specimens that exist in the world, are estimated to have cost three millions sterling. The labour of excavation may sometimes be spared, and a series of wet docks or basins conveniently made, by turning the course of a tide-river through an isthmus, and placing a pair of gates at each end of the old channel. In this way were the new docks of Bristol constructed out of the bed of the Avon.

Wet docks. Wet docks are an improvement in navigation and commerce of the utmost importance, but of very modern date in this country; indeed, they owe their introduction entirely to a spirit of individual enterprise in commercial speculation. Liverpool might still have remained a poor fishing village but for its convenient docks, which not only produce to the town and corporation a large revenue, but ensure to the merchant every possible facility in refitting, loading, and discharging his ships, whatever their burden or their cargo may be, without being exposed to the risk of losing both ship and cargo in a rapid tide-river; and, at all events, to an unavoidable delay, occasioned by distance, the weather, or the state of the tides.

Hull is also greatly indebted for the extension of its commerce to its docks. Its old wet dock contains an area of ten acres nearly, and has accommodated at one time 130 sail of such vessels as frequent that port. Dock.

London, though unquestionably the first city in the world for its opulence, its commerce, and public spirit, and possessing within itself the powerful internal means of supporting docks, and all other conveniences that trade and shipping may require on the most extensive plans; London was the last to try the experiment of docks, except in the case of two spirited individuals, Mr Perry at Blackwall, and Mr Wells at Greenland Dock, both private ship-builders. Notwithstanding the total inadequacy of legal quays, which subjected the merchants to incalculable losses and delays, and in many cases proved absolutely ruinous; notwithstanding the effect of the heavy, expensive, and fatal embarrassments experienced regularly on the arrival of the West India fleets, and the annual losses, by plunder in the river, on West India produce, which alone were calculated to amount to L.150,000 to the proprietor, and L.50,000 to the revenue, and more than the double of those sums, including other branches of commerce; it was not till the year 1799 that prejudices and private interests were so far removed as to enable the merchants concerned in the West India trade to obtain an act of parliament to carry into execution a plan of docks, quays, and warehouses, for the convenience of that trade on the Isle of Dogs. Since that time the London Docks, St Katharine Docks, and various others, have been completed, to the incalculable benefit of the shipping interest and the commerce of the metropolis.

The docks of Liverpool were the first of the kind that were constructed in this kingdom, by virtue of an act of parliament passed in 1708; and from that period the town of Liverpool has rapidly raised itself from a poor fishing village, and a port for coasting vessels, to be the second commercial town and port in the empire; and the improvements carried out for the enlargement and better arrangement of the docks rendered it, for convenience and appearance, in this respect the very first, not even London excepted.

It appears from a statement, apparently authentic, that in the ten years ending with 1808 the number of ships which entered these docks was 48,497, tonnage 4,954,204; and the dock duties received L.329,566; and that in the following ten years ending in 1818 the number of ships was 60,200, the tonnage 6,375,560, and the amount of duties L.666,438; while for a single year (ending June 1853), no less than 20,490 vessels entered the docks, the tonnage of which was 3,889,981, and the amount of duties L.256,702—the largest amount yet received—the following being the return for the last ten years:—

Year.	Number of Vessels.	Tonnage.	Amount of Duties Received.
1843	16,606	2,445,278	L.188,286
1844	18,411	2,632,712	185,164
1845	20,521	3,016,531	223,247
1846	19,951	3,096,444	213,423
1847	20,889	3,351,539	244,435
1848	20,311	3,284,963	197,617
1849	20,733	3,639,146	224,224
1850	20,457	3,536,337	211,743
1851	21,071	3,737,666	235,527
1852	21,473	3,912,506	246,686
1853	20,490	3,889,981	256,702

It may also be observed, that this extraordinary increase has taken place since the abolition of the slave trade, which, it was formerly asserted, would be the ruin of Liverpool.

For a more detailed account of these docks, see the articles BIRKENHEAD and LIVERPOOL.

Dock.

The *West India Docks* on the river Thames were commenced in February 1800, and opened in August 1802. They consist of an outward and a homeward bound dock, and communicate by means of locks with a basin of five or six acres on the end next to Blackwall, and with another of more than two acres at the end next to Limehouse, both of which basins communicate with the Thames. The outward-bound dock is about 870 yards in length, by 135 in width, containing consequently an area of more than 24 acres; the homeward-bound dock is of the same length, and 166 yards in width, its area being little short of 30 acres; and the two together will contain with ease at least 500 vessels of from 250 to 500 tons. The whole are surrounded with a high wall, and, as a security against fire, the moment that a ship enters the dock the crews are discharged, and no person whatever is allowed to remain on board, or within the premises, the gates of which are closed at a certain hour. They are surrounded by immense warehouses, which are estimated to contain nearly 10,000 hogsheads of sugar, and an immense quantity of rum. The sum authorized by parliament to be raised for completing these docks and warehouses was L.1,200,000, and the total expense was probably not far short of one million and a half; yet on this capital the subscribers have been receiving from a very short period after their opening ten per cent., which, by the terms of the act, is not to be exceeded, and the term granted is limited to 21 years; but, like most other property, these docks have been greatly depreciated in value, and at present barely pay 8 per cent.

The next set of docks that were undertaken for the advantage of the trade of the capital was the *London Docks*. These docks are situated in Wapping, and are appropriated for the reception of all ships arriving in the port of London with wine, spirits, tobacco, and rice on board, but not exclusively, ships having on board other cargoes being admitted on the payment of certain fees. The act of parliament for incorporating the dock company was passed in 1800, authorizing them to raise a capital of L.1,200,000; but such was the number of houses to be purchased (we believe not less than 1200) occupying the site of the dock, that this capital by subsequent acts was extended to L.2,200,000, the dividends on which are limited, as in the West India Docks, to ten per cent. The great dock is 420 yards in length, and 230 yards in width, covering an area of twenty acres. A basin of three acres nearly connects it with the river. The warehouses are very magnificent; and the tobacco warehouse is the grandest and most spacious building of its kind in the world, being capable of containing 25,000 hogsheads of tobacco, and the vaults underneath as many pipes of wine. This single building, under one roof, is said to occupy upwards of four acres of ground. These docks were opened in February 1805.

The *East India Docks*, for the exclusive reception and accommodation of the East India ships, were the last in succession. The act for the incorporation of the company was passed in July 1803, authorizing them to raise a capital of L.200,000, which was afterwards increased to L.600,000, the dividend, as in the case of the two others, to be limited to ten per cent. These docks are situated at Blackwall. That for the reception of homeward-bound ships is 470 yards in length by 187 in width, containing a surface of rather more than 18 acres; the outward-bound dock is 260 by 173 yards, and is consequently something more than nine acres. An entrance basin of three acres nearly, and a spacious lock, connect them with the Thames.

Besides these there are the London Docks, the St Katharine's Docks, and the Victoria Docks in course of construction; of these, detailed accounts will be found under the article LONDON.

Hull has five docks, occupying with their basins a water area of $49\frac{3}{4}$ acres. A timber pond of 9 acres was constructed in 1853. The tonnage of shipping in 1852 was 799,866 sailing vessels, and 305,021 steam-vessels; the amount of dock dues L.433,755.

Southampton, the station for the West India mail and Lisbon and Alexandria steamers, is now constructing extensive docks and quays to accommodate their great and increasing traffic.

Grimsby Harbour has lately been greatly improved. Wet and dry docks have been constructed on the most approved principles, at an expense of L.250,000, and a canal cut into the Humber calculated to admit vessels of 1000 tons burden.

Hartlepool has also been of late years greatly enlarging its harbour and dock accommodation.

Sunderland has new docks of 18 acres extent, which were opened in 1850, and which can accommodate 300 sail.

Dundee has lately immensely improved her harbour and docks; besides two smaller docks, the wet dock now constructing will occupy $14\frac{1}{2}$ acres, the lock of which will be 60 feet broad.

Aberdeen has a wet dock, where the largest vessels may float in safety; it covers nearly 40 acres, with quay room of about 9000 feet.

Leith, the port of Edinburgh, has three wet docks, containing about 15 acres of water room. *Detailed accounts of these docks will be given under the names of the respective ports.*

The naval dry docks of the United States are among the most stupendous mechanical enterprises of that country; they are constructed at the navy-yards of New York, Philadelpia, Boston, Portsmouth, Norfolk, Pensacola, and San Francisco. By far the most extensive and magnificent of these structures is the granite dry dock of New York; 80,000 tons of stone have been used in its construction; the masonry foundations are 400 feet in length, and 120 in breadth. The main chamber is 286 feet long, and 30 feet broad on the bottom; 307 feet long, and 98 feet broad at the top within the folding gates; the height of the wall is 36 feet. The work was commenced in 1841, and took ten years to complete it; the aggregate expenditure was above L.430,000. For the docks at Cherbourg, see BREAKWATER.

Dry docks.

A dry dock, requiring to be perfectly water-tight, demands the greatest care in its construction. It is sometimes lined all round with wood, but more generally with masonry, mostly of hewn granite. The expense is very considerable, as the foundation, by means of piles or otherwise, must be well secured, all leakage prevented, and the culvers or drains properly constructed, to let in and carry off the water without its undermining the quays or piers. The cost of a complete dry dock will vary probably from L.20,000 to L.100,000, according to the size of the ships it is intended to admit, and the nature of the ground on which it is to be constructed. A dry dock may be *single*, or made to contain only one ship; or *double*, to contain two ships; but the former is the most common, because most convenient.

As it is of the utmost importance to preserve the water *in* a wet dock, and to keep it *out* of a dry dock, it may be proper to describe the different kinds of *gates* which are in use for this purpose.

Dock gates.

The most common, and on the whole perhaps the best and most convenient, are swinging gates, which open in the middle, and lie flat, one part against each wharf or side-wall of the passage leading into the dock or basin. The elevation of this kind of gate is represented in Plate CCVI., fig. 3. This kind of dock-gate requires to be made of great strength, with sound timber and good iron, and the gudgeons on which the hinges turn to be well secured into the stone abutments. Care also must be taken to make the bottom of the passage and the bottom of the gates perfectly plane and parallel, to prevent leakage, and give facility to their opening and shutting, which is usually assisted by rollers

fixed in a groove, and performed by means of a small capstern on each pier. Attached to the top of the gates is usually a foot bridge with railing, which, separating in the middle, opens and shuts with the gates.

The most simple but by no means the most effective contrivance for keeping out the water, is the wicket-gate, of which the plan and elevation are represented in Plate CCVI., figs. 5 and 6. It consists of three parts, which when opened are removed separately. This gate is rarely made use of unless where the abutments are not sufficiently strong, or their foundation sufficiently secure, to bear the weight of a pair of swinging gates.

A third kind of gate consists of a floating dam or caissoon, first introduced into this country by General Bentham, and first applied to the great new basin in Portsmouth dock-yard. They are built somewhat in the shape of a Greenland fishing-boat, sharp at the two ends, narrow, and deep in proportion to the depth of water at the entrance of the dock. The keel fits into a groove at the bottom of the passage, and the two slanting ends rise and fall in corresponding grooves cut into the two abutments. Of this kind of gate, figs. 1 and 2, Plate IV. represent the plan and elevation. By letting in the water, the caissoon sinks in the grooves, and acts as a closed gate; and by pumping out the water, or letting it out to a certain depth, the dam floats as the tide rises, and the narrow part, rising to the top, is readily disengaged from the grooves, and easily floated away as a boat. The advantages of these floating dams, as stated by General Bentham, are, that they are cheaper of construction than the gates heretofore in use for closing docks or basins; that they occupy less space, are more easily repaired, and one and the same dam is capable of being used, as need may require, in different places at different times. These caissoons have also the advantage of serving as bridges of communication for loaded carriages across the entrances they close, and they require much less labour than gates in opening or shutting up passages into docks or basins, since their occasional buoyancy may be obtained without pumping water or unloading ballast.

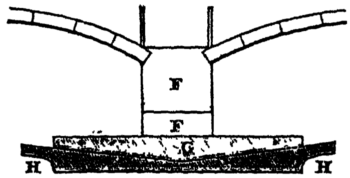
Fig. 7 represents a plan, and fig. 4 a sectional elevation, of a dry or graving dock, into which ships are taken to have their defects examined and repaired, coppered, &c., and in which, if necessary, as already observed, ships may be built.

Docking a ship.

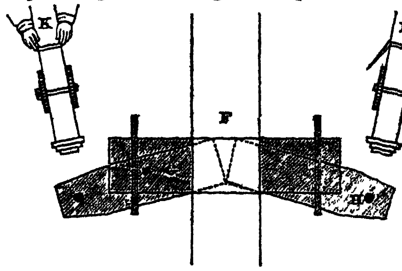
When a ship is brought into a dry or graving dock, she gradually subsides as the water flows out, till her keel rests upon the line of square blocks which are placed to receive it along the middle for the whole length; and on these blocks she is kept steady and upright by a number of shores or poles on each side, one of their ends being placed on the *altars* or steps of the dock, the other under the ship's bends and bottom. As a ship under repair generally requires something to be done to the main or false keel, or at any rate these parts require to be inspected, sometimes to shift the main keel, or to add to the whole length of the false keel, it was always found necessary in such cases to remove the blocks, in order to get at the bottom of the ship; but this operation could not be performed without the more serious one of first *lifting* bodily the ship clear of all the blocks, and suspending her as it were in the air. This process was performed by driving wedges simultaneously under the ends of all the shores that supported the ship; an operation that required from four to five hundred men to enable them to suspend a ship of the first rate. When the San Josef, a large three-decker, required her bottom to be examined in 1800, the assistance of almost every artificer in the dock-yard was found necessary to perform this process of lifting her; nor was this the only inconvenience; the ship, thus suspended, suffered very material injury by the pressure of her own enormous weight against the ends of the shores that supported her, such as forcing in her sides, straining the knees and all her fastenings, breaking the treenails, &c.

To remedy these glaring inconveniences and very serious injuries that ships thus placed were apt to sustain, and to effect a saving of time and expense in the operation, Mr (afterwards Sir Robert) Seppings, then master shipwright, and afterwards surveyor of the navy, contrived, several years ago, an improvement, as ingenious as it is simple, by which twenty men will suspend the largest ship in the navy, or rather, which amounts to the same thing, will disengage any one block that may be required, in the space of two or three minutes, without the necessity of suspending her at all; and, as a first rate in dock sits upon about fifty blocks, these twenty men will clear her of the whole of these blocks in about two hours; and as the saving of a day in completing the repairs of a ship is frequently the saving of a whole spring tide, the docking and undocking of a ship may make, and frequently has made, by this new method, the difference of a fortnight in the time of equipping her for sea.

The block of Mr Seppings, instead of being one solid piece, consisted of three wedges, or, more properly speaking, of one obtuse wedge and two inclined planes, which, when put together and placed under the ship's keel, appear as under, when viewed in the direction or line of the keel,



where G is the wedge on which the keel rests, having its obtuse angle equal to 170°, and HH are the two inclined planes, each having an acute angle of 5°. The wedge is of hard wood, having its two sides lined with iron; the two inclined planes are of cast iron. When one of these blocks is to be disengaged from under a ship's bottom, nothing more is required than a few smart blows alternately on the two sides of the two inclined planes, when they fly out, and the middle part or wedge drops; and the facility of thus disengaging any of the blocks is in proportion to the quantity of pressure upon that block. The strokes are usually given by a kind of catapulta or battering-ram, being a thick spar or pole moving on a pair of wheels, as KK.



This simple contrivance to get at any part of a ship's bottom by removing in succession all the blocks, without the necessity of lifting the ship, which the removal of any one block required to be done by the old method, is now universally adopted in all the dock-yards; and the Lords of the Admiralty marked their sense of the great utility of the improvement, by bestowing on Mr Seppings a reward of L.1000 for the invention.

Roofing the dock.

Another very material improvement introduced into her Majesty's dock-yards, is that of covering the dry docks and building slips with roofs. The rapid decay of our ships of war by that species of disease known by the name of the *dry rot*, attracted very general attention; its effects were well known, but a variety of opinions were entertained as

to its causes and its cure. It was quite obvious, however, that exclusion of air and moisture were the two great operating causes in giving activity to the progress of the disease (see DRY ROT); and that a ship in dock, stripped of her planking, and open to the weather in every part, alternately exposed to frost, rain, wind, and sunshine, must at least have her timbers differently affected, some swelled and water-soaked, others shrunk with heat, and others rifted with the wind and frost; and, if closed up with planking in this state, might be expected, at no great distance of time, to exhibit symptoms of decay. The workmen, too, in the open docks or slips, suffered from the vicissitudes of the weather no less than the ships, and their labour was frequently suspended, to the great detriment of the naval service. The measure of roofing over the docks and slips had long and repeatedly been suggested, but, either from prejudice or a false economy, it was only of late years carried into practice, but is now universal in all the yards. These roofs are generally constructed so as to be capable of having the sides and ends occasionally closed, according to the quarter from which the wind may blow; and by this contrivance the timber is prevented from rifting, as it is liable to do, by the action of a thorough draught of wind, and the health of the artificer is prevented from injury. The light is admitted through numerous windows placed in the roof. These roofs are in general supported on a row of pillars, and covered with plates of iron. Plate CCVI., fig. 8, exhibits the transverse section of a roof thrown over the head of the dock at Plymouth; its span, from A to A, being 95 feet 4 inches, and the extreme width, from B to B, 125 feet 4 inches, supported, on the principle of trussing, without a single beam. Another of the same kind was built at Chatham, whose span was 100 feet, and the extreme width 150 feet. These immense roofs, of which there are now some larger, were constructed after a plan of Mr Seppings. The cost of one of the dimensions above mentioned was from L.6000 to L.7000, which, great as it may appear, must be amply repaid by the superior quality and durability of the ships built under it; but the same roof, with little or no repair, serves as a covering for eight or ten different ships in succession. General Bentham, who, in his statement of *Services rendered in the Civil Department of the Navy*, seems to claim to himself all the inventions and improvements which have been introduced into the dockyards for the last forty years, carries his invention beyond a mere covering, and proposes to house over the docks and slips so completely as to afford "means of heating, warming, ventilating, and artificially lighting the interior at pleasure; the introduction of boilers or steam-kilns for bending the planks within the inclosure; the introduction of machinery for assisting in various operations, particularly the more laborious ones; the providing room for carrying on all the shipwright's work within the building; besides a variety of lesser works, such as it is found very inconvenient during the building or reparing of a ship to have executed, for example, in a smith's or carpenter's shop at a distance." Such buildings would not only be enormously expensive, but, in the present crowded state of the dock-yards, utterly impracticable. With regard to the invention of covered docks and slips, they have been used in Venice from time immemorial; and it appeared, from the evidence given by Mr Strange, the consul at that port in the year 1792, before the commissioners of land revenue, that two-and-twenty large ships had been under covered slips, some of them for sixty years nearly. At Carlscrona, also, there are several covered docks, and both Mr Nicholls and Mr Snodgrass strongly recommended the building of ships under cover nearly fifty years ago.

Hauling up ships on slips.

Among other experiments which were made in the dockyards for facilitating and expediting the repairs of ships, one may be mentioned, of which many persons were sanguine enough to think that the successful result was likely to be attended with most important benefits to the naval service. It was that of hauling up ships of war, of any dimensions, on building slips, instead of taking them into docks. It is no uncommon practice, at various ports of this kingdom, where there are neither artificial basins nor natural harbours, to haul vessels of the burden of fifty to two hundred tons, or probably larger, upon the beach, by means of capstans, to give them repairs; in like manner, most of the large fishing smacks are hauled up for security in tempestuous weather; but the practicability of hauling up ships of war, especially of the larger classes, was a matter of some doubt. Several frigates had, at various times, been hauled upon slips, when the docks were all occupied; and the ease with which the operation was performed induced the officers of the dock-yard to propose the hauling up of a line-of-battle ship. The Kent of 74 guns, was selected for this purpose. It was necessary, in the first place, to take her into a dock, to have proper bilgeways prepared, and to be stripped, so as to be made as light as possible; her weight being, according to a calculation made from the water she displaced when afloat, about fourteen hundred tons. To heave up this weight fourteen capstans were employed, and the number of men to work these were as under:

Nine men to each bar and swifter	1512
Eight men to hold on at each	112
Three men to each capstan, to attend the fall	42
Men on board the ship, and employed in other operations	450
Total of men employed	2116

The time occupied in hauling her up, after all the purchases were brought to bear, was forty minutes. The expense of preparing her, and the loss and wear and tear of the materials, was estimated at somewhere about L.2000.

The advantages which slips are supposed to possess over dry docks are many and important. They can be constructed at one-twentieth part of the expense; they occupy less space; they can be constructed on a steep or a shelving shore; and ships can be hauled upon them either in spring or neap tides; whereas a dry dock can only be made in particular situations, and, when made, ships can only be docked and undocked in certain states of the tides; from which circumstance a considerable delay and inconvenience are frequently experienced. It should be recollected, however, that a large ship must necessarily go into a dock preparatory to her being hauled up on a slip.

It has been considered as not at all impossible, as was suggested some time ago by Mr Perring, then the ingenious clerk of the check in Plymouth dock-yard, that the whole ordinary might hereafter be laid up on slips, which, if housed over, would unquestionably be the best means of increasing their durability, and preserving them from partial decay. Nor is it certain that in the end it would not be the most economical mode of preserving them. The expense, as appears from the *Estimates of the Ordinary of the Navy* for the year 1817, is L.187,000 for harbour victuals, harbour moorings and riggings, &c., besides L.135,000 for wages: the chief part of both which sums is on account of ships of war laid up in ordinary, none of which would be required by placing them on slips. It would indeed form a singular revolution in naval management, if ships hereafter should be laid up in ordinary on dry land, whilst the timber of which they are built was considered to be the best preserved under salt water; a process which, from some experiments recently made, promises fair to be the most effectual prevention of, and a probable cure for, the dry rot. (See DRY ROT.) This method of preserving timber has long been practised at Brest, Carthagena, and several other places on the Continent; and the only objection to it in some of our ports appears to be the attack of the worm known to naturalists by the name of *Teredo navalis*, whose bite is almost as destructive as the dry rot.

On the other hand, there are very many and serious objections, even were the measure practicable, of hauling up ships of the line in particular, to be laid in ordinary on slips. In the first place, the length of sea-beach which would be required is greater than probably all the dock-yards in the kingdom could furnish. Secondly, the three warrant officers who are now employed in each ship, and who are the best men in the service, being no longer necessary, would be turned adrift, and, in all probability, utterly lost to the navy. Thirdly, no large ship could be hauled on the slips without being previously taken into a dock to have her bilgeways fitted, and her bottom prepared for placing her on the slip. The time taken for this purpose must necessarily interfere with the other works of the yard; and after taking her out, the preparations for heaving her up, the capstans, blocks, purchase-falls, chains, and a variety of other articles, amount to a very large expense, not less, with the expense of the roof to cover the ship, than L.10,000 for each slip so hauled up.

Dock-Yards.

Previously to the reign of Henry VIII. the kings of England had neither naval arsenals nor dock-yards, nor any regular establishment of civil or naval officers to provide ships of war, or to fight them. They had admirals, however, possessing a high jurisdiction and very great power. (See the article ADMIRAL.) And it would appear, from a very curious poem in *Hackluit's Collection*, called *The Policie of Keeping the Sea*, that Henry V. had both ships, officers, and men exclusively appropriated to his service, and independently of those which the Cinque Ports were bound, and the other ports were occasionally called upon, to furnish, on any emergency. By this poem it also appears that Little Hampton, unfit as it now is, was the port at which Henry built

> ————his great *Dromions*
> Which passed other great shippes of the commons.

But what these *dromions* were no one can now tell; nor is it easy to conceive how the building and repairing of the Great Harry, which in the reign of Henry VII. was launched at Portsmouth, and cost L.15,000, was managed, considering the very rapid strides made at once from the small Cinque Port vessels, manned with 21 men and a boy, to this enormous floating castle. At that time it is well known that they had no docks, nor even substitutes for them.

The foundation of a regular navy, by the establishment of dock-yards, and the formation of a board, consisting of certain commissioners for the management of its affairs, was first laid by Henry VIII., and the first dock-yard erected under his reign was that of Woolwich. Those of Portsmouth, Deptford, Chatham, and Sheerness, followed in succession; and the last, excepting the new and unfinished yard of Pembroke, was Plymouth, which was founded by William III.

From the first establishment of the dock-yards to the present time, most of them have gradually been enlarged and improved by a succession of expedients and make-shifts, which answered the purposes of the moment; but the best of them possess not those conveniences and advantages which might be obtained from a dock-yard systematically laid out on a uniform and consistent plan, with its wharfs, basins, docks, slips, magazines, and workshops, arranged according to certain fixed principles, calculated to produce convenience, economy, and despatch.

Imperfections of the Queen's dock-yards. Neither at the time when our dock-yards were first established, nor at any subsequent periods of their enlargement as the necessities of the service demanded, could it have been foreseen what incalculable advantages would one day be derived from the substitution of machinery for human labour; and without a reference to this vast improvement in all mechanical operations, it could not be expected that any provision would be made for its future introduction; on the contrary, the docks and slips, the workshops and storehouses, were successively built at random, and placed whereever a vacant space would most conveniently admit them, and in such a manner as in most cases to render the subsequent introduction of machinery and iron railways, and those various contrivances found in the large manufacturing establishments of private individuals, quite impossible, even in the most commodious and roomy of her Majesty's dock-yards.

Proposed dock-yard on the Isle of Grain. The want of a systematic arrangement in our dock-yards, independently of machinery, and the enormous expenditure of money laid out on expedients, were questions of frequent discussion among naval men connected with the various administrations of the navy, and it was thought by many that it would be more desirable to construct an entire new dock-yard in some eligible situation, on an extensive scale, than to continue the *improvements* in the old ones. For this purpose, so early as the year 1765, the attention of the naval administration appears to have been turned to the Isle of Grain in the river Medway, along the shore of which is a fine expansive sheet of deep water. A dock-yard thus placed, on a systematic plan, would supersede that of Chatham on one side, and Sheerness on the other; but it was discovered on boring that the substratum was so loose and sandy as not to admit of a solid foundation. General Bentham, however, revived the project in the year 1800, which he seems to claim as his own, and painted the situation in such glowing colours, and as affording so many advantages for a grand naval arsenal, that the Lords of the Admiralty were induced to order a fresh set of borings to be taken. These were carried to the depth of 60 feet, and were everywhere found to consist of sand and mud, and totally unfit for the construction of basins, docks, and such solid buildings as are required for naval purposes.

On the peninsula of Northfleet. The imperfection of the naval yards to the eastward, the extension of the boundaries of France towards that quarter, the occupation of the greater naval port of Antwerp, and the uninterrupted command of the Scheldt and the ports of Holland by that power, rendered an enlargement of the means of naval equipment in the eastern dock-yards of England, or a new naval arsenal, indispensable. For the latter purpose the banks of the Thames were considered, in every point of view, as preferable to those of the Medway, the entrance into the latter being narrow, and having a bar across it, on which, at low water of spring tides, there is only 14 or 15 feet of water; whereas the navigation of the Thames is at all times uninterrupted, excepting by the badness of the weather. It communicates directly with the great market-town of London, in which every description of stores, foreign and domestic, is accumulated; and the trade of the Thames is the great source from which the fleet is supplied with seamen. The marshy peninsula of Northfleet was considered by naval men, who had turned their attention to the subject, to possess every possible requisite for the establishment of a royal dock-yard on an extensive scale. It was sufficiently removed from the mouth of the river to be completely sheltered, yet near enough for ships to proceed to sea with one wind. In the river between Northfleet and the sea there is plenty of water for the largest three-deckers to proceed with all their guns, ammunition, stores, and provisions on board, and almost with any wind, if moderate. A copious stream of good fresh water runs across the peninsula. The soil afforded plenty of earth suitable for bricks; the foundation was excellent for docks, slips, wharfs, and buildings of all kinds. It was sufficiently near the metropolis for speedy communication with the naval departments, and to receive stores in barges and the river craft. It was capable of being defended both on the land and river side; and when the whole was raised to the height of 12 feet with a dry gravelly soil, from the excavations of the docks and basins,

there could be no doubt of the healthiness of the situation. By the direction, therefore, of the Lords of the Admiralty, a complete survey was made by Messrs Rennie and Whidbey, who furnished a plan and estimate of a naval arsenal on a magnificent scale, within which all kinds of machinery were proposed to be employed for the making of anchors, sawing of timber, rope-making, block-making, &c.; iron railways to be laid from the timber wharfs to the timber fields, from thence to the mills and pits, and from them to the docks, slips, and workshops. The estimate, it appears, was about six millions sterling, which Mr Rose, in his letter to the late Lord Melville, calculates, with the fortifications and unforeseen expenses, to amount actually to ten millions; an expense which the minister did not venture to propose, though there can be little doubt that, when the case was fairly stated to the public, and the necessity of increasing our naval establishments to the eastward had been made apparent, no violent opposition would have been made to a measure which tended to keep up our naval superiority, and which was the less objectionable, as none of the money would have been taken out of the country, but circulated within it, to the encouragement of the arts, trades, and manufactures of the kingdom.

The board of revision made a detailed report on the merits of the plan, which, however, as the execution of it was delayed, was not printed; but the real reason was supposed to be, the very gloomy view taken by the commissioners of the disadvantages and imperfections of the present dock-yards, which Mr Rose seems to think, and indeed it is generally thought, is by no means warranted, and that those disadvantages in that report are greatly exaggerated, perhaps to enhance the value of the Northfleet plan, of which they seem to have been much enamoured. Imperfect as the old dock-yards are, chiefly from their having risen, as before observed, to their present state, by a succession of expedients and make-shifts, they are nevertheless far superior to any similar establishments on the Continent of Europe, if we except the arsenal of Cherbourg, whose magnificent basins (see BREAKWATER) are certainly unequalled, and the space surrounding them capable of being turned to every possible advantage. M. Charles Dupin, a French officer, who examined all our dock-yards with a skilful eye, pronounces them as by far superior to any on the Continent. We have heard much of the magnificent basins and the covered docks of Carlscrona, but the one has been greatly overrated, and the others are merely covered over with shed-like roofs; nor is there the least likelihood that the plan will ever be finished. We have been told likewise of the superior advantages of the naval arsenal of Copenhagen, where every ship has its appropriate storehouse. This plan has been adopted at Brest, and is reprobated there by every naval officer, and the officers of the yard, as most inconvenient, and a great waste of room, by having the most bulky and the most trifling articles stowed together in the same room. A better arrangement is that of having certain magazines appropriated to certain kinds of stores, and arranged according to the class or rate of ship for which they are intended, and, if appropriated or returned stores, the name of the ship to which they belong painted in front of the berth in which they are deposited. This is the system generally followed in our dock-yards.

The great point in which our naval arsenals were most defective was the want of wet docks or basins; which, however, was to a certain extent compensated at the two principal dock-yards of Portsmouth and Plymouth, by two magnificent harbours, in which the whole navy of England, when dismantled, may be moored and laid up in ordinary, in perfect security. The want of basins, however, in our dock-yards was most severely felt in time of war, when the expeditious fitting out of the fleet was so desirable. These wants are now happily remedied at all the great ports.

Idea of a perfect dock-yard.

The perfection of a dock-yard, then, independently of the advantages of machinery, which are but contingent, may be considered to depend upon one or more extensive basins, surrounded by spacious wharfs or quays. By means of these a prodigious saving of time, labour, and expense may be saved, in every stage of the progress of fitting out a ship for sea, from the moment she is launched from the slip, or taken out of a dock, as well as in dismantling a ship on returning to port to be paid off and repaired, or laid up in ordinary. For this purpose the docks and slips should occupy one of the sides of the basin, with working sheds for carpenters and joiners, smiths' shops, saw-pits, and seasoning-sheds between them. The ship, when completed on the slip and launched into the basin, may then be taken immediately into the adjoining dock to be coppered. From this she proceeds to the second side of the basin, in the corner of which is the ballast-wharf: the remainder of the side will probably be occupied by the victualling department, with appropriate stores in the rear for various kinds of provisions, and behind these the bakery, brewery, and slaughter-houses; on the wharf the iron tanks for holding water, now universally used for the ground tier, in lieu of wooden casks. These are taken on board next after the ballast, and, together with the superincumbent casks, would be filled in the ship's hold by means of flexible pipes to convey the water into them. The provisions would at the same time be taken on board at the same wharf, in front of the victualling stores. The third side might be appropriated to the ordnance department, with the gun-wharf extending along the whole side, and the gun-carriage storehouses, magazines, &c., in the rear. The fourth side would be occupied as the anchor wharf, with the cable storehouses, the sail lofts and stores, rigging loft, and magazines for various stores, in the rear. Behind these, again, on the first side, containing the dry docks and building slips, the ground would be appropriated to the reception, berthing, and converting of timber, from whence iron railways would lead to the saw-mills, saw-pits, and workshops, all of which would be placed on that side. On the second side a pond or basin for the victualling lighters and craft, with wharfs communicating with the manufactories and storehouses; the same on the ordnance or third side; and on the fourth side might be placed the ropery, hemp storehouses, tar-houses, with a basin for hemp-vessels, lighters, and the like. Communicating with the great basin on the building side, and also with the river or harbour on the shore of which the dockyard is to be formed, should be a mast-pond, with a lock for the storing of spars; in front the mast-houses, top-houses, capstan-houses, and a slip to launch the masts into the pond. Here also might be placed the boat-houses and boat-pond.

Advantages of a systematic dock-yard.

A peninsular situation like that of Northfleet, having at least three-fourths of its shore surrounded with deep water, is peculiarly favourable for some such arrangement as is here mentioned; as any number of locks and canals might be made to communicate with the river, so that ships coming into the basin might not interfere with those going out, nor the lighters and other craft bringing their several species of stores, with either or with one another. By such an arrangement a ship would be equipped for sea at half the present expense, and within half the usual time. A ship fitting out for an anchorage distant from the dock-yard, as at the Nore and Spithead, is liable to every inconvenience and delay, as all her guns, stores, provisions, and water, must be carried to her in dock-yard lighters and other craft, into which and out of which they must be hoisted and rehoisted; liable to delay from bad weather and contrary winds; to be stove alongside the ship, to the total loss or damaging of their cargoes: added to which is the loss of time in going backwards and forwards, especially to the artificers; the desertion of the men; the accidents from the upsetting of boats; and many other evils of a magnitude not easily to

be calculated, and exceeded only by the disappointment and vexation that unavoidably occur when ships are preparing for some particular and pressing service; all of which, when ships are fitted out in a basin for sea, are avoided. Here no delay, no embezzlement, no desertion, can take place. A ship in returning from sea may be docked and undocked into the basin with all her stores on board; and if to be paid off, instead of keeping the crew on board for weeks, till all the stores have been delivered into the dock-yard, the ship, by the proposed plan of basins, would remain securely in the basin, to be stripped at leisure by the riggers and labourers of the yard, and the crew become immediately available for other ships. Of the many superior advantages of wet docks for laying up ships to discharge, over the practice of exposing them in rivers or harbours, the shipping interest of the ports of London, Liverpool, Bristol, and Hull, can best testify, more especially that of London, which has taken the precaution to surround the docks with high inclosing walls, by means of which all access is debarred, and all possibility of embezzlement prevented.

Royal dock-yards.

From a brief description of the royal dock-yards as they now stand, a general idea may be formed of their several capacities, advantages, and defects. Taking them in succession, according to their vicinity to the capital, the first is

Deptford.—The front or wharf wall of this dock-yard, facing the Thames, is about 1700 feet in length, and the mean breadth of the yard 650 feet; the superficial content about thirty acres. It has three slips for ships of the line on the face next the river; and two for smaller vessels, which launch into a basin or wet dock, 260 by 220 feet. There are also three dry docks; one of them a double dock, communicating with the Thames, and the other a smaller one, opening into the basin. With these restricted means, even with an adequate number of workmen, its capacity for building ships, or for large repairs, must be very limited; but in the occasional repair of fourth-rates and frigates, and in the fitting out of sloops and smaller vessels, a great deal of work was performed at Deptford in the course of the war. The proximity of Deptford dock-yard to the capital is, however, of great importance, in the convenience it affords of receiving from this great mart all the home manufactures and products which may be purchased by contract for the use of the navy. It is, in fact, the general magazine of stores and necessaries for the fleet, from whence they are shipped off, as occasion requires, to the home yards, the outports, and the foreign stations, in store-ships, transports, coasting sloops, lighters, and launches, according to the distance to which they must be sent, to the amount, in time of war, of more than 30,000 tons a-year.

The principal stores deposited in Deptford dock-yard are small cordage, canvas, and ships' sails, to an immense amount; beds, hair for beds, hammocks, slops, and marine clothing; anchors under the weight of about seventy-five hundred, which are generally made by contract, all above that size being manufactured in the Queen's dock-yards.

The great magazines for the reception of these stores consist of a large quadrangular building, with a square in the middle, of three stories in height, with cellars underneath, in which are contained pitch, tar, rosin, and turpentine. The length of each side of these storehouses is nearly the same, differing from a square only by some 18 feet: this length is about 210 feet, but they vary in width from 46 to 24 feet.

Parallel to the west front of this quadrangle is the rigging-house and sail-loft, 240 feet, and nearly 50 feet wide, in which all the rigging is fitted for ships and stowed away, the sails cut out, made, and placed in proper berths for their reception, as well as for various other stores of a smaller kind.

On the eastern extremity of the yard is a long range of building, called the pavilion, in which the beds, hammocks, and slop-clothing are kept, and in which also are the house-carpenters', the joiners', and wheelwrights' shops. This building is about 580 feet long by 26 feet wide.

The remaining buildings usually appropriated to the different services of a dock-yard are all to be found at Deptford; a good blacksmith's shop, a plumber, glazier, painter shops, seasoning-sheds, store-cabins, saw-pits, mast-house, and pond, boat-houses, mould-loft, timber-berths, besides good houses and gardens for the principal officers, with several coach-houses and stables, so that the whole space is completely filled up in every part.

The number of men employed in this yard, in time of war, may have been about 1500, of whom about one-half were shipwrights and other artificers, and the other half labourers. There were, besides, in constant employ, 18 or 20 teams of 4 each, of horses, to drag timber and heavy stores.

Adjoining to the dock-yard is the victualling yard, the completest establishment of the kind, perhaps, in this or any other kingdom, though still capable of much improvement in the arrangement. Its frontage to the Thames is about 1060 feet, and mean depth 1000 feet, containing about 19 acres. This space is laid out in a more convenient manner than any of the dock-yards, for answering all the purposes which were intended. The general storehouses in front of the wharf wall, the cooperage, the brewery, the butchery, and the bakery, are all separate and complete in themselves; and a mill of such capacity as to grind corn to be made into biscuit sufficient for supplying the whole navy. Besides all the requisite offices for keeping the accounts, there are houses and gardens for eight of the principal officers of the yard.

The cooperage is spacious and well laid out. The staves are all sawed by hand, and this operation employed about 100 sawyers in time of war. Mr Brown of Fulham succeeded in making casks by machinery, by which 17 men in nine hours were able to complete 300 casks, whereas, by the ordinary method, the same number could only complete about 80. The brewery is well arranged, so is the bakery; and the butchery, consisting of a yard for keeping the cattle, with pens for sheep and hogs, two spacious slaughtering-houses, cutting and salting houses, by the abundant supply of water and constant washing, are kept in the cleanest order, and free from any disagreeable smell.

In the salting season 260 carcases have been slaughtered in each of the two days in the week appropriated to killing, and the hog hanging-house is capable of containing 650 carcases.

The total number of coopers, sawyers, bakers, and labourers employed during war, in the victualling-yard at Deptford, amounted probably to 1200 or 1300.

Woolwich Dock-yard.—This first and most ancient of the dock-yards presents a frontage to the river of 3680 feet, to which may be added 160 feet timber grove; the breadth now is very irregular, being from 250 to 900 feet. It has two docks with entrance from the river, and one dock with entrance from a large basin. This large basin has likewise an entrance into an inner basin, which is also of considerable size. There are besides three building slips for line-of-battle ships—one for steamers, one for corvettes, one for frigates; besides two smaller slips. There is also a boat pond. With all its imperfections, Woolwich yard, with a complete establishment of artificers, has been of great service both in the building and repairing of ships of all classes. Some of the largest and finest ships in the navy have been launched from Woolwich yard, among which may be mentioned the Nelson and the Ocean in former days, and latterly, the Trafalgar, Agamemnon, and Royal Albert. In fact, it is chiefly as a building yard that Woolwich ought to be considered as of much importance. It is stated in the *Eighth Report of the Select Committee on Finance* (1818), that "the wharf wall at Woolwich, owing to the action of the tide on

the foundation, is in a falling state, and in danger of being swept into the river, it being secured only in a temporary manner; and requires to be immediately rebuilt in a direction that will preserve it from similar injury hereafter, and prevent, in a great degree, that accumulation of mud which has, in the course of the last ten years, occasioned an expense of upwards of L.125,692, and would threaten in time to render the yard useless." The tides which sweep round the river wall keep a clear way along shore; but the deposits in the basin are considerable each time the caissoons are taken out, and the quantity of mud which is periodically removed in barges is a work of labour and great cost to the government.

It was found necessary to diminish the depth of the hold of the Nelson, in consequence of the Trinity Board having stated that no vessel drawing above 19 feet of water could be navigated down to Erith Reach, and one even of that draught not without difficulty and danger.

The magazines or storehouses are not in some respects to be compared with those of Deptford. They are more confined, and, owing to the narrowness of the yard, and the progressive additions made according as necessity required, there is little or no methodical arrangement. As far, however, as regards the building and repairing of ships, its conveniences are now very far superior to those of Deptford. The new mast-houses and mast-slip, the new mast-ponds, and the houses for stowing yards, topmasts, &c., with the locks under them, are all excellent; and two new and spacious basins complete these great conveniences. The timber-berths are well arranged, and the addition recently made to the western extremity of the yard allow the stacking of several thousand loads of timber, and of classing it according to the purposes to which it may be applicable; the new smithery, and the line of wharf wall has made the dock-yard of Woolwich an important and valuable naval arsenal.

Few of her Majesty's dock-yards have undergone greater improvement in late years than that at Woolwich. It has now got its steam factory, its steam kiln, steam saw-mills, foundry boiler shop, engineers' stores, smithery, &c., which render it very convenient for the repair of steam vessels and for the manufacture of engines.

Woolwich dock-yard seems to be complete in all the usual appendages of artificers, workshops, store-cabins, offices for the clerks, houses and gardens for the superintendent and principal officers of the establishment. The number of men employed during the war amounted to about 1800, of whom nearly 1100 were shipwrights and artificers, and the rest labourers. The number of spinners, knitters, layers, labourers, &c., in the ropery, might be about 260. Upwards of 20 teams of horses were daily employed in this yard.

One of the four divisions (the 4th, consisting of twenty-five companies) of royal marines is stationed at Woolwich, where barracks, an hospital, and all the other necessary buildings have been erected for their accommodation on shore.

Chatham Dock-Yard.—This dock-yard is situated on the right bank of the Medway, to which it presents a line of river wall at least 5000 feet in length; the width at the upper end being 400, in the middle 1200, and at the lower end about 800. The superficial contents may be estimated at about ninety-two acres. It has seven building-slips on the front, from which ships are launched into the river, all equal to the building of ships of the line, and three others for frigates and smaller vessels. In the same front are four dry docks communicating with the Medway.

The inconveniences arising from want of arrangement are less felt in Chatham than in any other of her Majesty's dock-yards; and it could not perhaps be materially improved, if on the same site an entirely new dock-yard was to be planned. At the southern extremity of the yard is the ropery, which is 1248 feet in length and 47½ feet in width, in which are employed about 250 persons. It is equal to the manufacture of every description of cordage required for the naval service, including the largest size cable, which is equal to 24½ inches. The hemp houses, 306 feet long by 36 feet wide, are equal to the stowage of 1600 tons of hemp and 3000 hauls of yarn. Next to these are the slips and docks, with the working-sheds and artificers' shops close in the rear, an excellent smithery, timber-berths, seasoning-sheds, deal and iron yard, &c.; and beyond these, on the eastern extremity of the yard, the officers' houses and gardens. The superintendent's house and excellent garden are situated nearly in the centre of the yard. The lower or north-eastern part of the yard is occupied by mast-ponds, mast-houses and slips, store boat-houses and slips, ballast-wharf, timber-berths, and saw-pits.

With all the advantages of interior arrangement, Chatham dock-yard still labours under that great defect to which most of the dock-yards are liable, from the injudicious manner in which the wharf walls have been constructed, without any regard being paid to the ebbing and flowing of the tide, or the currents of rivers, projecting in one part and retiring in others; the consequence of which is, that eddies are formed, and a constant accumulation of mud takes place along the line of the wall, and particularly in the openings of the dry docks, the slips, and the jetties. Of late years, however, since the attention of engineers has been called to this important subject, every opportunity is taken, in the repair of the wharf walls of the dock-yards, to correct the injurious effects arising from their improper direction.

There is no wet dock or basin in Chatham-yard; but the Medway, flowing along it in a fine sheet of water, in some degree answers the purpose of one. The whole river might indeed be converted into a magnificent basin, by pursuing the same plan as that adopted in forming the new docks at Bristol. This would be effected by cutting a new channel for the river through the chalk cliff below Frindsbury Church, opening out a little above Upnor Castle, and continuing the new channel across the marsh near St Mary's Creek, so as to open out into Gillingham Reach close to the fort. Here a basin might be constructed wherein ships might be equipped in all respects, ready for sea whenever the wind and tide should be favourable. At present, owing to the shallowness of the water and the crooked navigation from Chatham round Upnor Point, they are obliged to take in their water and ballast at one place, their stores and provisions at another, their guns, powder, and ammunition at a third; in consequence of which, a ship is usually longer in getting out to sea from Chatham than even from Deptford. If this new channel was made for the river, the whole space from the first reach below Rochester Bridge to St Mary's Creek, at the lower extremity of the dock-yard, might be converted into one magnificent basin.

Chatham being a building, a repairing, and refitting yard, the establishment of men was much greater in war than at Woolwich or Deptford; the number of shipwrights and other artificers, and labourers, being probably upwards of 2000, besides those of the rope-yard, which might amount to about 250.

A considerable piece of new ground (about 2000 feet in length by 200 in breadth) was added to the upper part of Chatham dock-yard, on which is erected one of the completest saw-mills in the United Kingdom, under the direction of Mr Brunell. The mill is situated on high ground, and close to the margin of a deep circular basin or reservoir of water, dug down to the level of the Medway, with which it communicates by a tunnel or subterranean canal, passing through the mast-pond. From the side of the reservoir opposite to the mill proceeds a long iron railway, supported on a double row of iron pillars; and alongside of

and parallel to this railway, on the side next to the dock-yard, are a continued series of stages for the reception of timber after it has been sawn into planks. A steam-engine of the power of thirty-six horses sets in motion all the operations of this mill, which may thus be briefly enumerated: *1st*, It drags up the large balks of timber through the canal into the reservoir as they are wanted. *2d*, It lifts up these large logs to the margin of the basin, carries them into the mill, and places them on the frame under the saws. *3d*, It saws them with the greatest nicety into planks of any required thickness. *4th*, It takes away the pieces thus sawn, and places them on carriages of iron. *5th*, It drives these carriages along the iron railway to any required distance. And, *6th*, It deposits the sawn timber on the stages, ready to be used in any part of the dock-yard where it may be required. From these stages it is conveniently conveyed to the docks or slips by single horse carts or trucks, with great expedition, down an easy descent, and without the least interference with any of the works carrying on in the yard. The whole of these operations are conducted by about ten, or at most twelve men.

This mill is supposed to be equal to the power of fifty saw-pits and nearly one hundred sawyers, and is capable of supplying the dock-yards of Chatham and Sheerness with all the straight-sawn timber that they can require. But the great advantage of the plan is in its application of the steam-engine to the management and arrangement of timber, by which the labour and expense of a great number of horses are saved, and, what is of still greater importance, the obstruction and impediments to the general services of the yard are avoided, which the dragging about of large balks to and from the saw-pits, with teams of four horses each, occasions in all the other yards. It allows, besides, the large space of ground which these saw-pits would occupy to be appropriated to other purposes.

The first division of royal marines, consisting of twenty-five companies, is stationed at Chatham, in excellent barracks, situated near to one of the extremities of the dock-yard.

There was formerly a small victualling depôt, situated partly in the parish of Chatham and partly in that of Rochester, from which the ships at Chatham and at Sheerness and the Nore received a supply of provisions and water. The premises are still in existence. The establishment consisted of an agent, clerk of the check, storekeeper, and their respective clerks, which, with the messengers, porters, labourers, &c., amounted to about ninety persons. Ships now obtain their supplies from Deptford or Sheerness, except fresh meat and vegetables, which are obtained on local contracts on demand.

Sheerness Dock-Yard.—The dock-yard is situated on a low point of land on the island of Sheppey, whose soil is composed of sand and mud brought from the sea on the one side and down the Medway on the other, and has so much contracted the mouth of this river as completely to command the entrance of it. The situation, in a military point of view, is a most important one, particularly from its vicinity to the North Sea and to the anchorage at the Nore; by which anchorage, and the works of Sheerness, the mouths of the Thames and the Medway are completely defended.

As a situation for a dock, the objections to which it was liable are now in a great measure removed. On account of the low swampy ground on which it stood, fevers and agues were at one time so prevalent, that shipwrights and other artificers were literally impressed and compelled to work at Sheerness. In process of time, however, a town sprung up close to the dock-yard, and with it some little improvement by drainage, embankments, and other measures. Still it continued, for a considerable time, an unhealthy and disagreeable place. As a dock-yard it was totally destitute of all convenience or arrangement; and the whole premises, mixed among wharfs and buildings belonging to the ordnance department, did not exceed fifteen acres of ground. The storehouses were dispersed in various parts of this space, and in so ruinous a state, that a ship hauled up in the mud was by far the best in the whole yard. It had two small inconvenient docks for frigates or smaller vessels. It was in fact a mere point of refitment, and might be considered as an appendage to Chatham.

From the very limited capacity of Sheerness, and the mighty preparations in the Scheldt, originated the magnificent project of the naval arsenal at Northfleet, which, from a change of political circumstances, and from the important improvements now carried out at Sheerness, is not likely ever again to be revived. The Finance Committee (*Eighth Report*) say they have learned "that the re-establishment and extension of the yards at Sheerness and Chatham may be considered as superseding, under any circumstance that can now be likely to occur, the plan contemplated for a naval establishment at Northfleet, on so extensive a scale as to require the expenditure of several millions."

These improvements are of sufficient magnitude to render any establishment at Northfleet wholly unnecessary, by making Sheerness as complete a dock-yard, and perhaps more so, than any other in her Majesty's dominions. Previously to carrying into execution this important undertaking, a committee of engineers and others was appointed, among whom were Watt, Huddart, and Jessop, whose plan was afterwards minutely examined, and some slight improvements suggested therein by Mr Rennie. The first stone was laid on the 19th August 1814, and the whole was completed at an expense not far short of one million sterling.

The advantages arising from the adoption of this plan are, *1st*, The addition of nineteen acres of ground to the dock-yard, by taking in the whole of the muddy western shore of the Medway, beyond the low-water mark of neap tides, and getting rid of the offensive and unwholesome smell which it perpetually occasioned. *2dly*, The construction of a wet dock or basin 520 feet in length by 300 in width, equal in surface to three and one-half acres, and capable of containing a fleet of ten sail of the line, in which they can take on board all their stores, ammunition, and provisions, and be equipped in all respects ready to proceed to sea. The entrance into this basin is from the Medway, through a lock that is closed by a floating dam-gate. *3dly*, The construction of three dry docks on the eastern side of the basin, and opening into it, each capable of holding a first-rate ship of the line. *4thly*, Ample space for constructing storehouses, mast-houses, mast-ponds, and slip, smithery, and artificers' workshops of every description. *5thly*, A further extension of the dock-yard, by the addition of ten or twelve acres of a low marshy tract of land called Major's Marsh, which was below the level of the sea, and the water kept out, as in Holland, by embankments, but is now raised several feet by the excavation of the basin, the dry docks, and the mast-ponds, so as to allow of drains to carry off the water to the shore, affording space for timber-berths, houses, and gardens, for all the officers of the dock-yard, as well as for the admiral commanding in chief at Sheerness and the Nore. These additions, together with some part of the premises held by the board of ordnance, make the whole area of the dock-yard of Sheerness amount to upwards of fifty acres. The wharf wall on the south side of the basin in front of the mast-houses is a hundred feet, and that on the river front sixty feet in width, lined on both sides with as complete a specimen of good and beautiful masonry of granite as any in the kingdom.

The usual officers, with their clerks, amounted during the war to about fifty; and the shipwrights, artificers, and labourers, to about eight hundred; the shipwrights being the most numerous, as the principal part of the work was con-

fined to the repairing of small vessels in the yard, but mostly to repairs of the fleet afloat at the Nore or in the Medway.

Portsmouth Dock-Yard.—Portsmouth dock-yard will always be considered as the grand naval arsenal of England, and the headquarters or general rendezvous of the British fleet. The dock-yard accordingly is by far the most capacious; and the safe and extensive harbour, the noble anchorage at Spithead, the central situation with respect to the English Channel and the opposite coast of France, and particularly with regard to the naval arsenal at Cherbourg, render Portsmouth of the very first importance as a naval station; and in this view of it, every possible attention appears to have been paid to the extension and improvement of its dock-yard. The noble steam basin, which was opened by the Queen in May 1848 with great ceremony, is one of the most important of the recent improvements. The sea wharf-wall of this yard, extending in the direction of north and south along the western shore of the harbour, is about 3900 feet in length, and the mean depth may be 2000 feet; and it in-closes an area of more than 100 acres.

In the centre of the wharf-wall, facing the harbour, is the entrance into the great basin, whose dimensions are 380 by 260 feet, and its area 2½ acres. Into this basin open four excellent dry docks, and on each of its sides is a dry dock opening into the harbour; and all of these six docks are capable of receiving ships of the largest class. Besides these is a double dock for frigates, the stern dock communicating through a lock with the harbour, and the head dock with another basin about 250 feet square. There is also a camber, with a wharf-wall on each side, 660 feet in length, and of sufficient width to admit of transports and merchant ships bringing stores to the dock-yard. In the same face of the yard are three building slips capable of receiving the largest ships, and a small one for sloops, besides two building slips for frigates on the northern face of the yard, and a smaller slip for sloops. The range of storehouses on the north-east side, and the rigging-house and sail-loft on the south-west side of the camber, are magnificent buildings, the former occupying nearly 600 feet in length, exclusive of the two intermediate spaces, and nearly sixty feet in width, and the two latter 400 feet. The two hemp-houses and the two sea-store houses occupy a line of building which, with the three narrow openings between them of twenty-five feet each, extend 800 feet. The rope-house, tarring-house, and other appendages of the ropery, are on the same scale. The two sets of quadrangular storehouses, and the two corresponding buildings, with the intervening timber-berths and saw-pits, at the head of the dry docks, issuing from the great basin, are all excellent, and conveniently placed. The smithery is on a large scale, and contiguous to it is an iron-mill, a copper-mill, and a copper refinery, at which is remelted and rolled all the old copper which is taken from ships' bottoms; and here, also, are cast bolts, gudgeons, and various articles of copper used in the navy. The number of sheets manufactured in one year of the war amounted to about 300,000, weighing above 12,000 tons; on which it has been calculated that a saving of at least L.20,000 was effected for the public, besides obtaining a good pure article. Most of these were constructed under the direction of General Bentham. (Bentham's *Services.*) At the head of the north dock are the wood mills, at which every article of turnery, rabetting, &c., is performed for the use of the navy, from boring the chamber of a pump to the turning of a button for a chest of drawers. But the principal part of these mills is the machinery for making blocks, contrived by that ingenious artist Mr Brunell (see BLOCK-MACHINERY), which cannot be regarded without exciting the highest respect for the talents and skill of the inventor.

The northern extremity of the dock-yard is chiefly occupied with seasoning-sheds, saw-pits, and timber-berths, the working boat-house, and boat store-house. On the eastern extremity are situated the houses and gardens of the superintendent and principal officers of the yard, the chapel, and the royal naval college.

Naval College.—The establishment of a college at Portsmouth for the education of young gentlemen for the navy was first formed in 1729 under the title of the Naval Academy. It contained 40 scholars, the sons of the nobility and gentry. In 1806 it was reorganized under the name of the Royal Naval College, and the number of scholars was raised from 40 to 70; of whom 40 were to consist of the sons of commissioned officers of the navy, and to receive their board, clothing, lodging, and education, free of all expense; the remainder to consist of sons of noblemen, gentlemen, civil and military officers, on payment of L.72 a-year. The age of admission from twelve and a half to fourteen years. A bond was required to be signed by their friends, in the penalty of L.200 for the first class, and L.100 for the second class, in the event of any young gentleman being withdrawn from the navy before he had served the proper time to qualify for the commission of lieutenant. (See article NAVY.) No student to remain at college longer than three years; at the end of which, or sooner if he shall have completed the plan of education, he was to be discharged into one of her Majesty's ships, the college time being reckoned two years of the six required to be served to qualify for such a commission. In 1837 the Royal Naval College for the education of young gentlemen for the navy was abolished, and by an order in council of 1838 it was reopened as an establishment for the scientific education of a certain number of officers and mates of the naval service, the latter to have passed both their examinations in seamanship and in navigation, and to remain one year in the college. At the end of six months an examination takes place, and a lieutenant's commission is awarded to the mate who attains the greatest proficiency. A limited number of commissioned officers of any rank are also permitted to study at the college, but no expense is incurred on their account: neither for the mates beyond their sea pay, and a customary allowance in lieu of provisions. The establishment at present consists of a governor (the first lord of the admiralty), a captain superintendent; a professor, mathematical master, instructor of fortification and mathematical drawing, and assistant in the observatory.

Naval Architectural School.—The number of students formerly did not exceed 24. Candidates for admission were examined at stated periods, the degree of merit alone giving preference of admission; the age of entrance from fifteen to seventeen, and the duration of their apprenticeship seven years. The students were lodged, boarded, and educated, free of all expense, and had the following yearly allowances: First year L.25, second L.30, third L.35, fourth L.40, fifth L.45, sixth L.50, seventh L.60. And at the expiration of their apprenticeship they were eligible to all the situations in the shipbuilding department of her Majesty's dock-yards, to be there employed as supernumeraries until regular vacancies might occur; provided the apprentice had completed the plan of education, and was certified by the professor to be properly qualified.

The consolidated establishment of the two foregoing departments consisted of a governor, who was the first lord of the admiralty for the time being; a lieutenant-governor, who was a post-captain in the navy, with a salary of L.800 a-year and apartments; two lieutenants of the navy, with L.200 a-year each, apartments; and an allowance for board; a professor who was a graduate of the university of Cambridge, with a salary of L.700 a-year, and apartments: a master of classics, history, and geography, with L.350 a-year and apartments; three assistant-masters, well skilled in mathematics, the first with L.250, the two others L.200 a-year each, with an allowance for house rent; besides masters for teaching draw-

ing, dancing, fencing, and the French language, and two serjeants of marine artillery. In addition to these, there was a superintendent of the school for naval architecture, a professional shipbuilder, brought up in one of her Majesty's dock-yards, to instruct the apprentices in the practical parts of shipbuilding. The school for naval architecture has also been abolished; but there is a central mathematical school for apprentices, with a principal at its head.

The professor of the naval college has the charge and keeps the rate of all the chronometers which may not be in use belonging to the navy; and all midshipmen in the navy are now required to pass their examination in the theory of navigation at the naval college. See NAVY.

The strength of Portsmouth dock-yard, during the war, was considerably above 4000 working men, of whom about 1500 were shipwrights and caulkers; the joiners and house-carpenters were nearly 500; the smiths 200 nearly; the sawyers 250; the riggers and their labourers nearly 200; the scavelmen and labourers of various kinds nearly 700; and the rope-yard employed about 350 persons.

Victualling Yard.—There were formerly two victualling establishments at this port; the one in Portsmouth town, the other across the harbour, at a place called Weevil; both of them inconveniently situated for supplying the ships with water and provisions, more especially such as may have to take them in at Spithead. The former consisted chiefly of provision-stores and magazines, with a tide-mill and a bakery; at the latter there were a cooperage and a brewery. The total number of persons employed, including the officers, at the two establishments, during the war, amounted to about 500. The victualling establishments are now consolidated at Gosport, and the Royal Clarence Victualling Yard is a very fine establishment.

The noble building for the reception of sick and wounded seamen (Haslar Hospital) is situated on the Gosport side of Portsmouth harbour. Being appropriated to the military branch of the navy, it will be described under the head of NAVY.

The second division of royal marines, consisting of twenty-seven companies, is stationed at Portsmouth, in barracks, which are inconveniently situated in the town; and eight companies of the royal marine artillery have their head-quarters at Fort Monckton, on the Mainland between Gilkicker Point and Haslar Hospital.

Plymouth Dock-Yard.—The naval station of Plymouth is inferior only to that of Portsmouth; and, in point of its more westerly situation, as considered with reference to the grand naval arsenal of Brest, it is superior even to Portsmouth. It possesses one of the finest harbours in the world, capable of containing, in perfect security at their moorings, not less than a hundred sail of the line; and by means of the breakwater it may boast of an excellent roadstead for eighteen or twenty sail of the line. The dock-yard, however, has only one basin, without gates, whose dimensions are 300 by 280 feet; but the excellent harbour of Hamoaze, on the western bank of which the wharf-wall extends, almost compensates for the want of others, especially as the depth of water allows the largest ships to range along the jetties, and receive their stores on board immediately from the wharf.

Plymouth dock-yard extends in a circular sweep along the shores of Hamoaze 3500 feet, its width about the middle, where it is greatest, being 1600, and at each extremity 1000 feet, making its superficial contents about ninety-six acres. The land front is about 2850 feet. In the line facing the harbour are two dry docks for ships of the first rate, a double dock for seventy-four gun ships, communicating with Hamoaze, and another dock for ships of the line, opening into the basin. There is, besides, a graving-dock without gates, and a canal or camber similar to that in Portsmouth yard, for the admission of vessels bringing stores into the yard; which communicating with the boat-pond, cuts the dock-yard nearly into two parts. There are five jetties projecting from the entrances of the dry docks into Hamoaze, alongside of which ships are conveniently brought when undocked. All these are situated between the centre and the northern extremity of the harbour line. On the southern part are three building slips for the largest class of ships, and two for smaller vessels; the outer mast-pond and mast-houses, timber-berths, saw-pits, and smithery. Higher up, on this end of the yard is an extensive mast-pond and mast-locks, with plank-houses over them; and, above these, three hemp magazines, contiguous to which is the finest ropery in the kingdom, consisting of two ranges of buildings, one the laying-house, the other the spinning-house, each being 1200 feet in length, and three stories in height. In the construction of the new rope-house no wood has been used excepting the shingles of the roof, to which the slates are fastened. All the rest is of iron. The ribs and girders of the floors are of cast iron, covered over with Yorkshire paving stone, and the doors, window frames, and staircases are all of cast iron, so that the whole building may be considered as proof against fire.

The northern half of the yard, besides the docks and basin, with all the appropriate working sheds and artificers' shops, contains a cluster of very elegant stone buildings, ranged round a quadrangle, the longest sides being about 450 feet, and the shortest 300 feet. Within the quadrangle are also two new ranges of buildings, in which iron has been used in the place of wood. These buildings consist of magazines for different kinds of stores, rigging-houses, and sail-lofts. The northern and upper part of the yard is occupied by a range of handsome houses, with good gardens behind them, for the commissioner and the principal officers of the yard, the chapel, the guard-house, and pay-office, stables for the officers, and the teams, and a fine reservoir of fresh water for the supply of the yard.

Plymouth is not only a good building and repairing yard, on account of its excellent docks and slips, and the great length of line along the Hamoaze, but also a good refitting yard, and was fully occupied during the war with the refitment of the western squadron, employed in the constant blockade of Brest. The number of men borne on the establishment of this yard might have been about 3000, of which about 800 were shipwrights.

A large addition has been made to Plymouth yard by the fine establishment of Keyham steam factory which adjoins it, with a water frontage of about 1300 feet, and with a steam basin 630 feet by 560 feet, and another in progress 700 feet by 400 feet.

Plymouth Victualling Establishment.—The Royal William Victualling Yard stands on the eastern entrance to Hamoaze, on about eleven acres of ground; adjoining four acres on its south side, on which stand two small forts, and a reservoir containing about 8000 tons of water, which supplies the fleet—the water being brought from Dartmoor.

Plymouth Hospital is a handsome building of stone, or rather a series of separate buildings, regularly arranged, in which respect, as admitting a freer circulation of air, it is perhaps superior to that of Haslar. See NAVY.

The third division of royal marines, consisting of twenty-five companies, are stationed at Plymouth. The barracks are conveniently situated at Stonehouse, very airy, and sufficiently spacious.

Pembroke Dock-Yard.—This dock-yard has been established but a few years comparatively, and is intended merely as a building-yard. It is situated on the southern shore of Milford Haven, not two miles from the town of Pembroke. It includes an area of about sixty acres, its surface descending in a gradual slope to the water's edge, along the shore of which there is a frontage of about 2350 feet. It has a dock, and 14 building slips, 6 of which are for first-rates. The

Dock-Yards.

largest ship of the royal navy, the Duke of Wellington, 131 guns, was launched from this yard.

Other Yards.—In addition to the foregoing, there are several small naval yards—at Deal, Harwick, Leith, and Cove of Cork, as well as at Gibraltar, Malta, Antigua, Jamaica, Halifax, Bermuda, Kingston (Canada), Cape of Good Hope, and Trincomalee.

Dock-Yard Officers.—The management of the dock-yards is intrusted to a superintendent, either a rear-admiral or captain; a master attendant and his assistant; master shipwright and assistant; a store-keeper, store-receiver, and director of police—a force which has only of late years been introduced for the protection of the yards.

Ordinary of the Dock-Yards.—At each of the ports where there is a dock-yard, Pembroke excepted, a certain number of ships when put out of commission, or new ships not commissioned, are laid up in what is called a state of ordinary; and such ships were formerly placed under the immediate charge of the commissioner, the masters attendant, and other officers of the dock-yard. But a new system has been adopted, both with regard to the fitting of the ships for their better preservation, while thus unemployed (see Dry Rot), and also as to the care and management of them by warrant officers living constantly on board. See Navy.

Capacity of a Dock-Yard.—The capacity of a dock-yard for building, repairing, and refitting ships of war, depends upon so many circumstances that it scarcely admits of calculation; chiefly, however, on the facilities afforded by a suitable arrangement of dry docks, building slips, and basins, and on the number of shipwrights and other artificers borne on the strength of the yard. In building new ships, where the materials are at hand, and no interruptions occur, the capacity may be ascertained to a tolerable degree of accuracy. To complete the building of a seventy-four gun ship, it is calculated that the labour of one man would be required for 18,000 days, or of eighteen men for 1000 days, or about fifty-four men to finish her in the space of one year. A dock-yard, therefore, with 500 good shipwrights, might be expected to launch from eight to ten 74-gun ships every year, if the conveniences of the yard admitted them all to be employed on building; but this kind of ship is now supplanted by ships of 120 and 130 guns, requiring a relative increase of hands. With regard to repairs, they are so various and so uncertain, that it would be next to impossible to form any calculation that should at all approach to the truth. A writer well versed in naval matters, in attempting to prove the sufficiency of our dock-yards, without having recourse to private merchant yards during war, has stated, that by a uniform system of management, "the annual regeneration of ships of the line may be safely reckoned at *twelve sail*, and that of frigates at *eight sail*;" and that, besides, there might be docked for casual repairs, in the course of one year, *two hundred and sixty-seven sail* of ships and vessels of war." (*Letter to Lord Melville on the General State of the Navy*, 1810.)

Management of the dock-yards, &c.

When Henry VIII. first established a regular king's dock-yard at Woolwich, he appointed a board, consisting of certain commissioners, for the management of all naval matters; and it is curious enough, as appears from the *Pepysian Collection of Manuscripts* in the university of Cambridge, that the regulations which he made for the civil government of the navy, and which were in the reign of Edward VI. revised, arranged, and turned into ordinances, form the broad basis of all the subsequent instructions given to the several officers to whom the management of the civil affairs of the navy has been committed. (*First Rep. Nav. Rev.*)

Commissioners of the navy.

The commissioners of the navy then consisted of the vice-admiral of England, the master of the ordnance, the surveyor of the marine causes, the treasurer, comptroller, general surveyor of the victualling, clerk of the ships, and clerk of the stores. They had each their particular duties; and once a-week they were ordered to meet at their office on Tower Hill, and once a-month to report their proceedings to the lord high admiral.

In 1609 the principal officers for conducting the civil affairs of the navy were suspended, in consequence of many abuses being complained of; and other commissioners were appointed, with powers to manage, settle, and put the affairs of the navy into a proper train, and to prevent, by such measures as might appear to be necessary, the continuance of the many great frauds and abuses which had prevailed. A similar commission was renewed in 1618, which in a full and minute report detailed and explained those frauds and abuses.

That commission, which ended on the death of James I., was renewed by his successor, and remained in force till 1628, when it was dissolved, and the management of the navy was restored to the board of principal officers, as established by Edward VI.

In the disturbed reign of Charles I. the navy was suffered to go to decay; but by the extraordinary exertions of Cromwell it was raised to a height which it had never before reached, but again declined under the short and feeble administration of his son.

Duke of York the lord high admiral.

On the restoration of Charles II. the Duke of York was appointed lord high admiral; and by his advice a committee was appointed to consider a plan he had drawn out for the future regulation of the affairs of the navy, at which he himself presided. "In all naval affairs," say the commissioners of revision, "he appears to have acted with the advice and assistance of Mr Samuel Pepys, who first held the office of clerk of the acts, and was afterwards secretary of the admiralty; a man of extraordinary knowledge in all that related to the business of that department, of great talents, and the most indefatigable industry."

The entire management of the navy was now in the hands of the duke, as lord high admiral, by whom three new commissioners were appointed to act conjunctly with the treasurer of the navy, the comptroller, the surveyor, and clerk of the acts, as principal officers and commissioners of the navy. A book of instructions, drawn out by Mr Pepys, was sent to the navy board for its guidance. A rapid progress was made in the repair and augmentation of the fleet; but being called away, in consequence of the Dutch war in 1664, the example of zeal and industry set by Mr Pepys was not sufficient, in the duke's absence, to prevent neglect and mismanagement in every department except his own.

New set of commissioners.

From 1673 to 1679, the office of lord high admiral being put in commission, at the head of which Prince Rupert was placed, the king, through Mr Pepys, arranged all naval affairs; but in the latter year, when the duke was sent abroad, and Mr Pepys to the Tower, a new set of men were made commissioners of the navy, who, without experience, ability, or industry, suffered the navy to go to decay. "All the wise regulations," say the commissioners of revision, "formed during the administration of the Duke of York, were neglected; and such supineness and waste appear to have prevailed as, at the end of not more than five years, when he was recalled to the office of lord high admiral, only twenty-two ships, none larger than a fourth-rate, with two fire-ships, were at sea; those in the harbour were quite unfit for service; even the thirty new ships which he had left building had been suffered to fall into a state of great decay, and hardly any stores were found to remain in the dock-yards." He re-appointed Mr Pepys as secretary of the admiralty; he set about an inquiry into the characters and abilities of the first ship-builders in England; and by the advice of Mr Pepys he joined Sir Anthony Dean, eminent in that profession, with three others, to the former principal officers in a new commission. The old commissioners were directed entirely to confine their attention to the business of a committee of accounts. To each of the new ones was

intrusted a distinct branch of the proposed reform; and it appears that, highly to their credit, "they performed what they had undertaken in less time than was allowed for it, and at less expense;" having completed their business to the general satisfaction of the public two months before the Revolution.

The business of the navy, thus methodized and settled, remained undisturbed by that event. The commissioners of revision justly observed, that "the great work of re-establishing the fleet, and restoring order, industry, and discipline, in the dock-yards, accomplished in so short a time by the commissioners then chosen, with so much care, proves, in the most convincing manner, how much depends on having the civil affairs of the navy placed under the management of men of real ability, professional knowledge, and uninterrupted industry."

Commissioners of naval inquiry and revision.

It will readily be supposed that the vast increase of our naval force since that time has necessarily required many additional orders and regulations, some of which, from circumstances, were not compatible with each other; some were given to one dock-yard and not to another; others in one yard became obselete, while they continued to be acted upon in another; so that there was no longer that uniformity in the management which it is so desirable, indeed, so essentially necessary, to preserve. From the year 1764 to 1804, when his Majesty appointed a commission "for revising and digesting the civil affairs of his navy," the attention of the lords of the admiralty and the navy board had frequently been directed to this important subject; but owing to various causes nothing was done to forward so desirable an arrangement, except that Sir Charles Middleton (afterwards Lord Barham), when comptroller of the navy, classed and digested under distinct heads, in a book for that purpose, all orders and regulations prior to the year 1786. The commissioners of naval inquiry, appointed in 1803, state the necessity of revising the instructions, and digesting the immense mass of orders issued to the dock-yard officers, and regret that a work of such utility should not have been completed. The late Lord Melville, to whom the navy is perhaps more indebted than to any single individual, and who, from the active part he had long taken in its concerns, was well aware of the irregularities and disorder which prevailed in the dock-yards, on his appointment to the administration of naval affairs determined to carry into execution a complete system of reform and of uniform management in all the several departments. The commission consisted of Admiral Lord Barham, John Fordyce, Esq., Admiral Sir Roger Curtis, Bart., Vice-Admiral Domett, and Ambrose Serle, Esq. They made fifteen distinct reports, the date of the first being 13th June 1805, of the last the 6th March 1808; all of which except two have been printed by order of the House of Commons, and mostly carried into effect by orders in council. One of the two not printed is an inquiry into the state of the navy at different periods, and of naval timber; the other relates to the formation of a new dock-yard at Northfleet.

Uniform system of management introduced.

From these reports were established, for the first time, in all dock-yards, one uniform system of management, by which it was hoped incalculable advantages would have been derived to the public, in the preventing of frauds, in the saving of labour and materials, and consequently time and expense, and in securing better workmanship in the construction of ships, which is perhaps of all other considerations the most important; but the system was cumbrous and expensive, and has given way to other more judicious management.

Commissioners of the navy.

The management of the dock-yards, and of all the civil affairs of the navy, was formerly intrusted to certain commissioners appointed by patent, of whom the comptroller of the navy and three surveyors, and seven other commissioners, formed a board at Somerset House, for the general direction and superintendence of the civil concerns of the navy, subject to the control of the lords commissioners of the admiralty. At most of the home yards and of the foreign yards was a commissioner of the navy, who was always a naval officer of the rank of captain. The foreign yards over which a commissioner presided, were Bermuda, Cape of Good Hope, Gibraltar, Halifax, Jamaica, Malta, Quebec, Kingston, including the lake establishments and Trincomalee, which, with the five belonging to the home yards, Woolwich (including Deptford), Chatham, Sheerness, Portsmouth, and Plymouth, made the whole number of commissioners of the navy amount to twenty-four. The salary of each of the home commissioners was L.1000 a-year, that of the comptroller L.2000. The salary of the foreign commissioners L.1200 a-year, except that of the Cape of Good Hope, which was L.1800, and Trincomalee L.3000 a-year. They were also entitled to liberal superannuations when unfit for further service; and, at their death, their widows received a pension for life of L.300 a-year. All these have been swept away, and the two great departments, the navy and the victualling offices, have been consolidated with the admiralty, and the details of the business placed under five principal officers, each having a separate department. These are, 1. the surveyor of the navy; 2. the accountant general; 3. the storekeeper general; 4. the comptroller of the victualling and transports; 5. the director general of the medical department. There is also a director of engineers and architectural works, who superintends all the great works carried on in the dock and victualling yards.

Victualling establishment.

To each of the dock-yards at Deptford, Portsmouth, and Plymouth, are victualling establishments for supplying the fleet with provisions and water; and also at Cork, Cape of Good Hope, Gibraltar, Malta, Jamaica, Halifax, Trincomalee, and Rio de Janeiro. The victualling board at Somerset House consisted formerly of a chairman and deputy chairman, the former with a salary of L.1200, the latter of L.1000 a-year, and five other commissioners with salaries of L.800 a-year each; a secretary to the board, and a secretary to the committee of accounts; a registrar of securities, and 136 clerks, with salaries varying from L.800 to L.80 a-year, according to their class and length of service. These have all been abolished, and, as before stated, consolidated with the admiralty.

The transport board having been dissolved at the end of the war, its twofold duties were divided between the navy and victualling boards; those which concerned the hiring of transports devolved on the commissioners of the navy, and those which related to the sick and hurt department on the commissioners of the victualling board, on whom also devolves the direction and superintendence of all the naval hospitals at home and abroad. These have also merged in the admiralty.

Officers of the dock-yard; their duties.

The principal officers of an established dock-yard, prior to 1833, were, 1. the commissioner; 2. the master attendant; 3. the master shipwright; 4. the clerk of the check; 5. the storekeeper; 6. the clerk of the survey; to which have recently been added the subordinate officers of timber-master, and the master measurer. By the new regulations, the commissioner has been superseded by a superintendent, the clerk of the check and clerk of the survey abolished, as well as the master measurer, and a store-receiver substituted for the timber-master. Many subordinate officers have also been abolished, and the whole system of working the men, keeping the accounts, &c., simplified and amended; and some idea may be collected of the diminution of the expense by the simple fact, that, in the ordinary estimate of the navy for 1817 the establishment of officers in Portsmouth yard was L.50,065, whereas in 1833 it was only L.19,803; and in 1853, L.20,121. To this, however, must now be added the salaries of officers employed in the steam factory, which amount to L.2555.

The principal officers in the factory are,—1. the chief engineer and inspector of machinery; 2. his assistant; 3. assistant inspector of machinery; 4. foreman of the factory; 5. foreman of boilermakers; 6. pay-clerk and book-keeper.

Hitherto the men were usually employed by what was called task and job; but they are now wholly put upon day pay. The total number of men employed in the yards may be stated, in round numbers, at 10,000.

Defence of the yards.

In the year 1847 the workmen of the several dock-yards were enrolled into a corps for the defence of the yards, and certain numbers were trained to the use of the great gun exercise; so that each of the dock-yard battalions have some artillery attached to them. This valuable body of men are annually drilled, and, considering the short season during which they are under arms, present a most creditable appearance. Their uniform consists of blue frock-coat and trousers, and a helmet recently substituted for the chaco.

The commissioners of naval inquiry (*Sixth Report*) clearly expose the "combination of self-interest which has been permitted to exist against the public in all the persons who were concerned in the accounts of job-work, and the fictitious manner of making up those accounts." The quarter-men, for instance, were paid wages according to the amount of the earnings of the men under their own superintendence, and the accounts of those earnings were taken by themselves. General Bentham has furnished an instance of the gross abuses which existed under the old system of job-work. "By the regulations of the navy board, nothing less than L.5, 2s. was to be paid for the *smallest* repair of a thirty-four feet launch. If the above sum should be found inadequate to the payments for the work done to a boat of this class, the repair was then to be denominated a *middling* repair; in which case L.11, 1s. was the exact sum. Again, if this sum were insufficient, the repair was to be denominated a *large repair;* and in this case, although the value of the workmanship might have exceeded the sum of L.11, 1s. only by a few shillings, the expense was to have appeared in the account as doubled, and set down at L.22, 2s., and nothing less was to be the exact sum paid for this work." Nothing was more common, in estimating a man's wages, than to find him working three or four tides, and very often three nights, in one day. (Bentham's *Services*, &c.) The whole of this system is now done away; and the consequence is, that as much work is performed, and turned out in a more workman-like manner, and a very large saving effected in pay and materials, by resorting to day-pay, under proper superintendence. The effect of the change of system, and the reductions that were made in the establishments at home and abroad, reduced the expense in the year 1817 from about L.556,000 to L.286,000, making a saving of L.270,000 a-year. (J. B—W.)

DOCKET or DOCQUET (Lat. *documentum*), in *Law*, a small piece of paper or parchment, containing an abridged entry of an instrument or proceeding, for convenience of reference: also, an alphabetical list of cases in a court, &c.

DOCTOR (Lat. from *doceo, I teach*), a person who has passed all the degrees of a faculty, and is empowered to teach or practise the same. Hence the terms doctor in divinity, doctor in physic, doctor of laws.

The establishment of the *doctorate*, as now in use amongst us, is ordinarily attributed to Irnerius, who himself drew up the formulary. The first ceremony of this kind was performed at Bologna, in the person of Bulgarus, who began to profess the Roman law, and on that occasion was solemnly promoted to the *doctorate*, that is, installed *juris utriusque doctor*. But the custom was soon transferred from the faculty of law to that of theology; the first instance of which was given in the university of Paris, where Peter Lombard and Gilbert de la Portrée, the two leading divines of those days, were created doctors in theology, *sacræ theologiæ doctores*.

Spelman conceives the title of doctor not to have been in use till after the publication of Lombard's Sentences, about the year 1140. Others, however, go much higher, holding Bede to have been the first doctor at Cambridge, and John de Beverley at Oxford, where the latter died in 721. But Spelman contends that doctor was not the name of any title or degree in England till the reign of King John, that is, about the year 1207. As to the qualifications or course of study necessary to obtain the degree of doctor in the different faculties of theology, law, and medicine, see UNIVERSITIES.

Doctor of the Law, a title of honour among the Jews. The investiture, if we may so speak, of this order, was performed by putting a key and a table book in their hands; and it was in allusion to this ceremony, some authors imagine, that our Saviour, when speaking of the doctors of the law, says—"Wo unto you, lawyers! for ye have taken away the key of knowledge; ye enter not in yourselves, and them that were entering in ye hindered."

Doctor of the Church, a title given to certain of the fathers whose doctrines and opinions have been the most generally followed and authorized. We usually reckon four doctors of the Greek Church and three of the Latin. The former are, St Athanasius, St Basil, St Gregory Nazianzen, and St Chrysostom; the latter are St Jerome, St Augustin, and Gregory the Great. In the Roman breviary there is a particular office for the doctors, which only differs from that of the confessors by the anthem of the Magnificat and the lessons.

DOCTOR is also an appellation adjoined to a specific epithet, expressing the merit of some eminent schoolman. Thus, Alexander Hales is called the irrefragable doctor; Thomas Aquinas, the angelic doctor; St Bonaventure, the seraphic doctor; John Duns Scotus, the subtile doctor; Raimond Lully, the illuminated doctor; Roger Bacon, the admirable doctor; and so on.

DOCTORS' COMMONS. See COLLEGE OF CIVILIANS.

DOCUMENT, in *Law*, some written muniment produced in proof or support of anything asserted.

DODD, DR WILLIAM, an unfortunate English divine, eldest son of the Rev. William Dodd, many years vicar of Bourne, in Lincolnshire, was born in May 1729. He was sent, at the age of sixteen, to the university of Cambridge, where he was admitted a sizar of Clare Hall in the year 1745. In 1750 he took the degree of B.A. with credit, being upon that occasion in the list of wranglers. On leaving the university, he married a young lady of the name of Perkins in 1751, was ordained a deacon the same year, and priest in 1753, and soon became a popular and celebrated preacher. His first preferment was the lectureship of West-Ham and Bow. In 1754 he was also chosen lecturer of St Olave's, Hart Street; and in 1757 he took the degree of A.M. at Cambridge. He was a strenuous supporter of the Magdalen Hospital, which was founded in 1758, and soon afterwards became preacher at the chapel of that charity. By the patronage of Bishop Squire, he in 1763 obtained a prebend at Brecon; and by the interest of some city friends got himself appointed one of the king's chaplains; soon after which the education of the Earl of Chesterfield was committed to his care. In 1766 he went to Cambridge and took the degree of LL.D.

At this period, the estimation in which he was held by the world was sufficient to give him the expectation of preferment, and hopes of riches and honour; and these he

might probably have realized had he possessed a portion of common prudence and discretion. But, impatient of his situation, and eager for advancement, he unhappily fell upon means which in the end proved the occasion of his ruin. On the living of St George, Hanover Square, becoming vacant, he wrote an anonymous letter to the chancellor's lady, offering three thousand guineas if, by her assistance, he was promoted to the benefice. This letter having been traced to him, a complaint was immediately made to the king, and Dr Dodd was dismissed with disgrace from his office of chaplain. After residing for some time at Geneva and Paris, he returned to England in 1776. He still continued to exercise his clerical functions, but his extravagant mode of life soon involved him in difficulties. To meet the demands of his creditors he forged a bond on his late pupil Lord Chesterfield, for L.4200, which he actually received. But he was detected, committed to prison, tried at the Old Bailey, found guilty, received sentence of death, and, in spite of numerous applications for mercy, executed at Tyburn on the 27th June 1777. Dr Dodd was a voluminous writer, and possessed considerable abilities, with but little judgment and much vanity. An accurate list of his various writings is prefixed to his *Thoughts in Prison*.

DODDRIDGE, Philip, D.D., an eminent Dissenting minister, was the son of an oilman in London, and born there 26th June 1702. At his birth, according to his biographer Orton, "he was thrown aside as dead;" and in his feeble childhood his parents, who were exceedingly pious, took great pains in his instruction. He was left an orphan at the age of thirteen; and after having completed his classical studies at various schools, he was placed by Dr Clarke of St Albans under the tuition of the Rev. John Jennings, who kept an academy at Kibworth, Leicestershire, for the education of Dissenting ministers. Previous to this he had hesitated greatly in regard to his course in life. Some of his friends pressed him to study law; and the Duchess of Bedford, hearing of his inclination for the ministry, offered to defray the expenses of his education and provide him a living in connection with the Church of England. Both of these offers, however, he declined on conscientious grounds. On the removal of his tutor to Hinckley, Doddridge began to preach to the vacant congregation; and on the death of Jennings in 1723, he succeeded to the charge of the academy, which he at first opened at Market-Harborough. Having been soon afterwards chosen minister of a large congregation of Dissenters at Northampton, he removed his academy to that place, where he continued to preside over it for twenty years. Here he was especially known as a preacher for the earnestness with which he sought to elevate the spiritual tone of his communion, and to urge the practical realities of the Christian life. His prelections were attended by students from all quarters of the kingdom, and were remarkable for the facility with which he brought the results of an extensive course of various reading to bear on almost every topic of divinity. He received the degree of D.D. from the university of Aberdeen. In 1751 his health began to break down amid the incessant labours of the pulpit and the academy. On the 30th September he embarked for Lisbon, where he died the 13th October 1751. His remains were interred in the burying-ground belonging to the British factory at Lisbon, and a handsome monument was erected to his memory in the meeting-house at Northampton.

As a writer Dr Doddridge was exceedingly voluminous. The works on which his fame principally rests are his *Rise and Progress of Religion in the Soul*, and his *Family Expositor*. Among his minor works, his *Treatise on Regeneration, Sermons on the Education of Children*, and the *Life of Colonel Gardiner*, are best known. His *Theological Lectures* were published after his death by Dr Kippis; and among his collected hymns are some of the finest now in use among the Dissenters. Biographies of Doddridge have appeared from the pens of Jacob Orton and Dr Kippis. The best delineation of his character will be found in his *Private Life and Correspondence*, collected in five vols. 8vo, by one of his descendants. His works have been collected and edited by Williams in 10 vols. 8vo.

DODECAGON, in *Geometry*, a regular polygon consisting of twelve equal sides and angles.

DODECAHEDRON, in *Geometry*, one of the platonic bodies, or regular solids, contained under twelve equal and regular pentagons.

DODO, an extinct bird, one of the largest, or rather the largest of the feathered race, but so unwieldy and helpless as to be captured without the least difficulty. It is said to have been found in Madagascar when that island was first visited by the Dutch, but is now an extinct species. It is described as having had only four or five short black feathers in the place of wings, a small tuft of curly feathers for a tail, short-unwebbed toes, and a bill of very large size. The foot of a dodo is preserved in the British Museum, and the head exists in the Ashmolean Museum at Oxford. The beak resembles that of the auk, and the foot has a resemblance to that of the penguin, though not palmated.

DODONA, the seat of one of the most celebrated of the ancient oracles, was a Pelasgic town of Epirus in the north of Greece. Though the oracle of this town was the oldest and one of the most sacred of antiquity, ranking indeed with those of Delphi and Ammon, no vestige either of the city of Dodona or of the temple of Jupiter has been discovered in modern times. Even the district of Epirus in which the town was situated has become matter of discussion. By some it is believed to have been in Thesprotia, by others in Molossis. It is not impossible that, as the town was somewhere on the boundary line of these two divisions, it may have been included at one time in Molossis, and at another in Thesprotia. The antiquity of the Dodonean oracle was very great. Its name occurs frequently in the Homeric poems, where it is said that the service of the temple was performed by the "Selli—men with unwashed feet, sleeping on the ground." The actual abode of the deity, however, was not at first a temple, but the stem of a great oak-tree, the wide-spreading branches of which when shaken by the wind were believed to be giving voice to the mystic utterances of the inhabitant within. From this circumstance the oak-grove of Dodona was feigned by some of the ancient poets to be endowed with the power of speech. By others it was said that the responses were delivered by the doves that nestled in the branches. Hence the constant allusions in the classics to the "Chaoniæ aves." In later times it was maintained that the oracular Peleiæ, or Peleiades, were not doves, but priestesses, to whom Jupiter sent a message by the doves to devote their lives to the service of his temple at Dodona.

With the rise of Delphi, the general repute of Dodona began to decline, though its local celebrity remained unimpaired. The final destruction of the oracle is attributed to the Ætolians, who near the end of the third century B.C. ravaged Epirus and levelled the temple of Jupiter with the ground. So complete was the destruction of the place, that not a fragment of house or temple now remains that can with certainty be identified as belonging to the ancient Dodona. Colonel Leake has endeavoured to fix the site of the old oracle at the modern Kastritza, but his arguments are far from being conclusive.

DODONIAN (*Dodonæus*), in *Antiquity*, an epithet given to Jupiter, from his temple in the grove of Dodona. See Dodona.

DODRANS, in *Antiquity*, three-fourths of the *as*, or of anything; and as a measure of length, 9 inches.

DODSLEY, Robert, an eminent bookseller and ingenious writer, born in 1703 at Mansfield, Nottinghamshire, where his father is said to have been a schoolmaster. His first poetical attempts seem to have been made when he was a servant in the family of the Hon. Mrs Lowther; and were published under the title of the *Muse in Livery*. This was followed by an elegant little satirical farce called *The Toyshop*, the hint of which is said to have been taken from Randolph's *Muse's Looking-glass*, and which, having obtained the approbation of Pope, was acted at Covent Garden with great success. The profits accruing from the sale of these two publications enabled him to establish himself as bookseller in Pall-Mall; and his own merit and enterprising spirit soon procured him eminence in that profession. In 1737 a new piece entitled *The King and the Miller of Mansfield* was received with undiminished applause. His immediately subsequent farces, however, were not so popular. In 1738 he published a collection of his dramatic works in one volume 8vo, under the modest title of *Trifles;* which was followed by the *Triumph of Peace*, a masque, occasioned by the treaty of Aix-la-Chapelle, and a fragment on *Public Virtue*. Dodsley was also the author of the *Economy of Human Life*, a work which acquired considerable celebrity; but for this it is supposed he was not a little indebted to the mistaken opinion which long prevailed of its being the production of Lord Chesterfield. The name of Dodsley is from this period associated with much of the literature of his time. Among other things he projected *The Annual Register*, *The Museum*, *The World*, and *The Preceptor*. To these various works Horace Walpole, Akenside, Soame Jenyns, Lord Lyttleton, Lord Chesterfield, and others, were contributors. It would be tedious and uninteresting to enumerate the various other literary enterprises in which he engaged. His own latest production was a tragedy entitled *Cleone*, and was received with even greater enthusiasm than his earlier pieces. His personal character was excellent; he observed the strictest integrity in all his dealings; and lived on easy terms with authors of the highest rank and genius. Dodsley died at Durham while on a visit to a friend, 25th Sept. 1764.

DODWELL, Henry, a learned controversial writer, was born at Dublin in 1641. He was descended from an Irish family who had once been possessed of considerable property in Connaught, but who having lost it at the rebellion had settled at York in 1648. By the death of his parents Dodwell was reduced in early life to the greatest poverty. In 1654 he was sent by his uncle to Trinity College, Dublin, of which he was soon afterwards chosen scholar and fellow. To avoid taking orders he relinquished his fellowship in 1666, and resided for some time at Oxford, Dublin, and London successively. In 1688 he was elected Camden professor of history at Oxford, but was deprived of his professorship in 1691 for refusing to take the oaths of allegiance to William and Mary. Retiring to Shottesbrooke in Berkshire, and living on the produce of a small estate in Ireland, which he had at first generously relinquished in favour of a near relation, he devoted himself to those literary labours in chronology and church politics on which his fame now rests. In the former department he published—*Discourse on the Phenician History of Sanchoniathon; Annales Thucydidei et Xenophontei; Chronologia Græco-Romana pro Hypothesibus Dion. Halicarnassei; Annales Velleiani, Quintiliani, Statiani;* and a larger treatise entitled *De Veteribus Græcorum Romanorumque Cyclis, obiterque de Cyclo Judæorum ac Ætate Christi, Dissertationes.* All of these obtained considerable reputation, and were frequently reprinted. In the latter department his works are more numerous and fragmentary. In his earlier writings he was regarded as one of the greatest champions of the non-jurors; but the absurd doctrine which he afterwards promulgated, that immortality could be enjoyed only by those who had received baptism from the hands of one set of regularly ordained clergy, and was therefore a privilege from which Dissenters were hopelessly excluded, justly deprived him of the confidence even of his friends. Dodwell died at Shottesbrooke, 7th June 1711. His eldest son Henry is known as the author of a pamphlet entitled *Christianity not founded in Argument*, to which a reply was published by his brother William, who was besides engaged in a controversy with Dr Conyers Middleton on the subject of miracles.

DOFRINES, or Dorefeld. See Norway

DOG. See *Canis*, in index to Mammalia.

Dog-*Days*, that period of the year when Sirius (*The* Dog-star) rises and sets with the sun. The dog-days commence in the latter part of July, and terminate the beginning of September. See Canicula.

Dog-*Fish*. See index to Ichthyology.

Dog-*Star*, Sirius, a star of the first magnitude, whose rising and setting with the sun gives name to the Dog-days.

Dog-*Watches*, among seamen, half-watches of two hours each, from 4 to 6 and from 6 to 8 p.m.

DOGE, the title of the chief magistrate in the republics of Venice and Genoa. The word properly signifies *duke*, being formed from the Latin *dux;* as *dogate* and *dogado* are formed from *ducatus*, a duchy.

The dogate, or office and dignity of doge, was elective; the doge at Venice being elected for life, and at Genoa only for two years. He was addressed under the title of Serenity, which among the Venetians was accounted superior to that of Highness.

The doge was chief of the council, and the mouth-piece of the republic; yet the Venetians did not go into mourning at his death, because he was not their sovereign, but only their first minister. In effect, the doge of Venice was merely the phantom or shadow of the majesty of a prince, all the authority being reserved to the republic. He only lent his name to the senate; and the power was diffused throughout the whole body, though the answers were all made in his name. If he gave any answers on his own account, they required to be very cautiously expressed and in general terms, otherwise he was certain to meet with a reprimand.

Anciently the doges were sovereigns; but afterwards things were much altered; and latterly the prerogatives reserved to the quality of doge were, to give audience to ambassadors, but not to make any answer as from himself in matters of importance; to answer according to his own pleasure to the compliments made to the signory, such answers being of no consequence; and, as first magistrate, to preside at all the councils. The credentials with which the senate furnished its ministers in foreign courts were written in his name, but not signed by him; this being usually done by a secretary of state, who also sealed them with the arms of the republic. The ambassadors directed their despatches to the doge; and yet he durst not open them except in presence of the counsellors. The money was struck in the doge's name, but not with his stamp or arms. All the magistrates rose and saluted the doge when he came into council: the doge rose to none except foreign ambassadors. In short, he was a mere pageant of state, and, politically speaking, a nonentity.

The doge nominated to all the benefices in the church of St Mark; he was protector of the Monastery delle Virgine; and bestowed certain petty offices of ushers of the household, called commanders of the palace. His family was not under the jurisdiction of the master of the ceremonies; and his children might have staff officers, and gondoliers in livery.

At the same time his state was tempered with a variety of circumstances which rendered it exceedingly burdensome. He might not go beyond Venice without permis-

sion of the council; and if he did, he was liable to receive affronts, without being entitled to satisfaction; and should any disturbance occur in the place where he happened to be, it belonged not to him but to the podestà, as being invested with the public authority, to suppress it.

The children and brothers of the doge were excluded from all the chief offices of state. They could not receive any benefice from the court of Rome, but were allowed to accept of the cardinalate, as being no benefice, nor including any jurisdiction. The doge could not divest himself of his dignity at will; and after his death his conduct was examined by three inquisitors and five correctors, who sifted it with great severity. The office of doge ceased even to have a nominal existence when Venice, "sunk in its glory, decayed in its worth," yielded, almost without a struggle, to the ascendency of republican France.

DOGGER, a Dutch vessel navigated in the German Ocean, and chiefly employed in the herring fishery. It is equipped with two masts, namely, a mainmast and mizenmast, and somewhat resembles a ketch.

DOGGERBANK, an extensive sandbank in the North Sea, lying between the coasts of England and Holland. Its western extremity extends nearly to Scarborough in Yorkshire, and its eastern to within 20 leagues of the coast of Jutland. It is the seat of important fisheries, and in 1781 was the scene of an obstinate naval engagement between the English and Dutch.

DOGGERS, in the English alum works, a name given to a sort of stone found in the mines with the true alum-rock. They contain some alum, and in some places in such quantity that they are wrought to advantage.

DOGMA (δόγμα), a maxim, tenet, or settled opinion, particularly with regard to matters of faith and philosophy.

DOGMATICAL, pertaining to a dogma, or to a settled opinion. A dogmatist is one who asserts things positively; a magisterial teacher; and hence the philosophy of the dogmatists was opposed to that of the sceptics, who doubted everything.

DOGMATICS, in *Church History*, one of the three orders of theologians before the Reformation. They were so called from basing their systems or dogmas on the authority of Scripture and the judgment of the Fathers. Opposed to them were the *Mystics*, who rejected the Scripture, and framed their opinions according to the dictates of spiritual intuition; and the *Scholastics*, who paid an almost sacred deference to the Aristotelian philosophy. Dogmatics is also used as a contraction for *dogmatic theology*, or the systematic exhibition of the doctrines of revelation.

DOGMATISM, one of the three great schemes into which philosophy is divided in regard to the possibility of truth and the means of its attainment. The first scheme is that of *scepticism* or Pyrrhonism, which denies the possibility of truth altogether, and affirms that we are by the constitution of our being condemned to hopeless and helpless doubt. The second scheme is that of *mysticism*, which, admitting the deceptive nature of human reason, and the unsatisfactory character of all human inquiry, yet postulates the possibility of truth as attainable by a certain inspiration or intuition superior to reason. The third scheme, viz., that of *dogmatism*, asserts full confidence in the results of our intellectual faculties when duly exercised on objects within their grasp, and affirms the possibility of discovering truth by a proper attention to order, method, and the laws of our constitution.

DOGMATISTS, a sect of ancient physicians, of which Hippocrates was the first author. They are also called *logici*, or logicians, from their using the rules of logic in subjects of their profession. They laid down definitions and divisions; reduced diseases to certain genera, and these genera to species, furnishing remedies for them all; supposed principles, drew conclusions, and applied these to the particular diseases under consideration. In this sense the dogmatists were contradistinguished from empirics and methodists. They rejected all medicinal virtues which they thought not reducible to manifest qualities; but Galen long ago observed of them, that they must either deny plain matter of fact, or assign but poor causes and reasons for many effects which they pretended to explain.

DOIG, David, the most learned of Scottish schoolmasters in modern times, was born in 1719. His father, who was a small farmer in the county of Forfar, died when he was yet in his infancy; and his mother contracted a second marriage with a worthy man, who, though by no means in affluent circumstances, and soon burdened with children of his own, treated him with the tenderness of a parent. A constitutional defect in his sight prevented him from learning to read till he was twelve years of age, but his subsequent progress was uncommonly rapid. Having for the space of three years attended a parochial school, where he was instructed in writing, arithmetic, and Latin, he became a successful competitor for a *bursary*, or exhibition, in the university of St Andrews. Here he completed the usual course with great approbation; and having taken the degree of A.B. he enrolled himself as a student of divinity, but his scruples respecting some articles in the Confession of Faith prevented him from entering the church. What those articles were, we have not discovered; but it appears sufficiently evident that his scruples had no reference to the essential doctrines of Christianity. Reconciling himself to the more humble avocations of a parochial schoolmaster, he for a considerable number of years taught the schools of Monifieth in his native county, and of Kennoway and Falkland in the county of Fife. He was afterwards appointed master of the grammar-school of Stirling; and the duties of this office, as a late writer remarks, he discharged for forty years with the greatest ability, and with the respect and esteem of all who knew him.

His accomplishments, not only as a classical scholar, but as a man of general erudition, procured him no mean reputation long before he was known as an author. Of his extensive knowledge of languages, the earliest specimen which he imparted to the public is to be found in about twenty pages of annotations on the Gaberlunzie-man, inserted in an edition published by his learned friend and neighbour Mr Callander.[1] His contribution is introduced in the following terms: "For the following elucidations of the general principles laid down in the preface, and exemplified in the notes on the foregoing ballad, the public and I are indebted to a learned and worthy friend of the author, whose extensive erudition is only equalled by the modesty and candour conspicuous in his whole deportment. I am sure our learned readers will regret with me, that he has not pushed his researches further than he has done. But from the little he has here given us, the general principles of etymology I have endeavoured to establish will derive new force, and our readers new entertainment." Although his learning did not procure him any academical preferment, it at least procured him a due share of academical honours. On the same day he received a diploma of A.M. from St Andrews, and another of LL.D. from Glasgow.

After an interval of ten years, he published "Two Letters on the Savage State, addressed to the late Lord Kaims." Lond. 1792, 8vo. This work which consists of 157 crown pages, is dedicated to Dr Horne, bishop of Norwich, and is introduced by a preface written by the author's friend Dr

[1] Two ancient Scottish Poems, the Gaberlunzie-man, and Christ's Kirk on the Green; with notes and observations, by John Callander, Esq. of Craigforth. Edinb. 1782. 8vo.

Gleig, a learned Episcopalian clergyman of Stirling. The first letter, written in 1775, was sent to Lord Kames, who was passing his Christmas vacation at Blair-Drummond, and who was much struck with the learning and ability of his anonymous correspondent. Having without much difficulty detected the author, he invited him to dine with him next day, when they met and parted with mutual satisfaction, but with no abatement of the confidence of either party in the correctness of his own views as to the primitive condition of the human race. After a very copious and free discussion of the savage state, each of the disputants retained his own opinion; but they nevertheless laid the foundation of a cordial friendship, which continued uninterrupted during the lifetime of the judge, who survived till 1782. It was scarcely to be anticipated that his lordship should abandon the favourite paradox which pervades his *Sketches of the History of Man*; namely that the tribes of mankind were originally placed in the condition of savages, from which they were enabled to emerge by the slow and gradual operation of certain instinctive principles implanted in their nature. This was a paradox which he did not himself devise, but which had already been exhibited in a variety of shapes by Condillac, Rousseau, Hume, Smith, Monboddo, and other speculators. Some of these lovers of wisdom delight in representing the human species as very closely allied to what we venture to describe as the lower animals; and whether the remote ancestors of men were not downright monkeys, or at least ourang-outangs, they feel a very philosophical degree of hesitation in deciding.

Dr Doig was of opinion that "had all mankind, without exception, been once in a state of absolute savagism, they would not only have continued in that state, but would have sunk still lower and lower, till they had at last, in a manner, put off the character of humanity, and degraded themselves to the level of the beasts that perish." All the learning, religion, laws, arts, and sciences, and other improvements that have enlightened Europe, a great part of Asia, and the northern coast of Africa, were so many rays diverging from two points, on the banks of the Euphrates and the Nile. In proportion as nations receded from these two sources of humanity and civilization, in the same proportion were they more and more immersed in ignorance and barbarism. "I think it obvious, beyond all possibility of contradiction," he adds, "that all those nations and societies of men which were removed to a considerable distance from the grand sources of civilization above mentioned, had early degenerated into a state of savagism, that this degeneracy increased exactly in proportion to their distance from those two points; that none of those nations who are known to have sunk into that state ever became civilized till they had renewed their correspondence with nations, or individuals, who had derived light and knowledge from the oriental sources;[1] that previous to the opening of this correspondence, no one people discovered the least propension or tendency towards culture and civilization; that, consequently, had all mankind been, at any one period, absolute savages, they would have continued in that unhappy state as long as the world existed; that if this train of reasoning should happen to be just, there must always have existed, in some part of the globe, a select society, a civilized race of men, among whom the knowledge of arts and sciences was always preserved, and from whom the blessings of civilization, and a cultivated state of life, were, in process of time, propagated to all the other nations, which at this day enjoy these invaluable benefits." This reasoning, supported with much ingenuity and learning, directly leads to the conclusion, which he leaves the reader to draw for himself, that the scriptural account of the primeval history of the human race is much more consonant with the principles of sound philosophy than the account devised by the united wisdom of modern philosophers.

His next publication, which is of a very different description, bears the subsequent title: "Extracts from a Poem on the Prospect from Stirling Castle. I. The Vision. II. Carmore and Orma, a love Tale. III. The Garden. IV. The King's Knot. V. Three Hymns, Morning, Noon, and Evening." Stirling, 1796, 4to. The entire publication extends to 35 pages. As a specimen of his English versification, we transcribe a passage from the Vision, in which he introduces the shade of Wallace addressing King Robert the night before the battle of Bannockburn. The hero mentioned in the first verse is Sir John Graham.

Great was the hero's fall, when squadrons round,
Mow'd by his well-try'd falchion, strew'd the ground;
Thrice blest his envy'd fall, maturely dead,
Fresh laurels blooming round his sacred head!
While I by Faction's tumults rudely tost,
My country thrall'd, my patriot labours lost,
Betray'd, and basely sold, inglorious died,
The sport of perjur'd peers and tyrant pride.
Go, noble Bruce! fulfil thy happier fate,
On thee new glories smile, new triumphs wait:
To-morrow's sun, I see the fulgence rise,
Shall seal thy fame, and waft it to the skies;
To-morrow's sun shall blast yon barbarous host,
And chase the cloud that low'rs o'er Scotia's coast.
Dread not, great sire, their threats or boasted might,
Their skill in council or their fame in fight.
Now patriot blood, by impious Edward shed,
In flaming vengeance bursts o'er Edward's head:
Far round thy camp, array'd in blazing arms,
Thy Scotia's slaughtered heroes sound th' alarms;
On fiery steeds, unseen they watch the fray,
And spread terrific din, and pale dismay;
With dreams of conquer'd foes they fan the fire,
And bid ev'n dastard souls to fame aspire,
With shields of proof thy half-armed bands protect,
Each random lance, each wav'ring shaft direct,
Till, deeply sped, it reach the deadly wound,
And stretch some champion breathless on the ground,
Till heaps of carnage choak th' impurpled flood,
And all these fields are drench'd in hostile blood.
I see Caernarvon pale, aghast with fear,
Fly swift, great Douglas thundering in his rear:
Ill fare the faithless churl who shelter lends,
And homeward safe the trembling tyrant sends.

These are the only works which Dr Doig published in a separate form. For the reputation of authorship he appears to have felt no particular ambition; he was, however, an indefatigable student, and wrote many tracts which were never printed, which he probably had no intention of printing. He wrote an elaborate dissertation *On the Ancient Hellenes*, which appeared in the Transactions of the Royal Society of Edinburgh, vol. iii. He afterwards prosecuted the same subject, and transmitted his manuscript to one of the secretaries of the society; but on the decease of that gentleman, no vestige of it could be found among his papers. His contributions to the third edition of the present work, and particularly the article *Philology*, exhibit the most conspicuous monument of his erudition. In the articles *Mysteries* and *Mythology*, although they bear marks of the same hand, he has not taken so wide a range; but the article *Philology* is a long and elaborate treatise, distinguished by ingenuity as well as learning. "In addition," says Lord Woodhouselee, "to the most profound knowledge of the Greek and Latin languages, which he wrote with a classical purity, Dr Doig had successfully studied the Hebrew, Arabic, and other kin-

[1] Relative to the barbarism and civilization of Greece, the following passage occurs in the work of a very ancient philosopher: Πολλακις γαρ και γεγονε και ἐσται βαρβαρος ἡ Ἑλλας, οὐχ ὑπ' ἀνθρωπων μονον γινομενη μεταναστατος, ἀλλα και ὑπ' αὐτης της φυσεως οὐ μειζονος οὐδε μειονος αὐτης γινομενης, ἀλλα και νεωτερας ἀει, και προς ἡμας ἀρχην λαμβανουσης. (Ocellus Lucanus de Universi Natura, cap. iii. edit. Gale, 1688.)

Doig.

dred dialects, and was deeply versed in Oriental literature." Of this diversified knowledge he has fully availed himself in his treatise on Philology. That portion of the Encyclopædia Britannica which contains it was published in London during the same week with a tract on the Greek verb, written by Dr Vincent, afterwards dean of Westminster,[2] "who was so struck with the coincidence of Dr Doig's opinions on many points with his own, that he began an epistolary correspondence with the author; and these two eminent scholars went hand in hand in their researches, and in a free communication of their opinions, with a liberality of sentiment which did honour to both. Such likewise was the conduct of the learned Mr Bryant, who had entered into a correspondence with Dr Doig on the subject of ancient mythology."[3]

Dr Doig, who was married and left descendants, died 16th March 1800, at the mature age of eighty-one. The following epitaph, written by himself, has been engraved on a marble monument erected to his memory by the town of Stirling, where he was respected for his worth and admired for his learning:—

Edidici quædam, perlegi plura, notavi
  Paucula, cum domino mox peritura suo.
Lubrica Pieriæ tentarem præmia palmæ,
  Credulus, ingenio heu nimis alta meo.
Extincto famam ruituro crescere saxo
  Posse putem, vivo quæ mihi nulla fuit?

Of his Latin versification we subjoin a more considerable specimen, which relates to the erection of a monument to the memory of Buchanan.

En, Buchanane, pii, longo post tempore, cives
  Ingenio statuunt hæc monumenta tuo.
Scotia te natum, te Gallia jactat alumnum,
  Te canit Europe, quæ plaga cunque patet.
Nil opus est saxo, nil indice: læta sonabunt
  Carmine Levinium sæcula cuncta decus.
Seu decoras Latio divina poemata cultu,
  Seu recinis nugas, ludicra, festa, sales;
Grandia seu tragico devolvis verba cothurno,
  Seu reseras varii claustra viasque poli;
Æmula seu captas Patavî præconia linguæ,
  Fœdera dum patriæ, bella virosque refers,
Eloquio, gravitate, sono, vi, lumine, verbis,
  Æquiparas veteres, exsuperasque novos.
Quod Graii potuere simul, quod Romula virtus,
  Tu solus numeris, arte, lepore potes.
Sin aliqua titubas patriæ labefactus amore,
  Aut nimium vera pro pietate pius,
Ipsa notam lecti Libertas plorat alumni,
  Ipsa tegit lauri Calliopea comis.
Sæpe nitor veri spissis latet obrutus umbris,
  Nec semper Lynceus cuncta videnda videt.

Besides Latin and English poems, Dr Doig left an immense variety of works in manuscript. The following list includes his most considerable treatises:—*A Rational Demonstration of the Divinity and Incarnation of Christ*, 36 pp. fol.; *The History of the Passion*, 45 pp. 4to; *On Vicarious Punishments*, 19 pp. fol.; *Strictures on Dr Campbell's Translation of the Sermon on the Mount*, 15 pp. 4to; *An Analysis of the Epistle to the Romans*, 48 pp. fol.; *An Analysis of the Epistle to the Hebrews*, 60 pp. 4to; *A Dissertation on the Place where the Ark rested after the Deluge*, 30 pp. fol.; *An Essay on the Situation of Tarshish and Ophir*, 66 pp. 4to; *A Dissertation on the Origin of Idolatry*, 21 pp. 4to; *An Enquiry into the Origin of Statue-Worship*, 84 pp. fol.; *A Philological Dissertation on Chain and Remphan*, 135 pp. fol.; *A Philological Dissertation on the Gods of the Egyptians*, 344 pp. 4to; *The History of the Titans*, 146 pp. 4to; *On the Doctrine of Demons*, 199 pp. 4to; *Letters on Mr Bryant's Ancient Mythology*, 133 pp. fol.; *An Essay on the Origin of the Greeks*, 406 pp. fol.; *Elucidations of Grecian Antiquities*, 98 pp. 4to; *On the Origin of the Scots*, 33 pp. 4to; *On the Origin of Language*, 59 pp. fol.; *Letters to Lord Kames on Language*, 112 pp. fol.; *Strictures on Dr Smith's Considerations on the Formation of Language*, 33 pp. fol.; *Letters to Dr Vincent on the Formation of Greek Verbs*, 48 pp. fol.; *An Essay on the Utility of the Learned Languages*, 49 pp. 4to, *Figures of Rhetoric poetically described*, 16 pp. 4to.

Doit || Dolci.

DOIT, a small Dutch copper coin, in value half a farthing. It was also the name of the ancient Scottish pennypiece, of which 12 were equivalent to a penny sterling.

DOKKUM, a town of Holland, province of Friesland, 12 miles N.E. of Leeuwarden, and about a league from the North Sea, with which it communicates by means of the ship canal Dokkum-diep. It has salt-refineries, breweries, and building-docks; and some trade in cheese, butter, and cattle. Pop. 3800.

DOLABELLA, Publius Cornelius, one of Cæsar's generals and the son-in-law of Cicero, was born about B.C. 70. At the death of Cæsar he espoused the party of Brutus, but soon after went over to that of the Triumvirs. By them he was intrusted with the province of Syria and the command against the Parthians; and accordingly he proceeded to Asia Minor, where he abused his power for the purpose of extorting money and troops from the inhabitants. For this he was declared an enemy of his country; and Cassius, to whom the proconsulate of Syria had been handed over, declared war against him. After the fall of Laodicea, Dolabella in despair ordered one of his soldiers to kill him, B.C. 43.

DOLCI, Carlo, or Carlino, a painter of considerable celebrity, was born at Florence in 1616. He was a disciple of Jacopo Vignali; and when only eleven years of age he attempted a whole figure of St John, which received extraordinary approbation. He afterwards painted a portrait of his mother, and displayed a new and delicate style, which brought him into notice, and procured him extensive employment at Florence and in other parts of Italy. Dolci appears to have used his pencil chiefly in sacred subjects, and bestowed much labour on his pictures. In his manner of working he was remarkably slow; and it is said of him that his brain was affected by seeing Luca Giordano despatch more business in four or five hours than he could have executed in as many months. His works are consequently not numerous. He generally painted in a small size, although there are a few pictures by him as large as life. He died at Florence in 1686, leaving a daughter (Agnese), who also painted historical pieces, and arrived at some degree of excellence in copying the works of her father.

Carlo Dolci holds the same rank in the Florentine that Sassoferrato does in the Roman school. Without the possession of much genius or invention, both these artists produced pleasing and highly-finished pictures. The works of Dolci are easily distinguishable by the delicacy of the composition, and by an agreeable tint of colour, improved by judicious management of the chiaroscuro, which give his figures a surprising relief. "His pencil," says Pilkington, "was tender, his touch inexpressibly neat, and his colouring transparent; though he has often been censured for the excessive labour bestowed on his pictures, and also for giving his carnations more of the appearance of ivory than the look of flesh." All his best productions are of a devout description, and most frequently represent the patient suffering of Christ, or the sorrows of the Mater Dolorosa. In these the heads are marked with calm intellectual beauty and pathetic emotion, and are peculiarly expressive of pure and tranquil devotion. They are full of sensibility, and yet all unstained by earthly passion. There is, we allow, a want of character and deep shadowing in his pictures, but the colouring and general tone accord with the idea of the passion portrayed; nothing is turgid or bold, harsh, or obtrusive; all is modesty, repose, and placid harmony. The best works of this master are the "St Sebastian;" the "Four Evangelists," at Florence; "Christ Breaking the Bread," in the Marquis of

[1] On this subject Dr Vincent published two different tracts. The Origination of the Greek Verb; an Hypothesis; Lond. 1794, 8vo. The Greek Verb analysed; an Hypothesis, in which the Source and Structure of the Greek Language in general is considered; Lond. 1795, 8vo.

[2] Woodhouselee's Memoirs of Lord Kames, vol. ii., p. 142.

Exeter's collection at Burleigh; and several smaller pictures, which are highly valued, and occupy honourable places in the richest galleries. (A. H.)

DOLE, a town of France, capital of a cognominal arrondissement in the department of Jura; situated on the declivity of a hill, on the right bank of the Doubs, and on the canal between the Rhone and Rhine; 28 miles N. of Lons-le-Saunier. Pop. (1851) 9913. It is the seat of a tribunal of primary instance, and has a Jesuit college, agricultural society, school of design, and a public library of about 6000 volumes. It is pleasantly situated and well built. The principal public buildings are the Hall of Justice; the Church of Nôtre Dame, a Gothic edifice; the Hôtel-Dieu; the new prison; barracks; two hospitals; and the ancient tower of Vergy, now used as a prison. Part of the Roman road leading from Lyons to the Rhine, and remains of a Roman aqueduct and theatre, are to be found here. Among its manufactures are straw hats, hosiery, leather, chemicals, and agricultural implements; and its trade in agricultural produce, wood, iron, marble, &c., is considerable. Dôle is a place of great antiquity, and was at one time the capital of the Franche-Comté and the seat of a parliament and university. In 1479 it was taken by Louis XI., when the greater part of the town was destroyed, and many of its inhabitants were put to the sword. It subsequently came into the hands of the Spaniards, and was fortified by Charles V. in 1530. In 1636 it was ineffectually besieged by the Prince of Condé. In 1668 it was taken by the French; and again in 1674, when its fortifications were destroyed.

DOLE, in the Saxon and British tongue, signified a part or portion; most commonly of a meadow where several persons had shares, and called dole-meadow. It also still signifies a distribution or dealing of alms, or a gift made by a great man to the people.

DOLE, in *Scotch Law* (Lat. *dolus*), is used for malevolent intention. It is an essential ingredient to constitute a crime; and hence the rule, *Crimen dolo contrahitur*.

DOLGELLEY, a market-town of North Wales, Merionethshire; situated on the Wnion, in a wide and fertile valley at the foot of the majestic mountain Cader Idris, 18 miles S.W. of Bala. The town is very irregularly built, and many of the older buildings are mean and unsightly; but these are gradually giving place to modern erections of a superior class. The Wnion is here crossed by a neat stone bridge of seven arches, erected in 1638; and a small stream, the Aran, descending from the Cader Idris, flows through the town. The church is a spacious edifice, standing on an eminence in the centre of the town, but with no pretensions to architectural beauty. It has a large tower, and contains some handsome monuments. The other principal buildings are the county hall, county gaol, old parliament house, and national school. Market-days—Tuesday and Saturday. Its manufactures are chiefly coarse woollen cloths and flannels. Pop. (1851) 2041.

DOLLAR, a village of Scotland, county of Clackmannan, 11 miles N.E. of Stirling; only worthy of notice for its academy, endowed by a Mr M'Nab, a native of the place, who left nearly L.80,000 for that purpose. The academy is an elegant Grecian structure, founded in 1819.

DOLLAR (Ger. *thaler*), the name of a silver coin of Spain and of the United States; worth 100 cents, or about 4s. 2d. sterling. The dollar appears to have been originally a German coin; and in various parts of Germany there are coins of different values so called. See MONEY.

DOLLOND, JOHN, a practical and theoretical optician of the highest celebrity; the discoverer of the laws of the dispersion of light, and inventor of the achromatic telescope; descended from a family of French refugees, was born in London on the 10th June 1706.

His first destination was the manufactory which afforded employment to the greater part of the French colony established in Spittalfields, and he passed some of his earlier years in the mechanical labour of a silk-weaver. He was, however, always attached to the mathematics and to natural philosophy, and he even extended his studies to the outlines of anatomy and of scholastic divinity; and in the pursuit of these objects he found himself obliged to acquire a competent knowledge of the Latin and Greek languages, a task which was much facilitated to him by the possession of a memory no less retentive than his observation was accurate and his reasoning correct. He married early, and he continued in his first occupation till he had established his eldest son, Peter Dollond, who inherited his own tastes as an optical instrument maker; and the success of the undertaking was such as to induce him, in 1752, to leave his own business, and to enter into partnership with his son in Vine Court.

These arrangements having taken place, it was not long before Mr Dollond communicated to the Royal Society some of the results of the application of his inventive powers to his new pursuits; and Mr Short, who then enjoyed the highest reputation as an optician, paid him the compliment of bringing them forward to the Society under the auspices of his name.

1. *A Letter to Mr James Short, F. R. S. concerning an Improvement of Refracting Telescopes. Phil. Trans.* 1753, p. 103. The author here describes a telescope with six glasses, as calculated for correcting, either wholly or in great measure, the errors of refraction arising from the dispersion of the different colours, as well as from the spherical form of the surfaces of the eye-glasses; appealing to the superiority of the telescopes which he had thus constructed, to those which had before been in use; but he reserves a more ample detail of the theory for a future occasion, which, however, does not appear to have presented itself, the improvement having been superseded by others incomparably more important.

2. *A Letter to James Short, A. M. F. R. S. concerning a Mistake in Mr Euler's Theorem for correcting the Aberration in the Object Glasses of Refracting Telescopes;* read 23d November 1752; together with an introductory letter of Mr Short, in which Euler's calculations are somewhat too categorically condemned, and with Euler's answers to Short and Dollond. *Phil. Trans.* 1753, p. 287. It is remarkable with what profound respect the experiments of Newton are treated in Mr Dollond's letter: "It is somewhat strange," he says, "that any body now-a-days should attempt to do that which so long ago has been demonstrated impossible." But although the investigation of truth was perhaps in this instance retarded, yet its ultimate discovery was not prevented by a just deference to a high authority. Euler was, however, certainly right in considering the law which he had assumed as sufficiently compatible with the results of Newton's experiments; although he was much mistaken in his conjectures respecting the achromatic properties of the eye.

3. *A Description of a Contrivance for Measuring Small Angles. Phil. Trans.* 1753, p. 178. This apparatus consists of a divided object-glass, with a scale for determining the distance of the images, by measuring the linear displacement of the two portions of the glass, which subtends the same angle from the focus of parallel rays, as the actual distance of the images does from the object-glass. The apparatus is recommended as particularly calculated to be applied to a reflecting telescope, and was afterwards adapted by Mr Peter Dollond to the improved achromatic telescopes. Mr Savery and Mr Bouguer had before used two separate lenses in a manner nearly similar; but the employment of a single glass divided affords a much more convenient arrangement.

Dollond.

4. *An Explanation of an Instrument for Measuring Small Angles. Phil. Trans.* 1754, p. 551. This paper contains a more detailed theory of the divided object-glass micrometer, and a testimony of its utility from Mr Short, founded on actual experiments.

5. *An Account of some Experiments concerning the Different Refrangibility of Light. Phil. Trans.* 1758, p. 733. We have here the important results of a series of accurate experiments, by which the author had undertaken to investigate the foundations of the Newtonian theory of refraction; though he began them without any hope of a success so brilliant as that which ultimately crowned his labours.

It was in the beginning of 1757 that Mr Dollond made the decisive experiment of putting a common prism of glass into a prismatic vessel of water, and varying the angle of the vessel till the mean refraction of the glass was compensated; when he found that the colours were by no means destroyed, as they were supposed to have been in a similar experiment related by Newton; for the remaining dispersion was nearly as great as that of a prism of glass of half the refracting angle. Mr Dollond then employed a thinner wedge of glass, and found that the image was colourless when the refraction of the water was about one fourth greater than that of the glass. He next attempted to make compound object-glasses by inclosing water between two lenses; but in this arrangement he found great inconvenience from the spherical aberration; so that he was obliged to try the effects of different kinds of glass, and he fortunately discovered that the refractions of flint and crown glass were extremely convenient for his purpose, the image afforded by them being colourless when the angles were to each other nearly as two to three; and hence he inferred that a convex lens of crown glass and a convex one of flint would produce a colourless image when their focal distances were in the same proportion. The spherical aberration, where the curvature was so considerable, still produced some inconvenience; but having four surfaces capable of variation, he was enabled to make the aberrations of the two lenses equal; and since they were in opposite directions, they thus corrected each other. All these arrangements required great accuracy of execution for their complete success; but, in the hands of the inventor, they produced the most admirable instruments, and he was singularly fortunate in obtaining a quantity of glass of more uniform density than had been ever manufactured on so large a scale. He afterwards made some small Galilean telescopes with triple object-glasses, and Mr Peter Dollond applied this construction to the longer telescopes with compound eye-pieces, the alteration rendering the spherical aberration still more manageable.

The merits of Mr Dollond's inventions were promptly acknowledged on the part of the Royal Society by the adjudication of the Copleyan medal for the year. In 1761, he was appointed optician to the king, and was elected a fellow of the Royal Society; a distinction which is often obtained on easy terms by those whose situation in life exempts them from the suspicion of seeking it for any purpose degrading to science, but which is generally an object of considerable ambition to persons of mechanical or commercial occupations.

A considerable share of the credit due to Mr Dollond's discoveries has been very erroneously attributed by some late historians and biographers on the Continent to Leonard Euler, a mathematician who most assuredly has little need of the appropriation of the merits of others to establish his claim to immortality. But in fact the only idea of Euler that could be said to have furnished any hint to Mr Dollond, has been shown by the calculations of Dr Maskelyne, and by the experiments of Dr Thomas Young and Dr Wollaston, to have been completely erroneous; nor did Euler even admit the accuracy of Mr Dollond's conclusions after his discovery was made, without considerable hesitation and scepticism. Mr Klingenstierna had simply expressed a doubt with respect to the result of Newton's experiments, though he by no means suspected the extent of the error. Mr Peter Dollond has sufficiently vindicated his father's claim to complete originality, in a paper read to the Royal Society in the year 1789; he has also suggested an explanation of the origin of Newton's mistake, by stating that there exists a kind of Venetian glass, of which the dispersive power little exceeds that of water, whilst its specific gravity nearly approaches to 2·58, which is assigned by Newton to glass in general; and it certainly seems more probable that some such circumstance as this was the cause of the error, than that Newton should, as some have suspected, have mixed acetate of lead with the water which he used, for an experiment which was so much more likely to be satisfactory without it.

Dolomieu.

Mr Dollond's appearance was somewhat stern, and his language was impressive, but his manners were cheerful and affable. He was in the habit of attending regularly, along with his family, the service of the French Protestant church. He constantly sought his chief amusement in objects connected with the study of those sciences which he had so much contributed to improve. Perhaps, indeed, he pursued them with an application somewhat too intense; for on the 30th of November, as he was reading a new work of Clairaut on the theory of the moon, which had occupied his whole attention for several hours, he had an attack of apoplexy, which shortly became fatal. He left two sons and three daughters. His sons succeeded to his business; and the younger dying a few years afterwards, his place was filled by a nephew, who assumed the family name, and who long conducted the establishment with undiminished respectability and success. (Kelly's *Life of John Dollond, with an Appendix of all the Papers referred to*, 3d edit, 4to, Lond. 1808.) (T. Y.)

DOLOMIEU, Deodatus Guy Silvanus Tancred de Gratet de, a distinguished mineralogist and geologist, son of Francis de Gratet de Dolomieu, and Frances de Berenger, was born on the 24th of June 1750, in the province of Dauphiné.

He was admitted a member of the order of Malta during his earliest infancy, as if he had been devoted from his cradle to glory and to misfortune. At eighteen he embarked in one of the galleys belonging to the order, and soon afterwards unhappily found himself under the necessity of fighting a duel, in which his adversary fell. The laws condemned him to die, but he received a pardon from the grand master; it was, however, necessary that it should be approved by the pope, who for a long time refused to confirm it, notwithstanding the solicitations of several European powers in behalf of the offender, until his consent was at last obtained by the Cardinal Torregiani. Dolomieu, in the mean time, was closely imprisoned in the island for nine months, and this period of solitude seems to have contributed materially to increase the seriousness of his character, and to confirm him in a contemplative turn of mind.

At the age of twenty-two he went to Metz as an officer in the regiment of carabineers, in which he had held a commission for seven years; and he displayed great courage and personal activity on occasion of an accidental conflagration which occurred soon afterwards. His leisure hours were employed in the study of chemistry and natural history, with the assistance of M. Thirion, an apothecary residing in that city. About the same time he also

Dolomieu. became intimate with De la Rochefoucault, with whom he maintained an unshaken friendship ever after.

1. He commenced his literary career with an *Italian translation of Bergman's Work on Volcanic Substances*, to which he added some *Notes*, and some observations on the *classification* of those substances.

2. He also furnished some *Notes* to a translation of Cronstedt's Mineralogy.

3. In 1775 he published *Researches on the Weight of Bodies at different distances from the Earth's Centre;* and upon the recommendation of La Rochefoucault, was made a correspondent of the Academy of Sciences at Paris. This compliment seems to have contributed to his determination to relinquish his prospects of success in the army, and to devote himself exclusively to science. Having resigned his commission, he commenced his geological labours with a tour in Sicily, Italy, and Switzerland.

4. This expedition afforded him the materials for his *Voyage aux Iles de Lipari, fait en* 1781, which he published in 1783, with some other tracts. He describes a singular kind of volcano at Macaluba, in Sicily, formed by air bubbling up from the crater, and causing its contents to overflow. The *Essay on the Climate of Malta* is rendered inconclusive by the imperfection of the eudiometrical apparatus that was then commonly employed.

5. He spent a part of the same year in examining the effects of the earthquake in Calabria, which are described in his *Mémoire sur les tremblemens de Terre de la Calabrie*, 8vo, Rome, 1784. Among other observations, he notices the singular fact, that all those parts of Calabria to which the earthquake extended are of a calcareous nature, without any traces of volcanic substances.

6. He published, in the *Journal de Physique*, vol. xxv. p. 191, a paper *on the extinct volcanoes* of the Val di Noto in Sicily.

7. His *Mémoire sur les Iles Ponces*, 1788, contains also a catalogue of the productions of Mount Etna, and an account of the eruption of 1787.

At the beginning of the revolution Dolomieu embarked, together with his friend La Rochefoucault, in that which appeared to be the cause of liberty. He was in Paris on the 14th of July, but he did not accept of any office under the newly-modified government. La Rochefoucault soon fell a victim to the horrors of the times. Dolomieu was present in his last moments, and received the affectionate messages which he sent to his mother and his wife, who were more distant witnesses of the dreadful scene.

8. No longer hoping for any benefit to his country from the political events of the day, he appears to have resumed his geological studies in other parts of Europe. In a *Letter on the Origin of Basalt*, dated Rome, 1790, *Journ. Phys.* vol. xxxvii. p. 193, he considers some stones of this description, for instance, the black trapps of Saxony, as the productions of water; and others, particularly the varieties found in the south of Europe, as of volcanic origin.

9. He writes, in 1791, a *Letter from Malta*, describing a species of limestone found in the Tyrol, hard enough to become phosphorescent upon collision, and not effervescing with acids until powdered. It was afterwards called the Dolomite. *Journ. Phys.* vol. xxxix. p. 3.

10. In a paper of *Directions for Naturalists*, he gives some useful advice to the circumnavigators about to sail to the South Seas. *Journ. Phys.* vol. xxxix. p. 310.

11. A series of his essays *On Compound Stones and Rocks* appeared from time to time in the *Journal de Physique*, vol. xxxix. p. 374; vol. xl. p. 41, 203, 372. In these he insists on the necessity of supposing that the ocean must have acted with great violence in reducing the continents into their present state; neither the slow subsidence of a general deluge, nor the continued action of ordinary rivers, being sufficient to explain the phenomena; and he remarks, that a violent agitation, such as must necessarily be supposed to have taken place, would naturally cause several alternations in the state of the waters, like immense waves or tides, which must have contributed to the modifications impressed on the earth's form. Indeed, the facts which support this opinion appear to be so obvious and so numerous, that it is difficult to understand how the opposite hypothesis should ever have become popular.

12. In the same volume there is a short paper *On Petroleum found in Rock Crystal*, and on some elastic fluids obtained from it, p. 318.

13. The progress of his memoirs was now interrupted by the proscription, in which many of the best and wisest of his countrymen were indiscriminately involved. "His duty and his inclination," he says, in a *Note* without a date, "required the devotion of his time and his arm to the defence of his king;" and he was obliged to submit to a temporary dereliction of his pursuits of science. P. 481.

14. But the cause was hopeless, and it was impossible for him to render it any essential service. He soon resumed his pen, and took occasion to express, with great spirit and energy, his political feelings, in his *Memoir on the Physical Constitution of Egypt. Journ. Phys.* vol. xlii. p. 41, 108, 194. In Egypt, he observes, there are many calcareous rocks and sands, which cannot have been brought down by the Nile; but there is also much of the soil which has the appearance of having been derived from the mud, with an admixture of sand only. The same cause, he thinks, may possibly have raised the bed of the river, so that the relative height of the inundations may have been little altered. He conceives that the Delta has increased even in modern times, though far less rapidly than it appears to have done formerly; for he is disposed to admit the credibility of the Homeric account of the distance of the Pharos from the continent, although he attempts to explain a part of the supposed change by the filling up of the lake Mareotis only; and, on the whole, he imagines that about a thousand square leagues of the surface of Egypt have been gained from the sea. He has not, however, thought it necessary to discuss the arguments which Bruce and others have brought against the established opinion, and against the facts asserted by Herodotus in its support; although some of the best informed of modern travellers have allowed the accuracy of Bruce's statements relating to this subject.

15. In a short paper *On the Figured Stones of Florence*, M. Dolomieu attributes the appearance of the arborescent and architectural figures which characterize them, to the process of slow decomposition and oxidation, gradually producing the stains in the extremely minute fissures, which favour these changes. *Journ. Phys.* vol. xliii. p. 285.

16. Upon the establishment of the school of Mines, in 1795, he accepted the situations of professor of geology and inspector of mines. He was also made one of the original members of the National Institute of Sciences and Arts, then organized by a law of the existing government. From this time he appears to have redoubled the energy with which he had before laboured in the pursuit of natural knowledge, and he published a great number of memoirs in the course of a very few years. One of the first of these consisted of *Observations on a pretended Coal Mine, called the Désirée. Journal des Mines*, year iii. N. ix. p. 45.

17. His *Methodical Distribution of Volcanic Substances* appeared in the new *Journal de Physique*, vol. (i.) xliii. p. 102, 175, 241, 406; vol. (ii.) xliv. p. 81. Of the five classes which he had before proposed in his notes on Bergman, the first comprehends substances actually pro-

duced by volcanoes; the second, substances thrown out by them unaltered; the third, bodies altered by the volcanic vapours; the fourth, bodies altered in the moist way; and the last, substances illustrative of the history of volcanoes only. The subsequent papers are partly continuations of the *Memoirs on Compound Rocks;* and they also relate particularly to the nature of lavas, some of which are shown to be formed from argillaceo-ferruginous stones. The heat of lavas has been pretty accurately entertained, in some cases, by the fusion of silver coins exposed to it, whilst those of copper remained entire; there is, however, an account of a stream of lava over which some nuns are stated to have walked while it was yet fluid; and this circumstance M. Dolomieu attributes to a mixture of sulphur, which remained melted at a temperature comparatively low. Some objections to this opinion have, however, been advanced by Mr Sage. *Journ. Phys.* vol. xlv. p. 281. *An Explanation of the New Method adopted in the Description of Minerals* was also published in the *Magazin Encyclopédique,* vol. i. p. 35.

18. Among the shorter essays of M. Dolomieu, we find a *Description of the Beryl. Journ. des Mines,* year iv. Ventose, p. 11.—19. *Description of the Mine of Manganese at Romanèche.* Germinal, p. 27.—20. *Letter on the Heat of Lavas.* Messidor, p. 53.—21. *On Quartzose Concretions,* p. 56. —22. *On Ancient Lithology. Mag. Enc.* i. p. 437.—23. *Description of the Emerald,* ii. p. 17, 145.—24. *A Letter from Berlin on the Magnetic Serpentine,* ii. vol. vi. p. 7.—25. *On the Leucite, or White Garnet. Journ. des Mines,* year v. p. 177.—26. *On the Necessity of Chemical Knowledge to a Mineralogist, and on the term Chrysolith,* p. 365.

27. *An Introductory Discourse on the Study of Geology* appears in the *Journal de Physique,* vol. xlv. p. 256. It was preliminary to a course of lectures on the natural position of minerals, and it contains good and detailed directions for the use of students, with some eloquent advice on the benefits of travelling, and on the merits of temperance and simplicity of manners.

28. In the next volume, p. 203, our author announces the *Discovery of the Crystallized Sulphate of Strontia in Sicily.* It had before been found uncrystallized in France.

29. *On Colour as a Characteristic of Stones. Journ. Phys.* vol. (iii.) xlvi. p. 302. This essay contains some objections to Werner's habit of relying too implicitly on colour, and the white tourmaline of St Gothard is adduced as an instance of the triumph of form over complexion; a just tribute of commendation is also paid to the merits of Haüy.

30. A paper *On the Pyroxene, or Volcanic Schörl,* is chiefly designed to support the opinion that such crystals have been formed previously to the existence of the volcano, by the observation of a specimen found adhering to a rock which had never undergone the effect of fire. *Journ. Phys.* vol. xlvi. p. 306.

31. *A Memoir read to the Institute* contains the report of M. Dolomieu's mineralogical tours, made in the years 1797 and 1798. *Journ. Phys.* vol. xlvi. p. 401. *Journ. des Mines,* year vi. p. 385. He visited the south of France, the Alps, and the neighbouring lakes and mountains, almost always on foot, and with his hammer in his hand, accompanied by Brochart, Cordier, Bonniers, and his brother-in-law the Marquis de Drée. From his observations in Auvergne, in particular, he concludes that the foundation or origin of the volcanoes there is certainly below the granite rocks, which therefore cannot, properly speaking, be called primitive; and he proceeds to a much bolder and less admissible conjecture, that the central parts of the globe are at present in a state approaching to fluidity, which he attempts to support by the ready transmission of the shocks of earthquakes to distant places; and he even quotes the authority of Lagrange as having been disposed to encourage the opinion. Volcanoes, in general, he divides into ancient and modern, as separated by the intervention of the changes which have reduced the continents to their present form. With respect to the heat of the lava, he observes, that it has not been sufficient to expel the carbonic acid from the limestone which has been exposed to it. He also remarks, that, where basalt in fusion has been suddenly cooled by water, the contraction has caused it to divide into columns, which are not crystalline, because their angles are irregular, and which are smaller and more uniform in proportion as the water is deeper. He contrasts the horizontal strata of France with the vertical tables of the Alps, and particularly describes the accretion of a mantle of calcareous substances, two miles in height, which has attached itself to the north-east faces of the Alps, subsequently to their first formation as mountains. From this expedition he brought home an immense collection of rocks and stones, principally valuable for their arrangement with a view to the illustration of his particular doctrines in geology, which, with the rest of his cabinet, have since formed a part of the superb museum of M. de Drée.

32. He published, about the same time, a paper *On the Mountains of the Vosges. Journ. des Mines,* year vi. p. 315.

33. *Extract of a Report on the Mines of the department of the Lozère,* p. 577.

34. The only communication of M. Dolomieu printed in the *Memoirs of the Institute,* is rather on a mechanical than a mineralogical subject, containing an *Account of the Art of Making Gun-Flints. M. Math.* vol. iii. p. 348. Nicholson's *Journal,* 8. vol. i. p. 88.

He was engaged, after his return from Switzerland, in some mineralogical contributions to the *Encyclopédie Méthodique,* when he was invited to take a part in the scientific arrangements of the expedition to Egypt. He did not, however, strictly confine himself to this department, but was successfully employed as a negociator for the surrender of Malta. In Egypt he visited the pyramids, and examined some of the mountains which form the limits of the country, but his health soon compelled him to return to Europe. In this voyage the vessel on board of which he had embarked was nearly overwhelmed by a tempest, and appears to have been only saved by the temporary expedient of throwing overboard pounded biscuit mixed with straw, which entered the leaks with the water, and afforded a partial remedy, which was repeated from time to time, until the vessel, at the last extremity, was driven into a port in the Gulf of Tarentum. The counter-revolution of Calabria had occurred but a few days before, and Dolomieu, with his companion Cordier, and many others of his countrymen, were thrown into prison, and they even owed their lives to the great exertions of an individual among the insurgents in their favour. They were afterwards removed to Sicily, but with the loss of their collections and their manuscripts; and Dolomieu being denounced, as a member of the order of Malta, for high treason, was separated from his countrymen, and closely confined in a dungeon. Solicitations were addressed to the king of Naples on his behalf, by the National Institute, by the French government, by the king of Spain, and in the name of the Royal Society of London, although its illustrious president was certainly not "at the time in Sicily," as the *Nouveau Dictionnaire Historique* affirms; but the captive derived essential assistance from the good offices of an English gentleman at Messina, and some Danes accommodated him in his pecuniary arrangements. Whilst still a prisoner, he was appointed successor to Daubenton, at the Museum of Natural History; and the very circumstance of his captivity seemed to give him an advantage

over his competitor. In the treaty made by the French with the king of Naples, after the battle of Marengo, it was expressly stipulated that Dolomieu should be set at liberty.

35. Upon his return to Paris he was made a member of the Conservative Senate, and he delivered soon afterwards a course of lectures on the philosophy of mineralogy. He had written part of an essay on this subject during his imprisonment in Sicily, with a bone for a pen, and a mixture of soot and water instead of ink, on the margins of such books as were allowed him; and his last publication was *Sur la Philosophie Minéralogique, et sur l'espèce Minéralogique*. Paris, 1801. His classification depended on considering the species as determined by the integrant molecule, and on arranging the different external forms as varieties, whether regular as modifications, or irregular as imperfections; besides the variations of colour and appearance, and the more essential affections of the consistence of the substance, which may be called contamination; but the whole essay may be considered as rather of a logical than of a physical nature.

After the delivery of his lectures, he set out upon a new expedition to his favourite mountains, in company with Mr Neergard and Mr d'Eymar, who published an account of the journey. Paris, 1802. He meditated a tour into Germany and to the north of Europe; but his return to Paris was interrupted by indisposition, when he had arrived, by way of Lyons, at Chateauneuf, where he met his sister and his brother-in-law, and this journey was his last.

The merits of Dolomieu consisted as much in his personal character as in his scientific attainments. His conversation was modest, though his courage was heroic; his manners were simple though refined; and though his talents were considerable, they seem to have been surpassed by his industry. It has been remarked, that he often undertook more than he had any reasonable prospect of completing; but, in the mean time, he was perhaps as happy in the pursuit as he would have been in the attainment of his object. He died, universally regretted, at Drée, near Maçon, on the 27th of November 1801, in the midst of his affectionate family, who had been the partakers in his pursuits, and the consolation of his misfortunes.

Lacépède, *Notice Historique sur la Vie et les Ouvrages de Dolomieu; Mém. Math. Inst.* vol. vii. 1806, p. 117; Chalmers's *Biographical Dictionary*, vol. xi. 8vo, London, 1818. (T. Y.)

DOLPHIN. See index to ICHTHYOLOGY.

DOLPHIN, in nautical language, a rope or strap fastened round the mast of a ship to give support to the *puddening* (a mass of yarn or oakum used to prevent chafing), where the lower yards rest on the slings. *Dolphin* is also applied to a spar or buoy furnished with a large ring, and anchored, to which a vessel may bend its cable.

DOM, or DON, a title of honour, invented, and chiefly used, the former by the Portuguese, the latter by the Spaniards. It is an abbreviation of *dominus*, and signifies *sir* or *lord*.

This title, it seems, was first given to Pelayo, in the beginning of the eighth century. In Portugal no person can assume the title of *Dom* without the permission of the king, since it is looked upon as a mark of honour and nobility. In France it is sometimes used among the religious. The old English form of the word is *dan*, so frequently used by Chaucer.

DOM AND SOM, in old charters, signifies full property and jurisdiction.

DOMAT, or DAUMAT, JEAN, a celebrated French jurisconsult, born at Clermont in Auvergne, in 1625. He is principally known from his elaborate legal digest, in four volumes 4to, under the title of *Lois Civiles dans leur Ordre Naturel*; an undertaking for which Louis XIV. settled on him a pension of two thousand livres. Domat was intimate with Pascal, and at the death of that celebrated philosopher was intrusted with his private papers. Besides the *Lois Civiles*, Domat made in Latin a selection of the most common laws in the collections of Justinian. This work, however, did not appear until after his death, when it was published separately under the title of *Legum Delectus*, and was subsequently appended to the *Lois Civiles*. It has been translated into English. Domat died in 1696.

DOME. See index to ARCHITECTURE, and ARCH.

DOME, or DOOM, judgment, sentence, or decree. The homagers' oath in the black book of Hereford ends thus: "So help me God at his holy dome, and by my trowthe."

DOMENICHINO, or DOMENICO, ZAMPIERI, the celebrated painter, was born at Bologna in 1581. He was placed, when young, under the tuition of Denis Calvart; but having been treated with great severity by that master, he left him, and became a pupil in the academy of the Caracci, where he remained for a long time. The genius of Domenichino was slow in its development. He was at first timid and distrustful of his powers; whilst his studious, thoughtful, and reserved manners were misunderstood by his companions for dulness. But the intelligent Annibale Caracci, who observed his faculties with more attention, and knew his abilities better, predicted that the apparent slowness of Domenichino's genius would in time produce what would be an honour to the art of painting. When his early productions had brought him into notice, he studied with incredible application, and made such advances in painting as to raise his works into a comparison with those of the most admired masters. From his acting as a continual censor of his own works, he became amongst his fellow pupils the most accurate and expressive designer; his colours were the truest to nature, and of the best *impasto*, and he proved the most universal master in the theory of his art; in short, the only painter, amongst them all, in whom Mengs found nothing to desire, except a somewhat larger proportion of elegance. That he might devote his whole being to the art, Domenichino shunned all society; or if he occasionally sought it in the public theatres and walks, it was in order better to observe the play of the passions in the features of the people—those of joy, anger, grief, terror, and every affection of the mind, and to commit them vividly to his tablets; and thus, says Belloni, it was that he succeeded in delineating the soul, in colouring life, and calling forth heartfelt emotions, at which all his works aim, as if he waved the same wand which had belonged to the poetical enchanters Tasso and Ariosto.

After several years' severe study at Bologna, Domenichino went to Parma, in order to examine the beautiful works of the Lombards; and thence proceeded to Rome, where he assisted Annibale Caracci, and obtained employment through his recommendation from Cardinals Borghese, Farnese, and Aldobrandi, for all of whom he painted works in fresco, which were justly admired. The distinguished reputation which he had acquired excited the jealousy of some of his contemporaries, who represented his very excellences as defects. Lanfranco in particular, one of his most inveterate enemies, asserted that his communion of St Jerome was an imitation from Agostino Caracci, and procured an engraving of this master's picture of the same subject, copies of which were circulated for the purpose of showing up Domenichino as a plagiarist. But this stratagem only tended to expose the calumnious intents of his rivals, as it was evident that there was no other resemblance in the compositions than what must necessarily be the case in the pictures of two artists treating the same subject; and that every essential part, and all that was admired in the work, were entirely his own. If it had been possible for the exertions of modest merit to have repelled the shafts of

Domesday. slander, the pictures which he painted immediately afterwards, representing subjects from the life of St Cecilia, might have silenced the attacks of envy and malevolence; but they only increased the alarm of his competitors, and redoubled their injustice and malignity. Disgusted with these cabals, Domenichino left Rome for Bologna, where he remained until he was recalled by Pope Gregory XV., who appointed him principal painter and architect to the pontifical palace. But the persecutions of his enemies continued unabated, and are said to have absolutely wearied out his life. He died, not without suspicion of being poisoned, in 1641.

Domenichino, in correctness of design, expression of the passions, and simplicity and variety in the airs of his heads, is allowed to be little inferior to Raffaelle. "We must," says Lanzi, "despair to find paintings exhibiting richer or more varied ornaments, accessaries more beautifully adapted, or more majestic draperies. The figures are finely disposed both in place and action, conducing to the general effect; whilst a light pervades the whole, which seems to rejoice the spirit, growing brighter and brighter in the aspect of the best countenances, whence they first attract the eye and heart of the beholder." The persons delineated could not tell their tale to the ear more plainly than they speak it to the eye. The scourging of St Andrew, which he executed in competition with Guido at Rome, is a powerful illustration of this truthful expression. Of the two works of these masters, Annabale Caracci preferred that of Domenichino. It is said that in painting one of the executioners the artist actually threw himself into a passion, using threatening words and actions, and that Annibale Caracci surprising him at that moment, embraced him, exclaiming with joy, "To-day, my dear Domenichino, thou art teaching me." "So novel," remarks Lanzi, "and at the same time so natural, it appeared to him, that the artist, like the orator, should feel within himself all that he is representing to others." Domenichino is universally esteemed as the most distinguished disciple of the Caracci. Algarotti prefers him to the greatest masters; and Nicolo Poussin considered him as the first painter after Raffaelle. His pictures of the Communion of St Jerome, Adam and Eve, and the Martyrdom of St Agnes, are esteemed amongst his best works. Domenichino was unrivalled in his frescos. He excelled also in landscape painting. In that style the beauty arising from the natural and simple elegance of his scenery, his trees, his well-broken grounds, and, in particular, the character and expression of his figures, gained him as much public admiration as any of his other performances.

The worth of Domenichino, as Agucchi foretold, was never rightly appreciated during his lifetime. But the spirit of party which set in so strongly against him whilst living, soon passed away when he was no more; and impartial posterity has done justice to the talents of this illustrious painter, whose works are in the highest esteem, and fetch enormous prices. (A. H.)

DOMESDAY, or Doomsday Book, a very ancient record containing a survey of all the lands of England, made in the time of William the Conqueror. It consists of two volumes—a greater and a less. The first is a large folio, written on 382 double pages of vellum, in a small but plain character, each page having a double column. Some of the capital letters and principal passages are touched with red ink, and some have strokes of red ink run across them, as if scratched out. This volume contains the description of 31 counties. The other volume is in quarto, written upon 450 double pages of vellum, but in a single column, and in a large but very fair character. It contains the counties of Essex, Norfolk, Suffolk, part of the county of Rutland, included in that of Northampton, and part of Lancashire, in the counties of York and Chester.

This work, according to the red book in the exchequer, was begun by order of William the Conqueror, with the advice of his parliament, in the year 1080, and completed in the year 1086. The reason given for taking this survey, as assigned by several ancient records and historians, was, that every man should be satisfied with his own right, and not usurp with impunity what belonged to another. But besides this, it is stated by others, that all those who possessed landed estates now became vassals to the king, and paid him so much money by way of fee or homage, in proportion to the lands they held; a circumstance which appears very probable, as there was at that time extant a general survey of the whole kingdom, made by order of King Alfred.

For the execution of this survey recorded in Domesday-book, commissioners were sent into every county and shire, and juries summoned in each hundred, out of all orders of freemen, from barons down to the lowest farmers. These commissioners were to be informed by the inhabitants, upon oath, of the name of each manor and that of its owner, also by whom it was held in the time of Edward the Confessor; the number of hides; the quantity of wood, of pasture and of meadow land; how many ploughs were in the demesne, and how many in the tenanted part of it; how many mills and how many fish-ponds or fisheries belonged to it; the value of the whole in the time of King Edward, as well as when granted by King William, and at the time of this survey; and also whether it was capable of improvement or of being advanced in value. They were likewise directed to return the tenants of every degree, the quantity of lands then and formerly held by each of them, what was the number of villeins or slaves, and also the number and kinds of their cattle and live stock. These inquisitions, being first methodized in the county, were afterwards sent up to the king's exchequer.

This survey, at the time when it was made, gave great offence to the people, and occasioned a suspicion that it was intended for some new impost. But notwithstanding all the precaution taken by the Conqueror to have the survey faithfully and impartially executed, it appears that a false return was given in by some of the commissioners, probably, as is alleged, from a pious motive. This was particularly the case with the Abbey of Croyland in Lincolnshire, the possessions of which were greatly underrated, both with regard to quantity and value. Perhaps more of these "pious frauds" were discovered, as it is said that Ralph Flambard, minister to William Rufus, proposed making a fresh and more rigorous inquisition; but this was never carried into operation.

Notwithstanding the proof of its falsehood in some instances, which must throw a suspicion on all others, the authority of Domesday-book was never permitted to be called in question; and when it has been necessary to distinguish whether lands were held in ancient demesne or in any other manner, recourse was always had to Domesday-book, and to it only, in order to determine the doubt. From this definitive authority, from which, as from the sentence pronounced at domesday, or the day of judgment, there could be no appeal, the name of the book is said to have been derived. But Stowe assigns another reason for this appellation, namely, that Domesday-book is a corruption of "*domus Dei* book;" a title given it because heretofore it was deposited in the king's treasury in a place of the church of Westminster or Winchester called *domus Dei*. From the great care formerly taken to preserve this survey, we may learn the estimation in which it was held. In the dialogue de Sacrariis it is said, *Liber ille* (meaning Domesday-book) *sigilli regis comes est individuus in thesauro.* Until latterly it has been kept under three different locks and keys; one in custody of the treasurer, and the others in that of the two chamberlains of the exchequer. It is now deposited in the chapter-house at Westminster, where

it may be consulted, on paying to the proper officers a fee of six-and-eightpence for a search, and fourpence per line for the matter transcribed from it.

Besides the two volumes above mentioned, there is also a third made by order of the same king, and which differs from the others in form rather than in matter. There is likewise a fourth, which is kept in the exchequer, and which, though a very large volume, is only an abridgment of the others. In the remembrancer's office in the exchequer there is kept a fifth book, also called Domesday, which is the same with the fourth book already mentioned. King Alfred had a roll which he called Domesday; and the Domesday-book made by William the Conqueror referred to the time of Edward the Confessor, as that of King Alfred did to the time of Ethelred. As the fourth book of Domesday had many pictures and gilt letters in the beginning, relating to the time of King Edward the Confessor, this led some into an opinion altogether erroneous, namely, that Domesday-book was composed in the reign of King Edward.

DOMESTIC, one who lives in the family of another in some particular capacity, as that of chaplain, secretary, servant, &c.

DOMFRONT, a town of France, capital of a cognominal arrondissement in the department of Orne, on a steep eminence at the foot of which flows the Varenne, 35 miles W.N.W. of Alençon. This was formerly one of the strongest places in Normandy. It was several times taken and retaken by the French and English, and by the Protestants and Catholics. The church of Notre Dame is a fine old building, and contains the tomb of William, Count of Bellesme, the founder of the town. The chief manufactures are coarse linen and hempen cloths. Pop. (1851) 2773.

DOMIFYING, in *Astrology*, the dividing the heavens into twelve houses, in order to erect a theme or horoscope, by means of six great circles, called *circles of position.* There are various ways of domifying. That of Regiomontanus, which is the most common, makes the circles of position pass through the intersections of the meridian and the horizon; but others make them pass through the poles of the zodiac.

DOMINANT, in *Music.* See MUSIC, *passim*, §§ *Harmony*, *Chords.*

DOMINATION, or DOMINION, in *Theology*, the fourth order of angelic beings in the celestial hierarchy.

DOMINGO, ST. See HAYTI.

DOMINIC DE GUZMAN, founder of the Dominican order of monks, was born at Calahorra, the ancient Calagurris, in Old Castile, in 1170. He preached with great zeal against the Albigenses when Pope Innocent III. proclaimed a crusade against that unhappy people; and he was appointed inquisitor in Languedoc, where he founded his order, and had influence enough to get it confirmed by the Lateran council in 1215. He died at Bologna in 1221, in the fifty-first year of his age, and was afterwards canonized. The Dominican order has produced many illustrious men. See DOMINICANS.

DOMINICA, one of the Leeward group of islands in the West Indies, belonging to Britain, and lying between the French islands of Martinique and Guadaloupe, 24 miles N. of the former, and about the same distance S. of the latter. Dominica was so named by Columbus from his having discovered it on a Sunday (in 1493). It was ceded to England by the peace of Paris in 1763, but was taken by the French in 1778. At the peace of 1783 it was restored to England, in whose possession it has since remained. Dominica is 29 miles in length from N. to S., and 16 in breadth, and has an area of about 186,436 acres. The principal town, Roseau, situated on the S.W. side of the island, is in Lat. 15. 19. N., Long. 61. 28. W. The surface is generally rugged and mountainous, interspersed with fertile and well-watered valleys. The highest point is 5314 feet above the level of the sea. The origin of this island is volcanic, and sulphur and other volcanic products are abundant. The soil is light and well adapted for the growth of coffee. The hills are covered with valuable timber trees of the kinds commonly found in the West Indies. Game is abundant, and the fisheries on the coast are very productive. The principal productions are sugar, molasses, rum, coffee, cocoa, and oranges. The cultivation of cotton has lately been introduced to a small extent, and has been found to answer very well, particularly on land near the sea coast. The principal staple products exported in the years ending 5th January 1852 and 5th January 1853 were as follows:—

	1852.	1853.
Sugar	62,168 cwts.	65,788 cwts.
Rum	30,927 galls.	35,794 galls.
Molasses	95,600 „	81,016 „
Coffee	58,063 lbs.	67,594 lbs.
Cocoa	33,884 „	69,296 „
Lime juice	4,280 galls.	5,062 galls.
Arrow root	5,944 lbs.	3,525 lbs.
Oranges	1,019,800	1,354,020
Cotton Wool	2,000 lbs.	3,250 lbs.

The value of exports and imports, and the revenue for the years 1849, 1850, and 1851, were as follows:—

	1849.	1850.	1851.
Imports	L.50,616	L.57,656	L.71,828
Exports	48,070	58,265	62,527
Revenue	8,913	10,275	12,901

The population in 1844 was 22,200, of whom 11,604 were females. There are places of worship for Episcopalians, Methodists, and Roman Catholics. A board of education has recently been established. There are three free schools in Roseau, and seven in other parts of the island, having in all (1852) 1190 pupils. The principal harbours are Roseau and Prince Rupert's Bay.

DOMINICAL LETTER, popularly called *Sunday Letter*, one of the seven letters A B C D E F G, used in almanacks to denote the Sundays throughout the year. (See CALENDAR, vol. vi. pp. 80, 81.) The word is formed from *Dominica* or *Dominicus dies*, the Lord's day. The dominical letters were introduced into the calendar by the primitive Christians instead of the *nundinal* letters in the Roman calendar.

DOMINICAL, in *Ecclesiastical History.* The council of Auxerre, held in 578, decreed that women should communicate with their dominical. Some authors contend that this signified a linen cloth in which they received the species, not being allowed to receive them in the bare hand; while others suppose it was a kind of veil for the head. The most probable account is, that it was a linen cloth in which in times of persecution they received and preserved the eucharist, to be taken upon occasion at home. That this was the case appears by the practice of the first Christians, and by Tertullian's book *Ad Uxorem.*

DOMINICANS, an order of religious persons, called in some places *Jacobins*, and in others *Predicants* or *Preaching Friars.*

The Dominicans took their name from their founder Dominic de Guzman, a Spanish gentleman of Calahorra, in Old Castile. He was first canon and archdeacon of Ossuna; and afterwards, as above stated, preached with great zeal and vehemence against the Albigenses in Languedoc, where he laid the first foundation of his order. It was approved of in 1215 by Innocent III., and confirmed in 1216 by a bull of Honorius III. under the title of St Augustin. Dominic afterwards added several austere precepts and observances, obliging the brethren to take a vow of absolute poverty, to abandon entirely all their revenues and possessions, and to assume the title of *Preaching Friars*, because public instruction was the main object and end of their institution.

Their first convent was founded at Toulouse by the bishop of that place and Simon de Montfort. Two years afterwards another was established at Paris, near the bishop's house; and some time subsequently a third in the Rue St Jacques, whence the denomination of *Jacobins*.

Immediately before his death Dominic sent Gilbert de Fresney, with twelve of the brethren, into England, where, in 1221, they founded their first monastery at Oxford, and soon afterwards another at London. In 1276 the mayor and aldermen of the city of London gave them two whole streets by the river Thames, where they erected a very commodious convent, whence that place is still called Black Friars, from the name by which the Dominicans were called in England.

St Dominic at first only took the habit of the regular canons, that is, a black cassock and rochet; but this he quitted in 1219 for that which the order afterwards wore, and which, it is pretended, was shown by the blessed Virgin herself to the beatified Renaud d'Orleans.

This order gradually diffused itself throughout the whole known world. It had forty-five provinces under the general, who resided at Rome; and twelve particular congregations or reforms, governed by twelve vicars general.

This order has produced three popes, above sixty cardinals, several patriarchs, a hundred and fifty archbishops, and about eight hundred bishops; besides masters of the sacred palace, whose office has been constantly discharged by a religious person of this order ever since the time of St Dominic, who held it under Honorius III. in 1218.

Of all the monastic orders, none enjoyed a higher degree of power and authority than the Dominican friars. Their credit was great, and their influence universal. But the measures which they used in order to maintain and extend their authority were so perfidious and cruel, that towards the beginning of the sixteenth century their influence began to decline. The tragic fate of Jetzer, at Bern, in 1509, which occurred there during an uninteresting dispute between them and the Franciscans relating to the immaculate conception, must ever reflect indelible infamy on this order. An account of it will be found in Burnet's *Travels through France, Italy, Germany, and Switzerland* (p. 31), and also in Mosheim's *Ecclesiastical History* (vol. iii. p. 294, 8vo). They were indeed perpetually employed in stigmatizing with the opprobrious name of heretic numbers of learned and pious men; in encroaching upon the rights and property of others, in order to augment their possessions; and in laying the most iniquitous snares and stratagems for the destruction of their adversaries. They were also the principal counsellors by whose instigation and advice Leo X. determined on the public condemnation of Luther. The papal see never had more active and useful abettors than this order and that of the Jesuits. As Nominalists, Augustinians, and Thomists, the dogmas of the Dominicans were keenly pitted against those of the Franciscans.

DOMINIS, Marc Antonio de, celebrated as a theologian and natural philosopher, was born in the island of Arbe, in 1566. He was educated in the order of the Jesuits, and was raised from the bishopric of Segni to the archbishopric of Spalatro. His endeavours to reform the church soon after made him obnoxious to the papal authorities, and he was compelled to leave his native country. Having become acquainted with Bishop Bedell, whilst chaplain to Sir Henry Wotton, ambassador from James I. at Venice, he communicated to that prelate his books *De Republica Ecclesiastica*, which were afterwards published at London, with Bedell's corrections. He came to England with Bedell, where he was received with great respect, and preached and wrote against the Roman Catholic religion. In 1619 he published at London Father Paul's *History of the Council of Trent*, with a dedication to King James. But on the promotion of Pope Gregory XIV., who had been his schoolfellow and old acquaintance, he was deluded by Gondomar the Spanish ambassador into the hopes of procuring a cardinal's hat, and thus of proving an instrument of great reformation within the church. Accordingly he returned to Rome in 1622, recanted his errors, and was at first well received; but he afterwards wrote letters to England recanting his recantation, and these being intercepted, he was imprisoned by Pope Urban VIII. and died in 1625. He is believed to have been the first to promulgate a true theory of the rainbow.

DOMINIUM Directum, in *Feudal Law*, the right which a superior retains in his lands, notwithstanding the feudal grant to his vassal. The right which the vassal acquires in the lands by such grant is termed *dominium utile*.

DOMINO (Ital.), a long robe of black silk furnished with a hood removable at pleasure, and used as a disguise by persons of both sexes, chiefly at masquerades.

DOMINUS (Lat. *lord*, *master*), a title formerly prefixed to a name, usually to denote that the person was either a knight or a clergyman. The title was sometimes also given to a gentleman not dubbed, especially if he were lord of a manor. In Holland the title *dominus* is still used to distinguish a minister of the Reformed Church.

DOMITIAN, Roman emperor, reigned A.D. 81–96. See Roman History.

DOMREMY LA PUCELLE, a small village of France, department of Vosges, on the left bank of the Meuse, 7 miles north of Neufchateau. It is only remarkable as being the birthplace and original residence of the famous Joan of Arc. The house which she inhabited is still preserved; and opposite to it a handsome monument surmounted by a colossal bust of the heroine was erected in 1820.

DON, a title of honour. See Dom.

Don, a river of Scotland, Aberdeenshire, rising in Ben Aven, near the N.W. boundary of the county, and after a course of 62 miles falling into the German Ocean about a mile and a half north of Aberdeen. Not far from its mouth it is crossed by the "Brig of Balgownie," an old Gothic one-arched bridge celebrated by Lord Byron; and a little farther down is a new bridge of five arches.

Don, a river of England, Yorkshire, rising upon Snailsden-pike near the borders of Cheshire, a few miles W.N.W. of Penistone, and falling into the Aire immediately below Snaith, after a course of about 50 miles. By means of artificial cuttings and canals it has been made navigable for 39 miles.

Don, a large river of Russia. See Russia.

Don Cossacks, land of, a province of Russia in Europe, taking its name from the river Don, by which it is traversed. It extends from N. Lat. 47. to 51., and from E. Long. 37. 20. to 44. 45., and contains about 62,300 square miles. The whole district is a plain, except on the S.E. part, where a low range of hills, a continuation of the Caucasian range, extends into the steppes. The soil is dry (consisting for the most part of a sandy clay), and the pasturage scanty, but near the river it is highly fertile. Besides the Don, it has other streams which mostly empty themselves into that river, but are in summer almost or wholly dry. Agriculture is but little pursued, and the corn raised is barely sufficient for the consumption. The breeding of cattle, especially of horses, is the chief occupation. Even the poorer Cossacks have from 5 to 10 horses, and many of the richer class from 500 to 1000. The fishing on the rivers and lakes is the branch of industry next in importance to the breeding of cattle. The feudal system prevails, the land is held by military tenure, and every man is a soldier. The country is divided into seven circles. Pop. (1846) 704,300. See Cossacks.

DONABUE, in the British province of Pegu recently acquired from the Burmese, a town situate within the delta of the river Irrawaddy. This place merits notice chiefly from its association with historical recollections. In 1825,

during the first Burmese war, it maintained a successful resistance against the assault of a British force under the command of Brigadier Cotton; and here in 1853, during the last war with the same nation, a detachment of British Sepoys, accompanied by a party of seamen and marines, under the command of Captain Granville Lock, R.N., suffered a repulse in an encounter with a Burmese force, and lost several officers, including its distinguished commander. Lat. 17. 10., Long. 95. 27. (E. T.)

DONAGHADEE, a seaport and market town of Ireland, county of Down, on the Irish Channel, 17 miles E.N.E. of Belfast. Pop. (1851) 2821. The town is built in the form of a crescent round the harbour. A new pier has recently been constructed, inclosing a basin of 7 acres in extent, with a depth of 16 feet at low water, and having a lighthouse at its extremity. It is not however a place of much trade. The principal exports are cattle, grain, and potatoes; and the imports coal, culm, and herrings. Many of the female inhabitants of the town are engaged in the embroidery of muslin; and in the neighbourhood are numerous flax mills. A submarine telegraph has been established between this town and Portpatrick in Scotland.

DONALDSON, Walter, a learned Scottish writer of the seventeenth century, was a native of Aberdeen, but the period of his birth has not been specified. His father was Alexander Donaldson, who is denominated an esquire: his mother was Elizabeth the daughter of David Lamb of Dunkenny.[1] In his youth, as he himself informs us, he attended David Cunningham, bishop of Aberdeen, and Sir Peter Young, during their embassy to the king of Denmark and to some of the princes of Germany. He returned to Scotland, but after a short residence he again visited the Continent; and he now prosecuted his studies in the university of Heidelberg, where the civil law was ably taught by the elder Gothofredus. It was perhaps in that university that he took the degree of LL.D.[2] While he resided at Heidelberg, he appears to have taken private pupils; for he mentions that he there read to some students a synopsis of ethics, which a young man named Werner Becker, a native of Riga, published without his consent or knowledge. This work, which was reprinted in Britain as well as in Germany, bears the title of "Synopsis Moralis Philosophiæ, III. libris;" *Ex officina Paltheniorum*, 1604, 8vo. He likewise complains that Keckermann had too unscrupulously availed himself of his labours, and he specifies a curious instance of this plagiarism. Donaldson afterwards settled in France, where he was appointed principal of the College of Sédan, and at the same time discharged the duties of professor of moral and natural philosophy, and of the Greek language; so that his attainments must have been various, and his labours not inconsiderable. In this Protestant seminary he was associated with two of his learned countrymen: Andrew Melville was one of the professors of divinity, and John Smith was one of the professors of philosophy.[3] His next publication, an arrangement in Greek and Latin of passages extracted from Diogenes Laertius, is entitled "Synopsis Locorum Communium, in qua Philosophiæ Ortus, Progressus, &c. ex Diogene Laertio digeruntur." Francof. 1612, 8vo. At Sédan he continued to reside for the space of 16 years, and was then invited to open a college at Charenton, near Paris; but the attempt was immediately resisted, and it seems to have been ultimately frustrated by the jealousy of the Papists. In order to occupy himself during the dependence of the legal process, he prepared for the press another learned work: "Synopsis Oeconomica, authore G. Donaldsono Scoto-Britanno, Abredonensi, J. C. ad celsissimum Carolum, Walliæ Principem." Paris, 1620, 8vo. It was reprinted at Rostock, 1624, 8vo; and another edition speedily followed, Francofurti, 1625, 8vo. Bayle considered this as a book which deserved to be read.[4] With respect to the subsequent history of the author we have not been able to collect any information; but it is not improbable that he resumed his station at Sédan, and there ended his days. Elizabeth Goffin, describing herself as the widow of Donaldson, addressed to Sir John Scott a letter dated at Sédan on the 15th of April 1630.[5] From this letter it appears that he left several children. (D. I.)

DONARIUM, in *Antiquity*, was used to designate the treasure chamber or place in a temple where the votive offerings were kept, and also the offering itself; and, by metonymy, was sometimes used to denote a temple, sanctuary, or altar. The custom of making presents to the gods was common to the Greeks and Romans; and these gifts were not only very various in kind, but frequently of the most costly description, such as gold and silver ornaments, statues, pictures, and, in short, everything that could enhance the magnificence of the terrestrial habitations of the gods.

DONATION (Lat. *donatio*), an act or contract by which a man transfers to another either the property or the use of the whole or a part of his effects as a free gift.

DONATISTS, ancient schismatics in Africa, so denominated from their leader Donatus. This sect arose in A.D. 311, when, in the room of Mensurius, who died in that year on his return to Rome, Cæcilian was elected bishop of Carthage, and consecrated by the African bishops alone, without the concurrence of those of Numidia. The people refused to acknowledge him, and set up in opposition Majorinus, who, accordingly, was ordained by Donatus, bishop of Casæ Nigræ. The Donatists were condemned in a council held at Rome two years after their separation; again, in another held at Arles the year following; and a third time at Milan in 316, before Constantine the Great, who deprived them of their churches, sent their seditious bishops into banishment, and even punished some of them with death. Their cause was espoused by another Donatus, called the Great, the principal bishop of that sect, who, with great numbers of his followers, was exiled by order of Constans. Many of them were punished with great severity. However, after the accession of Julian in 362, they were permitted to return, and restored to their former liberty. Gratian, however, in 377 deprived them of their churches. and prohibited all their assemblies. Yet notwithstanding the severities which they suffered, it appears that towards the close of this century they had a very considerable number of churches; but about the same time they began to decline, on account of a schism among themselves, occa-

[1] Litera Prosapiæ Alexandri Donaldson, Medicinæ Doctoris, dated at Edinburgh 15th November 1642. This is the son of Walter Donaldson. MS. Adv. Lib. W. 6. 26. p. 21. According to this account, one of his ancestors was Elizabeth Hay, daughter of George Earl of Errol.

[2] In the attested pedigree already quoted, we find mention made "Walteri Donaldson, Armigeri, Utriusque Juris Doctoris apud Ruppellam in Gallia;" but as Rochelle was not the seat of a university, we cannot but suspect the accuracy of the statement. A college, including a principal and four regents, was established there in the year 1561; but it did not obtain the privileges of a university, and had no law faculty, and no professor of law. (Expilly, Dictionnaire Géographique, Historique, et Politique des Gaules et de la France, tom. vi., p. 354.)

[3] M'Crie's Life of Melville, vol. ii., p. 420.

[4] Bayle, Dictionnaire Historique et Critique, tom. ii., p. 1013.

[5] Epistolæ doctorum Virorum ad Jo. Scotum, No. 227. MS. Adv. Lib. In the pedigree, she is described as the legitimate daughter "Joannis Goffan de Mostancells prope seden, et Joan. de Hen." For *seden*, we must apparently read *Sedanum*. The entire transcript, which is in the hand-writing of Robert Myln, is far from being accurate. In the preceding line, Donaldson's wife is called Hoffan. Her real name appears to have been Goffin.

sioned by the election of two bishops, in the room of Parmenian, the successor of Donatus. One party elected Primian, and were called *Primianists*, and another Maximian, and were called *Maximianists*. Their decline was also precipitated by the zealous opposition of St Augustin, and by the violent measures which were pursued against them by the Emperor Honorius, at the solicitation of two councils held at Carthage, the one in 404, and the other in 411. Many of them were fined, the bishops were banished, and some were put to death. The sect revived and multiplied under the protection of the Vandals, who invaded Africa in 427, and took possession of this province; but it sunk again under new severities, when their empire was overturned in 534. Nevertheless they remained in a separate body till the close of this century, when Gregory, the Roman pontiff, succeeded in suppressing them, and there are few traces of the Donatists to be found after this period. They were distinguished by other appellations, as *Circumcelliones*, *Montenses or Mountaineers*, *Campites*, *Rupitani*, and so on. They held three councils, or conciliabules, one at Cyrta in Numidia, and two at Carthage.

The primary errors of the Donatists consisted in holding that baptism conferred out of the church, that is, out of their sect, was null (for which reason they re-baptized those who joined their party from other churches, and re-ordained their ministers), and that theirs was the only true, pure, and holy church, all the rest of the churches being regarded as prostitute and fallen. From the Donatist controversies, the doctrine passed into the Catholic Church, that there is no salvation beyond the pale of the church, and that therefore men might be compelled to enter in. (Luke xiv. 23).

Donatus seems likewise to have inclined to the doctrine of the Arians, with whom he was closely allied; and accordingly St Epiphanius, Theodoret, and some others, accused the Donatists of Arianism; nor is it improbable that the charge was well founded, because they were patronized by the Vandals, who maintained that doctrine. But St Augustin affirms that the Donatists, in this point, kept clear of the errors of their leader.

DONATIVE (Lat. *donativum*), a present made by any person; called also *gratuity*.

The Romans made large donations to their soldiers, and hence the soldiers in time became the masters of the Romans. Julia Pia, wife of the Emperor Severus, is called on certain medals *mater castrorum*, because of the care she took of the soldiery, by interposing for the augmentation of their donatives.

The *donativum* or gift to the soldiers was also called *congiarium*, though by post-Augustan writers generally the latter term is used distinctively to signify a largess to the people. Salmasius, in his notes to Lampridius's Life of Heliogabalus, in mentioning a donative which that emperor gave of three pieces of gold per head, observes, that this was the common and legitimate rate of a donative. Casaubon, in his notes on the Life of Pertinax by Capitolinus, observes, that Pertinax made a promise of 3000 denarii to each soldier; also, that the legal donative was 20,000 denarii; that it was not customary to give less, especially to the prætorian soldiers; and that the centurions had double, and the tribunes more in proportion.

DONATIVE, in the canon law, a benefice given and collated to a person by the founder or patron, without either presentation, institution, or induction by the ordinary.

DONATORY, in *Scotch Law*, a donee of the crown; or one to whom property escheated to the crown is, on certain conditions, made over.

DONATUS, ÆLIUS, a celebrated grammarian of the fourth century, the author of a grammar, and also of *Notes on Terence and Virgil.* He taught rhetoric at Rome, where he had as his pupil the famous St Jerome. From the celebrity of his grammar, his name was in the middle ages used as a synonyme for that study.

DONAUESCHINGEN, a town of Baden, circle of the Lake, on the Brigach, 46 miles N.W. of Constance. Pop. 3000. In the court of the palace of the Prince of Fürstenberg is a spring, which some consider to be the source of the Danube. See DANUBE.

DONAUWERTH, or DONAUWORTH, a town of Bavaria, in the circle of Suabia, on the Danube, which is here crossed by a bridge and receives the Wernitz; 25 miles N. of Augsburg. Pop. 2700, principally employed in the raising of flax, hemp, and hops, and in trading by means of the Danube. The town is well built and surrounded by walls. It was formerly a free town of the empire, but since 1607 it has been in the possession of Bavaria. In the vicinity Marlborough gained a signal victory over the Bavarians in 1704.

DONCASTER, a municipal borough and market-town of England, in the west riding of Yorkshire, situated on the right bank of the Don, here crossed by two bridges, 36 miles S. by W. of York. It was the Danum of Antoninus, and was called by the Saxons *Dona Castre*, whence its present name is derived. The town stands on the Watling Street of the Romans; and coins, urns, and other Roman remains are occasionally dug up in the neighbourhood. It received its first charter of incorporation from Richard I. Under the new act it is divided into three wards, and governed by a mayor, six aldermen, and eighteen councillors. Doncaster is one of the cleanest and most agreeable towns in the kingdom. Among the public buildings the principal are the mansion house, a handsome structure, used for meetings of the corporation, concerts, &c., and which cost about L.10,000; Christ Church, erected in 1827–8, for which a sum of L.13,000 was bequeathed by the late J. Jarratt, Esq., a native of this place; the town-hall, gaol, theatre, market-house, &c. The parish church of St George was a spacious and elegant structure surmounted by a fine tower 141 feet high; but it was recently burned down and is at present (1854) in course of being rebuilt. There are a grammar and other schools, a public library, savings-bank, dispensary, union workhouse, Yorkshire institution for the deaf and dumb, and numerous public charities. About a mile S.E. of the town is the race-ground where the celebrated Doncaster races are held annually in the third week of September. They continue for five days. The grand stand is a magnificent and commodious edifice. Doncaster has several iron and brass foundries, and manufactories of sacking and linen. Market-day Saturday. The corn market is one of the largest in the kingdom. Pop. (1851) 12,052.

DONEGAL, a maritime county in the extreme N.W. of Ireland, in the province of Ulster; bounded on the N. and W. by the Atlantic Ocean; on the E. by Londonderry, or more strictly Lough Foyle, the Foyle river, and Tyrone; on the S. by the Bay of Donegal, and the counties of Fermanagh and Leitrim. According to the ordnance survey, it comprises an area of 1865 square miles, or 1,193,443 acres; of which 393,191 are arable, 769,587 uncultivated, 7079 in plantations, 479 in towns, and 23,107 under water.

Donegal, in Irish Dun-na-ngall, or the fortress of the foreigners, probably so named from a fortress erected here by the Danes, was anciently called Tir-conaill, or the country of Conall; and it was sometimes called O'Donnell's country, after the head chieftains of the district. The other chieftains of note were the O'Doghertys, MacSweeneys, O'Boyles, O'Gallaghers, O'Gormleys, O'Breslins, &c. Tyrconnell is connected with some of the earliest events recorded in Irish history or tradition. The chief castle of the O'Donnells, who became princes of Tyrconnell in the twelfth century, was at Donegal, and the place of their inauguration the rock of Doune in Kilmacrenan. The celebrated Red Hugh

O'Donnell, one of the most distinguished chieftains of the race, in conjunction with the Earl of Tyrone, became a formidable opponent to the government of Queen Elizabeth; but being ultimately defeated, he sailed to Spain to solicit fresh succours, was there seized with fever, and died at Valladolid. Rory O'Donnel, who was promoted to the chieftainship by the English government, and created Earl of Tyrconnel, a title now extinct, became afterwards disaffected to the government and fled to Rome, where he died in exile, his estates having been previously confiscated by James I. In 1608, Sir Cahir O'Dogherty, lord of Innishowen, deceived by hopes of aid from Spain, raised an insurrection against the English government in Ulster. He burnt Londonderry and maintained his ground for a short period; but the Lord-deputy Chichester having offered a reward for his head, he retired to the wilds of Kilmacrenan, and was shot by a Scotch settler in his encampment on the rock of Doune. His extensive estates were confiscated and transferred to Chichester, the able governor of Ireland at that time, and ancestor of the earls and marquises of Donegal. Shortly afterwards, the colonization of Ulster with English and Scotch undertakers and settlers, in pursuance of the scheme of James I., was partially carried out, and the baronies of Boylagh and Bannagh were allotted to John Murray; Sir James Cunningham, Sir John Stewart, and other Scotch undertakers, received the district of Portlough; the London Grocers' Company obtained Muff in Innishowen; Sir Roger Bingley, Sir John Kingsmill, and other English settlers the district round Lifford; Sir William Stewart, Sir John Kingsmill, Sir George Macburie, Captain Hart, Sir M. M'Swine, Turlogh Roe O'Boyle, MacSwine Bannagh, MacSwine Fannet, and other servitors and natives the district of Kilmacrenan. Since the period of the settlement of Ulster, no forfeitures have taken place in this county. The landholders remained loyal in the rebellion of 1641, and also during the war of the Revolution.

This district was formed into the county of Donegal in the reign of Queen Elizabeth, A.D. 1585, by the Lord-deputy Sir John Perrott. It is now divided into six baronies, viz., in the N. Innishowen, which is peninsulated by Loughs Foyle and Swilly, and the mountainous Kilmacrenan; in the W. Boylagh; in the E. Raphoe, including the best land in the county; in the S. Bannagh, a mountainous barony and Tyrhugh, containing the towns of Donegal and Ballyshannon. These six baronies are subdivided into fifty-one parishes, comprising the entire diocese of Raphoe, and small portions of the dioceses of Derry and Clogher. The union workhouses are at Ballyshannon, Donegal, Dunfanaghy, Glenties, Innishowen, Letterkenny, Milford, and Stranorlar. Portions of the county are included in the neighbouring unions of Strabane and Londonderry. The net annual value of property rated to the poor is L.267,398; and the amount of property valued under the 6th and 7th William IV., cap 84 (Griffith's Valuation), L.225,049. The county is in the Belfast military district, with barracks for infantry at Lifford and at Ballyshannon, where the staff of the county militia is stationed. The constabulary force, consisting of 275 officers and men, has its headquarters at Letterkenny; the district stations are at Buncrana, Ballyshannon, Carndonagh, Glenties, Dunfanaghy, Killybegs, Raphoe, and Ramelton. This county, as being the chief seat of illicit distillation in Ireland, affords occupation to a considerable portion of the revenue police, namely, to 220 men and officers, at 18 different stations.

The towns are small in extent and importance. Lifford, the county town, "the smallest of county towns," and formerly a parliamentary borough, is practically nothing more than a suburb of Strabane, in the neighbouring county of Tyrone, which derives all the advantages properly belonging to the county town of Donegal; and in the same manner the trade of Londonderry is swelled into greater magnitude by monopolizing that of the county of Donegal, which is deficient in the means requisite for carrying on its own commerce. Ballyshannon (population 3697) is the most populous and important town in the county. It stands on both sides of the noble river Erne, but has not yet derived much advantage from its favourable situation, in consequence of the fall of the river, usually called the Salmon Leap, above the town, and the bar at the mouth of the harbour. Were these impediments to its prosperity removed, as it is supposed they might be, the first by a canal four miles in length, and the other by a change in the position of the harbour, Ballyshannon would become an important commercial town. Letterkenny, with 1947 inhabitants, is next to Ballyshannon the largest town in the county. Rathmelton and Killybegs are inconsiderable seaports: and Donegal, which, instead of Lifford, should have been the county town, is of insignificant extent. It is situated at the foot of a range of magnificent hills in the midst of scenery of great natural beauty, with a mineral spa of the same quality as that of Harrogate, and sea-bathing close to the town. "Were all the advantages of scenery, locality, bathing, and cheapness of living, which this town possesses, connected with any English town, it would not be long before it was a second Brighton, or Bath, or Cheltenham."—*Foster's Letters on the Condition of the People of Ireland.*

This county returned no fewer than twelve members to the Irish parliament; two for the county at large, and two for each of the insignificant boroughs of Ballyshannon, Donegal, Killybegs, Lifford, and Johnstown. Since the union with Great Britain, it has been represented in the imperial parliament by two county members only.

The population of Donegal, according to the different enumerations taken by authority of parliament, has been returned as follows:—

Year.	Population.
1821	248,270
1831	289,149
1841	296,448
1851	255,160

The manners and habits of the people differ according to the local circumstances of the districts they inhabit. The lowland and fertile districts are chiefly peopled by an industrious and comfortable yeomanry, composed of small farmers and artizans, whose modes of life differ little from those in similar circumstances in the adjoining counties. In the mountainous and less cultivated tracts the want of free intercourse, and the consequent tardy spread of manufacturing and agricultural improvement, have occasioned a corresponding backwardness in education and civilization. "If you enter their cabins and converse with them frankly and kindly, you will find the people intelligent and communicative, quick to comprehend, and ready to impart what they know. Small holdings and minute subdivisions of land prevail in Donegal to a greater extent than I have found in any other part of Ireland; and the consequent growth of population has been there so great as to press hard upon the productive powers of the soil, and to depress the condition of the people to nearly the lowest point in the social scale, exposing them, under the not unfrequent contingency of an unfavourable season, or a partial failure of the potato crop, to the most dreadful privations. . . . Yet with all this suffering, no disturbance or act of violence has occurred in Donegal."—*Second Report of Mr Nicholls, Poor-Law Commissioner*, 1837.

The houses, particularly in the mountainous parts, are mean, and very little attention is paid to cleanliness. The pigs and cattle, if any, are not unfrequently housed along with the family. The fuel used by the people is everywhere turf; their food, potatoes and oaten bread, with milk and butter occasionally, and fish if near the sea. The men

are clothed in home-made frieze; the women, chiefly in cheap cottons. The Irish language still maintains its ground in the retired parts, though its use is every year diminishing. Adepts in the language consider the dialect spoken in this county as the purest known.

The state of instruction in the county of Donegal may be deduced from the following statement relating to the population above the age of five years:—

1851.	Rural Districts.	Civic Districts.	Total.	Proportion per cent.	
				Males.	Females.
Could read and write.....	47,415	1640	49,055	29	15
Could read only............	47,168	1121	48,289	19	23
Could neither read nor write......................	129,147	1715	130,862	52	62

This return exhibits a state of education much lower than that of any other county in Ulster. Yet crime, which is sometimes supposed to be in proportion to the ignorance of the population, is by no means frequent in Donegal; for although backward in the knowledge of the useful arts, the people are stained with few of the vices which indicate a demoralized state of society. The most common offences against the laws are connected with the practice of illicit distillation. The nature of the country peculiarly favours the operations of the unlicensed distillers, whose occupation is facilitated by an abundant supply of fuel and numerous inaccessible retreats, where they are able, by setting watches on the hills, to gain sufficient time to sink their tubs in the lake near at hand, knock off the head of the worm, and carry off the wort and whisky to the other side of the lake, before the revenue police could reach the scene of their operations.

In addition to the mountainous district, a considerable portion is high bog and moor land, making the general character of the surface of the county highland, inferior in elevation and grandeur to the Scottish highlands, but partaking of their nature, with a much larger proportion of bog land. The mountains and irregular groups of highlands occupy the whole interior of the county, sloping from Belleck on the border of Fermanagh in the south to Barnesmore hills northwards, turning westwards along the sea-coast by Killibegs to the great promontory of Tellen Head, from thence spreading northwards over the waste expanse of the Rosses round by the northern coast to Lough Swilly, and through Innishowen barony to Malin Head and Greencastle, rising occasionally to a considerable altitude. Arrigal mountain attains an elevation of 2462 feet above the level of the sea, and commands from its summit a fine panoramic view over a considerable portion of the county. Bluestack (2213 feet), Muckish mountain (2190 feet), in Kilmacrenan barony, and Slieve Snaght (2019), in Innishowen, are, next to Arrigal, the highest mountains. The eastern and southern portions of the county are comparatively level, and contain the most fertile land. Occasionally the scenery attains a character of savage and romantic grandeur in the highland districts and on the sea-coast, and of much beauty in the eastern part of the county; but a considerable portion of the surface, disfigured by bogs, entirely destitute of timber, and partaking of sombre sameness, may be described, in the language of the first Lord Bristol, as presenting "nothing curious to engage admiration, and nothing horrid enough to stare at."

The main body of the county rests upon mica slate, which forms the eastern districts and most of the barony of Bannagh. From Sheephaven to Lochrusmore and the north-western coast, granite forms the surface rock, and quartz is very abundant, often forming mountains of considerable elevation. Carboniferous or mountain limestone occurs round Donegal Bay. The geological aspect of the county affords many indications of internal wealth, which are in most cases but conjectural, very few attempts having been made to ascertain more accurately the mineral resources of the district. The minerals hitherto discovered are lead and iron. Mines of the latter of these metals were formerly wrought in the parish of Templecarne, until relinquished in consequence of the failure of timber for fuel. Manganese, copper pyrites, and clay for potteries and brick-making, are also found. Siliceous sand, raised in Muckish Mountain, and rolled down in bags, was formerly conveyed in large quantities to Belfast and Scotland for the manufacture of glass. Indications of coal have been observed near Lough Swilly, and at Inver on the southern coast; and marble of fine quality is found in many places. Among the mountain streams the pearl-mussel (*Unio margaritifera*) is sometimes found.

With the exception of the tidal river Foyle, which forms the boundary between this county and Tyrone and Londonderry, the rivers though numerous are of very inferior size. The branches of the Foyle which rise in Donegal are the Derg, issuing from Lough Derg, and the Swilly; the Finn rising in the beautiful little lake of the same name in the highlands, and passing through some of the best cultivated land in the county. The Foyle, augmented by their contributions, and by those of several other branches from Tyrone and Londonderry, proceeds northwards, discharging its waters into the southern extremity of Lough Foyle, at the city of Londonderry. It is navigable for vessels of large burden to this place, where their farther progress is prevented by a bridge; and thence by lighters of fifty tons as far as Lifford. Boats of fourteen tons can proceed up the Finn river as far as Castlefinn. The fine river Erne flows from Lough Erne through the southern extremity of the county into the southern extremity of Donegal Bay. Its navigation is prevented by a fall of 12 feet, generally called the Salmon Leap, in the neighbourhood of Ballyshannon, and by rapids between Ballyshannon and Belleck, on the confines of Fermanagh. Schemes for opening the navigation to the sea have been formed, but never carried out. The Guibarra, the Awen Ea, and the Eask, are the only other streams of any note.

Lakes, or rather loughlets, are very numerous in Donegal. The most remarkable, and also the largest in the county, is Lough Derg, comprising within its waters several small islets, on one of which, Station Island, is the cave named Saint Patrick's Purgatory, a celebrated place of resort for pilgrims and devotees—the victims of ignorance and superstition. The penances consist of constant prayer, fasting, and vigils. The circumference of the lake is about nine miles, and less than one acre is the extent of the island to which the pilgrims are ferried over. "Stowed like so many brutes in the bottom of the boat from front to stern—the master shoving and pushing them as he would a drove of pigs—no one could contemplate the scene without being forcibly reminded of the paintings of Charon and his cargo of damned." (*Inglis.*) The landscape around Lough Derg is desolate and sombre in the extreme. Barren moors and heathy hills, possessing neither form nor elevation, surround it on all sides, without one green spot, house, or tree, to refresh the eye. The other lakes are worthy of note only as being the sources of most of the rivers of the county.

The county of Donegal possesses a large extent of sea-coast indented by numerous bays and inlets. Ballyshannon harbour, the most southern of them, is small, and has a bar at its mouth, as have Donegal and Inver harbours farther west. Killibegs harbour is well sheltered, and capable of receiving large vessels. On the western coast are Bruckles or M'Swiney's Bay, and Tellen harbour, suitable for small vessels; and on the north is Sheephaven, within which is Dunfanaghy Bay, where the largest ships may lie in safety, as they may also in Mulroy Bay, farther east. Lough Foyle, which divides Donegal from Londonderry, is a noble sheet of water, but shallow and dry at ebb tide, contracted at its

entrance, and encumbered with shoals. A few miles from Malin Head, the most northerly portion of the mainland of Ireland, the varied and extensive Lough Swilly runs far into the interior. From these two loughs much land has of late years been reclaimed.

Numerous islands, islets, and isolated rocks stud the coast of Donegal. The largest is Arranmore or North Arran, about fifteen miles in circumference, with a lofty hill in its centre, and a gradual declivity down to the sea. On another of the Arran group of islands Innismacdurn, a town named Rutland, with stores and curing houses, was built in the last century, and the herring fishery cultivated with spirit; but the fishery having declined, the place is now in a ruinous condition. On the northern coast are Tory Island, on which is one of those singular round towers marking the holy places of ancient times, and Innistrahul the *ultima Thule* of Ireland. The inhabitants of the islands obtain a precarious livelihood by fishing, kelp-burning and rude husbandry, but are often reduced to extreme destitution.

The fishery districts of the county are—Dunfanaghy, Killibegs, and Carne, together comprising 395 miles of maritime boundary, employing about 2000 vessels and 9000 men and boys. In the project for the plantation of Ulster, drawn up in the early part of the reign of James I., twenty-five places in this county are named as being approved stations for the salmon, herring, and ling fishery. The principal salmon fishery at present is at Ballyshannon.

There are several mineral springs in the county, the chief of which is the sulphureo-chalybeate water at Killymard, adjoining the town of Donegal and of considerable local celebrity.

The modes of agriculture present little peculiar to the county, and the spade still supplies the place of the plough where the rocky nature of the surface prevents the application of the latter implement. The soil of the greater portion of the county, *i.e.* the granite, quartz, and mica slate districts, is thin and cold, while that on the carboniferous limestone is warm and friable. The number of holdings exceeding one acre in extent, in 1852 was 31,607; in 1853, 31,139—being a decrease of 468. In 1853 the number of cottier tenements or holdings which do not exceed one acre in extent, have somewhat increased in number over those of the previous year.

The division of land into holdings during the years 1852 and 1853 was as follows:—

	Not exceeding 1 Acre.	From 1 to 5 Acres.	From 5 to 15.	From 15 to 30.	From 30 to 50.	From 50 to 100.	From 100 to 200.	From 200 to 500.	Above 500.
1852......	668	3147	11,273	8872	4086	2914	857	352	106
1853......	697	2942	10,396	8121	4227	2901	864	334	114

The extent of land under crops in 1853 was 236,097 acres, being 792 or 3 per cent. less than in 1852; which year, however, showed an increase of 4·1 per cent. over the year preceding.

The crops on the land were divided in the following manner:—

	Corn, Peas, and Beans.	Potatoes.	Turnips, Mangold-Wurzel, &c.	Cabbage, &c.	Flax.	Meadow.
1852........	122,286	37,331	18,385	1945	21,604	35,338
1853........	118,547	39,221	18,876	1832	25,610	32·011

The total produce of corn, beans, and peas in 1853 was 76,688 tons, or an average of 673 lbs. per head, being 27 lbs. per head below the average of all Ireland: that of potatoes averaged 181 stones per head (41 stones above the general average), or a total produce of 2,307,993 barrels.

Of the 32 counties of Ireland arranged in the order of the condition of their farms as to cultivation, Donegal stands number 30 on the list, and number 28 in the comparison of the state of the road-sides as to the growth of weeds. The live stock in the county, in 1852, on 31,607 holdings, consisted of 23,025 horses, 1946 mules and asses, 149,852 cattle, 88,410 sheep, 17,731 pigs, 2946 goats, and 314,265 poultry, of the total value of L.1,289,750. The estimated value of stock in 1841 was L.882,203.

In proportion to its extent, Donegal contains a larger portion of uncultivated land, and a smaller area occupied by towns or plantations, than any other county in Ireland. On the authority of Mr Griffiths, the general valuation commissioner, and the commissioners of inquiry into the occupation of land in Ireland, it is stated as matter admitting of no doubt, that, notwithstanding the wetness of the soil, and the nature of the subsoil, "vast tracts may be easily reclaimed by the expenditure of a moderate capital, and the introduction of additional labourers. From a careful examination, it would appear that Donegal contains about 760,000 acres of unimproved and uncultivated land, 253,000 of which are situated at elevations which exceed 800 feet above the level of the sea; and, in such a climate, unless in favoured and sheltered spots, cultivation should not be attempted at elevations exceeding 800 feet. It is probable that, within the limits of the county of Donegal, there are about 150,000 acres which might be improved for cultivation, 250,000 acres might be drained and thus rendered available for the rearing of young cattle, and 369,000 acres of mountain land which it is probable would not repay the expense of draining." The reclamation of these 150,000 acres capable of being improved for cultivation would afford both present and future employment for the entire labouring population, increase the means of tenant farmers, and in addition to these advantages create a considerable rental for land now almost worthless. In some instances the process has been successfully carried out in spite of the torpidity and prejudice of the population, who are accustomed to regard as of paramount importance the amount of rent rather than the value or capabilities of the land for improvement. A remarkable and instructive instance of what may be accomplished in the most remote districts, and under great disadvantages, is recorded in Lord George Hill's work, "Facts from Gweedore," describing the circumstances of a large estate, exceeding 23,000 acres, in this county, the condition of its inhabitants, and the means employed to convert a property and community from a state of utter neglect, poverty, and disorganization, into one of order and comfort.

Gweedore is situated in the remote north-western portion of the county, in the midst of wild and magnificent mountain scenery, and when purchased by Lord George Hill, was almost wholly uncultivated, but in part thickly peopled, the population being in the most poverty-stricken condition; "famine was periodical among them, with fever as its attendant, and wretchedness pervaded the district." The land was held in rundale, *i.e.* a tenant had his proportion of a town-land sometimes in thirty or forty different places, each tenant considering himself entitled to a portion of each various quality of land, and the man who had some good land at one extremity was sure to have some bad at the other, and a bit of middling in the centre, and bits of other quality in odd corners, each bounded by his neighbour's holdings. Rents were almost nominal, and they were collected at fairs in small sums as they could be got; often no receipt being given, and no accurate account kept. There were arrears of eight, ten, and even twenty years' standing, and many lived on the estates who were quite unknown. The rents in fact were so small, numerous, and difficult to be obtained, that they were not worth the trouble and expense of collecting. There were no fences between the small patches

of land; and "fights, trespasses, confusion, disputes, assaults, and litigation, were the natural and unavoidable consequences of this system." There was neither inn, road, nor market within a dozen miles, and the only alternative therefore was for the people to distil their grain into whisky. The people had become so far degenerated as to be reconciled to the state of things, and the chief obstacles to improvement were found in their ignorance and prejudices; yet, by skilful management and perseverance, this portion of the county has been raised to a state of comparative independence. Notwithstanding much neglect, there are many other instances of improvement in this county; prominent among which is Sir Charles Style's estate of Cloghan (16,000 acres), in Glenfinn, not many years ago an uncultivated waste, inhabited by *potheen* makers, but now annually covered with rich crops.

In Donegal, as in other counties of Ulster, the linen manufacture affords employment for many of the people, especially in the neighbourhood of the Foyle and about Raphoe, Letterkenny, Stranorlar, and also to some extent near Ballyshannon. There are many corn mills in the county, but the export trade is carried on through the port of Londonderry.

Numerous ruins of ancient castles along the coast prove that much attention was formerly paid to the defence of the country from invasion, or, what was more to be dreaded, piratical depredations. The principal are—Kilbarron Castle, an ancient stronghold of the O'Clerys, near Ballyshannon; Donegal Castle, built by the O'Donells, anciently their chief residence, and now a fine ruin standing close to the water's edge; Burt Castle, built in the reign of Henry VIII. on the shores of Lough Swilly by Sir Cahir O'Dogherty, to whom is also attributed the erection of Green Castle, one of the strongholds of the clan on Lough Foyle. Near the Castle of Doe, or M'Swiney's Castle, at Horn Head, is a natural perforation in the roof of a cave, called M'Swiney's Gun, wrought by the workings of the ocean into the overhanging cliff. When the wind blows due north, and the tide is at half flood, the gun is seen to spout up jets of water to a height of 100 feet, attended with explosions heard occasionally in favourable weather at an immense distance. Culmore Fort, on the coast of Lough Swilly, supposed to have been erected by the O'Doghertys, having come into the possession of the crown, was granted in 1609 to the corporation of London. It was afterwards enlarged or rebuilt, and acted a prominent part in the celebrated siege of Derry. It is, and has been for the last century and a half, unoccupied as a military station, although the governorship of Culmore and Londonderry is still continued as a post of honour and emolument.

Traces of religious houses, some existing only in traditionary or documental records, are also numerous. Ashroe Abbey, on a small stream near Ballyshannon, was of great extent. The ruins of that of Donegal, founded in 1474, also afford proofs of its ancient grandeur. But its memory will be held in veneration by the lovers of antiquity as the place in which was written the celebrated collection of ancient Irish annals, still known by the name of the Annals of the Four Masters, and sometimes called the Annals of Donegal, compiled in the year 1632, by Michael O'Clery and his learned coadjutors, fellow brothers in that house, at the instigation and expense of Fergal O'Gara, lord of Moy O'Gara and Coolavin, in the county of Sligo. The original of this curious and valuable manuscript is now in the library of the Royal Irish Academy. (H. S—R.)

DONERAILE, a market-town of Ireland, county of Cork, on the Awbeg, here crossed by a handsome stone bridge, 6 miles N.N.E. of Malone, and 23 miles N.N.W. of Cork. It is a small but neat town, with a parish church, a spacious Roman Catholic chapel, a nunnery, courthouse, and dispensary. Pop. (1851) 1856. Previous to the Union it sent two members to the Irish parliament. About two miles N. of the town are the ruins of Kilcolman Castle, at one time the residence of the poet Spenser.

DONGOLA, a province of Nubia, extending along the banks of the Nile, from about 18. to 19. 30. N. Lat., but having generally a breadth of only from 1 to 3 miles. It is chiefly famous for its horses, which rival in beauty the finest Arabian breeds, besides being larger, and having more bone. The principal towns are New and Old Dongola.

DONGOLA, *New*, or *Marakah*, stands on the left bank of the Nile, in Lat. 19. 7. 30. N., and Long. 29. 54. 35. E., according to Linant; but according to Rüppell, in Lat. 19. 10. 19. N., Long. 30. 22. 15. E. It has taken its rise within the last forty years; and is now a considerable town, and a resting-place for the caravans from Kordofan and Senaar. The bazaar is well supplied with shoes, printed cottons, calicoes, rice, sugar, coffee, hardware, &c. from Cairo. It has large barracks, and a manufactory for indigo. Pop. about 6000.

DONGOLA, *Old*, lies to the S. of the preceding, on the right bank of the Nile. It was formerly a place of some importance, but is now in ruins, and does not contain more than 300 inhabitants. The sand has accumulated here in such quantities, as in many parts to conceal the houses, while others of them are only accessible by the roof.

DONGURPORE, in Hindustan, a town, the chief place of a petty native state of the same name, situate in the province of Rajpootana. This territory extends from Lat. 23. 35. to 24. 3., and from Long. 73. 40. to 74. 18. It contains an area of 1000 square miles, and its population is estimated at 100,000. Its chief is descended from a branch of the Odeypore family, whose ancestors became dependent on the emperor of Delhi, and so continued until subjugated by the Mahrattas, from whose yoke the country was rescued by the British. The treaty by which the British connection was established with this state was concluded in 1818. The town of Dongurpore is distant north from Bombay 345 miles. Lat. 23. 50. Long. 73. 50. (E. T.)

DONJON, or DUNGEON, the principal tower in ancient castles, underneath which there were vaults in which prisoners were confined. It was likewise called the *Keep*. See CASTLE.

DONNE, DR JOHN, a poet and divine, was born at London in 1573. His parents were of the Roman Catholic faith, and used their utmost efforts to keep him firm in the same persuasion; but an early examination of the controversy between the Church of Rome and the Protestants determined him to adhere to the creed of the latter. After having prosecuted the study of law for some time at Lincoln's Inn, he travelled into Italy and Spain, where he learned the languages of both countries to perfection. Soon after his return to England, Sir Thomas Egerton, keeper of the great seal, appointed him his secretary; and in this post Donne continued five years. Having however married privately Anne, the daughter of Sir George Moore, then chancellor of the garter, and niece to the lord keeper's lady, he was dismissed from his situation at the instigation of his father-in-law, and thrown into prison. But he was afterwards reconciled to Sir George by the good offices of Sir Francis Wooley. In 1612 he accompanied Sir Robert Drury to Paris. During this time many of the nobility solicited the king to give him some secular employment. But James I., who took pleasure in his conversation, and was highly delighted with his *Pseudo-Martyr*, a polemic treatise against Catholicism, printed at London in 1610, prevailed on the author to enter into holy orders, and appointed him one of his chaplains. He also procured him the degree of doctor of divinity from the university of Oxford. In 1619 Dr Donne attended the Earl of Doncaster in his embassy into Germany. In 1621 he was made dean of St Paul's; and the vicarage of St Dunstan in the West soon afterwards fell to him. Besides the work above men-

tioned, he wrote *Devotions upon emergent Occasions; the Ancient History of the Septuagint*, translated from the Greek of Aristeas, 1633, 12mo; *Three volumes of Sermons*, 1640, 1649, 1660, folio; A Treatise against suicide, entitled *Biathanatos;* and Poems.

Donne's writings show him to have been a man of wit and learning; but he chiefly excelled in satire. Lord Falkland, no mean judge, styles him one of the most witty and most eloquent of modern divines. His reputation as a poet was higher in his own time than it has been since. Dryden, with his usual judgment and discrimination, characterizes him as "the greatest wit, though not the best poet, of our own nation;" and adds, that "he affects metaphysics, not only in his satires, but in his amorous verses, where nature only should reign, and perplexes the minds of the fair sex with nice speculations of philosophy, when he should engage their hearts and entertain them with the softness of love." Donne's numbers, if they may be so called, are certainly the most rugged and uncouth of any of our poets; yet he was by no means ignorant nor unskilled in the higher attributes of style, for he wrote elegantly in Latin, and displays considerable taste in some of his smaller pieces and epigrams.

DONNYBROOK. See Dublin, *County of.*

DOOMSDAY Book. See Domesday Book.

DOON, a small river of Ayrshire, Scotland, immortalized by Burns. It rises in Loch Doon, a lake about 6 miles in length and $\frac{3}{4}$ths of a mile in breadth; and after a course of 18 miles falls into the Firth of Clyde, 3 miles S. of Ayr.

DOORNIK, the Flemish name of Tournai. See Tournai.

DOOSHAK, a town of Afghanistan. See Jelalabad.

DOR, the English name of the black beetle, or the hedge-chafer, a species of Scarabæus.

DORADO, a southern constellation of six stars, not visible in our latitude. It is also called *xiphias.*

DORAK, or Felahi, a town of Persia, province of Khuzistan, situated in low and marshy ground, on two branches of the river Jerahi, 75 miles S. of Shuster. It is surrounded by mud walls about 2 miles in circumference, 16 feet thick, and flanked with towers. It contains few houses within the walls, as the majority of the people prefer living in the suburbs, under the shade of date trees. Dorak is celebrated for its manufacture of Arabian cloaks, which are exported in great numbers, but it has little other trade. Pop. about 8000.

DORCHESTER (the *Durnovaria* of the Romans), a parliamentary and municipal borough and market-town of England, capital of the county of Dorset, situated on an eminence on the right bank of the Frome, 8 miles N. of Weymouth, and 120 miles from London by railway. It is governed by a mayor, four aldermen, and twelve councillors, and returns two members to parliament. Pop. of burgh (1851) 6394. Registered electors (1851-52), 432. The town, consisting chiefly of three spacious streets, is neat and pleasantly situated, and is nearly surrounded by a fine avenue. St Peter's church is an ancient edifice in the perpendicular style, containing some curious monuments. The grammar-school has two exhibitions to St John's College, Cambridge, and one to either university. Of the other public buildings the principal are, the town-hall, with market-house, shire-hall, county jail and house of correction, theatre, and county hospital. The cavalry barracks in the vicinity may also be noticed. There are also several almshouses and other charities, and a savings-bank. Market-days, Wednesday and Saturday. Its woollen manufacture was once considerable; but it is now noted principally for its ale. Dorchester is a place of considerable trade, and large sheep and lamb fairs are held here annually. The borough includes four parishes, All-Saints, St Peter's, Holy Trinity, and Fordington. In the vicinity there are some interesting Roman remains, including an amphitheatre, the most perfect of its kind in England. The seats for the spectators are formed of masses of chalk, rising 30 feet above the arena. This amphitheatre when perfect is supposed to have been capable of accommodating 13,000 spectators. Durnovaria was one of the principal stations in England of the Romans, by whom it was surrounded with a wall and fosse; part of the former having been standing as late as 1802. Here Judge Jeffries's "bloody assize" was held in September 1685.

Dorchester (the ancient *Durocina*), a village, formerly a market-town of Oxfordshire, situated at the junction of the Thame with the Thames, 50 miles from London. In 635 it was made the seat of a bishopric, which was removed to Lincoln in 1086. The church is a curious old building in the Norman and later styles; it has a leaden font said to be the most ancient of its kind in England; four brasses, effigies of bishops; and a window of richly painted glass, representing the genealogy of Christ from Jesse. Numerous Roman remains have been found in the vicinity.

DORDOGNE, an inland department in the S.E. of France, taking its name from its principal river the Dordogne, and formed out of the old province of Périgord, with a small portion of Limousin. It is bounded on the N. by Haute Vienne, W. by Charente and Charente-Inférieure, S.W. by Gironde, S. by Lot-et-Garonne, and E. by Lot and Corrèze. It extends from 44. 35. to 45. 42. N. Lat., and from 0. 0. to 1. 28. E. Long., being about 77 miles in length from N. to S., and 69 in breadth from E. to W. In extent it is only exceeded by the departments of Gironde and Landes, its area being 2,261,781 acres, or 3534 square miles. It is divided into five arrondissements, with cantons, communes, and population, as follows:—

	Cantons.	Communes.	Pop. 1851.
Perigueux	9	116	110,748
Bergerac	13	187	118,247
Nontron	8	87	86,697
Riberac	7	93	73,177
Sarlat	10	146	116,920
	47	629	505,789

This department belongs almost wholly to the basin of the Dordogne; and, though it has no mountains properly so called, it is very hilly, the greater part of it being covered by low projections of the Limousin and Auvergne mountains. The highest elevations are in the S.E., but even there they do not exceed 650 feet in height. Dordogne is formed by the union of two mountain streams, the Dor and the Dogne, which rise in Mont d'Or, Puy-de-Dôme, and unite after a short course. It flows westward through the departments of Corrèze, Lot, Dordogne, and Gironde, and after a course of 250 miles (for 180 miles of which it is navigable), joins the Garonne 13 miles N. of Bordeaux. Its principal affluents are the Vézère and the Isle, both of which are in this department. The climate is on the whole agreeable and healthy, but rather humid, the winter and spring being generally rainy. The prevailing winds are from the north and west. A great part of the department consists of arid heaths and wastes incapable of cultivation. Sufficient corn, however, is grown for home consumption. About one-tenth of its entire surface is taken up in the cultivation of the vine. Its red and white wines are in high repute. In the forests the prevailing trees are the oak and the chestnut. The fruit of the latter is much used both as food by the people and for fattening hogs. The walnut is extensively cultivated for making oil. The truffles of this department are considered the best in France. Dordogne is rich in various kinds of minerals, as iron, copper, lead, manganese, coal, marble, alabaster, lithographic stones, gypsum, &c. The chief branches of industry are the working in metals, particularly iron and steel, and the manufacture of paper. Dordogne also produces coarse woollens, serges, leather, earthenware, hosiery, beer, brandy, &c. The language is a patois of French and Provençal.

DORIA, Andrea, the famous Genoese admiral, was born at Oneglia in 1466. He entered into the service of Francis I. of France, and commanded his fleet in the Mediterranean, but preserved that spirit of independence which is so natural to a sailor and a republican. When the French, however, attempted to render Savona, long the object of jealousy to Genoa, its rival in trade, Doria remonstrated in a high tone against the measure; and this bold action, represented by the malice of the courtiers in the most odious light, irritated Francis to such a degree that he ordered his admiral Barbésieux to sail for Genoa, then in the hands of the French troops, to arrest Doria, and to seize his galleys. But Doria got a timely hint of this rash order; retired with all his galleys to a place of safety; and, whilst his resentment was warm, closed with the offers of the emperor Charles V., returned his commission with the collar of St Michael to Francis, and hoisted the imperial colours. To deliver his country, now weary alike of the French and the imperial yoke, from the dominion of foreigners, was Doria's highest ambition; and the favourable moment had presented itself. Genoa was afflicted with the pestilence, the French garrison was ill paid and greatly reduced, and the inhabitants were sufficiently disposed to second his views. He sailed to the harbour with thirteen galleys, landed five hundred men, and made himself master of the gates and the palace with very little resistance. The French governor with his feeble garrison retired to the citadel, but was soon forced to capitulate; upon which the people speedily levelled the citadel with the ground. It was now in Doria's power to have rendered himself the sovereign of his country; but, with a magnanimity of which there are few examples, he assembled the people in the court before the palace, disclaimed all pre-eminence, and recommended to them to settle what form of government they chose to establish. The people, animated by his spirit, forgot their factions, and fixed that form of government which, with little variation, subsisted until 1815. Doria afterwards engaged in an expedition against the Turks, from whom he took Coron and Patras. He also co-operated with Charles V. in the reduction of Tunis and Goulette. In 1547 two successive attempts were made against his life by Fieschi and a Genoese emigrant of the name of Giulio Cibo. He resigned his command in 1556, and died at Genoa in November 1560, being then ninety-four years of age. He is still celebrated in Genoa by the most honourable of all appellations, the Father of his Country, and the Restorer of its Liberty.

DORIAN or Doric *Mode*, in *Music*, one of the most ancient Greek modes or scales. It was equivalent to *d, e, f, g, a, b, c, d*, in which the two semitones occur between the second and third, and the sixth and seventh notes.

DORIANS, a people of Greece, who derived their origin from those districts in which the Grecian nation bordered towards the north upon numerous and dissimilar races of barbarians. According to Herodotus, they were from early times one of the chief races of that nation, which, in fact, was composed of Dorians and Ionians; the one of Hellenic and the other of Pelasgic origin, the former a migratory and the latter an aboriginal race. In this definition it is assumed that the Pelasgi were Greeks and spoke the Grecian language in its elder form; an opinion in support of which many arguments might easily be adduced. But all the races whose migrations took place at a comparatively late period, such as the Achæans, Ionians, and Dorians, particularly the last, were not sufficiently numerous or powerful to effect a complete change in the customs of a barbarous population: many districts, as Arcadia and Perrhæbia, remained entirely Pelasgic, without being inhabited by any nation not of Grecian origin: the most ancient names either of Grecian places, or those mentioned in the traditions of the Grecian race, belonged indeed to a different era of the dialect, but not to a different language: and, lastly, the great similarity between the Latin and the Greek can only be explained by supposing the Pelasgic language to have formed the connecting link. The Dorians are mentioned in ancient legends and poems as having been established in one extremity of the great mountain chain of Upper Greece, namely, at the foot of Mount Olympus; but there are, nevertheless, many reasons for supposing that, at a period still earlier than that to which these monuments refer, they dwelt at its other extremity, reaching to the farthest limit of the Grecian nation. Indeed the Doric Hylleans had a tradition that they came originally from those northern districts which bordered on the Illyrians, and were afterwards occupied by that people; a tradition, we may observe, which many facts and circumstances unite to confirm, or at least to render highly probable. Be this as it may, however, the earliest ascertained seat of the Dorians was the district of Mount Olympus. But, either from a restless and wandering disposition, or impelled by the pressure of some northern hordes, they seem to have migrated from this district into Crete, that is, from one end of the Grecian world to the other; thus presenting a striking anomaly in the history of the ancient colonies. The earliest trace of this circumstance is found in the Odyssey, where it is mentioned that the "thrice divided" (τριχαΐκες) Dorians formed part of the population of Crete. Though originally inhabiting a mountainous region, they appear, in course of time, to have become, as it were, the Normans of Greece, and to have sought settlements wherever they could find them. But the most important, and the most fertile in consequences, of all the migrations of the Grecian races, and that which continued even to the latest period to exert its influence upon the Greek character, was the expedition of the Dorians into the Peloponnesus. This circumstance is mentioned by Herodotus, who states that, under Deucalion, they dwelt in Phthiotis, and in the time of Dorus, the son of Hellen, inhabited the country at the foot of Ossa and Olympus, called Hestiæotis; that, afterwards, being driven from Hestiæotis by the Cadmeans, they dwelt under Mount Pindus, and were called the Macedonian nation; that thence they again migrated to Dryopis, and from Dryopis passed into the Peloponnesus, where they were called the Doric race. The traditionary name of the expedition in question is "the Return of the descendants of Hercules," who are admitted to have been of Doric origin; and, in process of time, successive conquests were effected by them in the Peloponnesus, until the whole of that country was at length subdued and occupied by the Dorians. Argos was captured by this people; Sicyon was conquered from Argos, Phlius from Sicyon, and Cleonæ from Argos. The Dorians expelled the Ionians from Epidaurus, and afterwards reduced Ægina and Trœzen; they appear also to have made themselves masters of Corinth and Megara; and, under Aristodemus, they conquered Laconia, which soon afterwards rose into great importance among the states of Greece. In due time, Doric colonies from Argos, Epidaurus, and Trœzen established themselves on the south-west coast of Asia Minor; and other colonies of the same race also settled in different parts of the same country, where, at a very early period, we find them forming a league against the Ionians, whom they had either encroached upon or expelled. In fact, there is nothing so remarkable in the history of this remarkable race as its extraordinary propagation and diffusion. In course of time it spread itself on all sides, from Greece to Asia Minor, Byzantium, Syracuse, and the country which sweeps round the Gulf of Tarentum, including the territory afterwards known by the name of Magna Græcia, with Crotona, Locri, and Lyctus, to say nothing of Chalcis, Solium, Ambracia, Anactorium, Leucadia, Corcyra, Epidamnus, Apollonia, Potidæa, Chalcedon, Trogilus, Thapsos, Selinus, and other places, which it conquered or colo-

Dorians.

nized. It is remarkable that, wherever any portion of Doric invaders or settlers proceeded, they not only carried along with them, but gave a permanent ascendency to the peculiarities and characteristics of their race. Their religion, their laws, their literature, their manners, and in short all that distinguished them as a separate people, appear to have taken root wherever they pitched their tents; and it is by the vestiges which still remain of their migrations, settlements, and power, that we are enabled to trace with some degree of certainty events which either took place before the commencement of authentic history, or in regard to which history, tradition, and even fable, are alike silent. The limits of this article, however, preclude our entering into details, which in fact would require volumes for their full development and illustration. We shall therefore confine ourselves to some general remarks on the character of the Dorians, deduced from the masterly analytical investigations of Karl. O. Müller in his *History and Antiquities of the Doric Race;* a work not more distinguished for its almost boundless erudition, than for the critical sagacity and philosophic spirit which is displayed in it throughout.

And the first peculiarity in the Doric character which we shall notice, is the tendency which it exhibited to produce uniformity and unity. Every individual was destined to remain within those limits which were prescribed by the will of the whole; every one was bound to obey in his own place. All the smaller associations were regulated on the same principle; there was a gradation of power, but never independent equality. The Dorians also had little inclination to admit the customs of others, and strong desire to disconnect themselves from foreigners; their instinct seems to have been to adhere scrupulously to their own national habits, and to preserve that distinct individuality of national character which appears to have given them so decided an ascendency over all the races amongst which they intermingled or settled. They loved independence, and knew well how to maintain and defend it. A calm and steady courage was the natural quality of the Dorians; and though they sometimes yielded to the impetuosity of excitable and enthusiastic enemies, their fortitude and pertinacity commonly secured them the victory, and almost always prevented defeat from degenerating into disaster. As they were not ready to receive, neither were they prone to communicate, outward impressions; and hence, both in their poetry and prose, the narrative is often concealed by expressions of the feeling, and tinged as it were with the hue and colour of the mind. They endeavoured always to condense and concentrate their thoughts, which was the cause of the great brevity and obscurity of their language; and as their attention was turned to the past rather than the future, they cherished an ardent attachment to the usages and manners of their forefathers, as embodied and preserved in their actual institutions. Hence the Dorians preserved most rigidly, and represented most truly, the customs of the ancient Greeks. They were not a stationary, far less a retrograding people; but the advances which they made were slow, and all their changes imperceptible.

With the desire to attain uniformity, for which the Dorians were distinguished, there was also combined in their character another remarkable peculiarity, namely, a love for measure and proportion. Their works of art are conspicuously marked by this attention to singleness of effect; and everything discordant or useless was pruned off with an unsparing hand. Their moral system also prescribed the observance of the proper medium in all things; and it was in this that the temperance which so distinguished them consisted; it was the synonyme, not of abstinence, but of moderation. One great object of the worship of Apollo, which the Dorians introduced into Greece, was to maintain undisturbed the balance of the mind, and to remove everything calculated to disquiet the thoughts, inflame the passions, or overcloud the serenity of the soul. The nature of this singular race seems to have required an equal and regular harmony; and for this reason dissonances, even if combined into harmony, were by no means suited to their taste. The national song was doubtless not remarkable for soft or pleasing melody; and the general accent of the language had the tone and character of command, without any of that delicacy or flexibility which are required in Elysian airs or Lydian measures. But the Dorians were contented with themselves, and with the powers to which they owed their existence and their happiness; in almost every sense, they were a self-centred race, living in themselves and for themselves; they looked not to future, but to present existence, and they loved their own laws, religion, institutions, manners, customs, literature, and arts, too much to envy those of other nations, or even desire to imitate them. Man was the chief and almost only object which attracted their attention. This feeling may be detected in their religion, which was always unconnected with the worship of any natural object, and originated solely from their own reflections and conceptions; and to the same source may perhaps be traced their aversion to mechanical and agricultural labour, a feeling which belongs and is indeed natural to minds of a contemplative turn. In a word, the whole Doric race bears the stamp and character of the male sex among nations; the desire of assistance and connection, of novelty and curiosity, the characteristics of the weaker sex, being directly opposed to the nature of the Dorians, which, from first to last, was marked by severe simplicity, inflexible independence, subdued strength, and unquenchable nationality. (See Müller's *History and Antiquities of the Doric Race*, English translation, Oxford, 1830, 2 vols. 8vo.) (J. B—E.)

Doric.

DORIC, pertaining to Doris, or to the Dorians.

Doric, in *Architecture*, the second of the five orders. See Architecture.

Doric *Dialect*, one of the five dialects, or forms of speech, which prevailed among the Greeks. It was first used by the Lacedæmonians, and particularly by those of Argos; and thence it passed into Epirus, Libya, Sicily, and the islands of Rhodes and Crete. Pindar used the Doric dialect in his poems, as did also Archimedes and Theocritus, who were both Syracusans.

In strictness, however, we should rather define Doric the manner of speaking peculiar to the Dorians, and which afterwards came to prevail among the Lacedæmonians and other states. Some even distinguish between the Lacedæmonian and Doric; but in reality, setting aside a few peculiarities in the language of the Lacedæmonians, these dialects were the same; as indeed is shown by Rulandus in his treatise *De Lingua Græca ejusquè Dialectis.*

Besides the authors already mentioned as having written in the Doric dialect, we might add Archytas of Tarentum, Bion, Callinus, Simonides, Bacchylides, Cypselas, Alcmæon, and Sophron.

Most of the medals of the cities of Græcia Magna and Sicily savour of the Doric dialect in their inscription: thus, ΑΜΒΡΑΚΙΩΤΑΝ, ΑΠΟΛΛΩΝΙΑΤΑΝ, ΑΧΕΟΡΟΝΤΑΝ, ΑΧΥΡΙΤΑΝ, ΗΡΑΧΛΕΩΤΑΝ, ΤΡΑΧΙΝΙΩΝ, ΘΕΡΜΙΤΑΝ, ΚΑΥΛΟΝΙΑΤΑΝ, ΚΟΠΙΑΤΑΝ, ΤΑΥΡΟΜΕΝΙΤΑΝ. These names indicate the countries in which the Doric dialect was used.

The general rules of this dialect are laid down by the grammarians of the Port-Royal; but they are much better explained in the fourth book of Rulandus, where he even notes the minuter differences of the dialects of Sicily, Crete, Tarentum, Rhodes, Lacedæmon, Laconia, Macedonia, and Thessaly. The omega abounds everywhere in the Doric; but this dialect bears so close a conformity to the Æolic, that many reckon them but one. (See Müller's *History and Antiquities of the Doric Race*, vol. ii., Appendix.)

Doric *Mode*, in *Music*. See Dorian Mode.

DORING, or Daring, among sportsmen, a method of taking larks, by means of a clapnet and a looking-glass. For this purpose there must be provided several pieces of looking-glass, which are to be so fixed in a frame as to reflect their light upwards; and this apparatus is supported on a moveable pin, with the end of a long line fixed to it, and so arranged that by pulling one end of the cord the apparatus is made to rotate. Several larks, termed *calls*, are provided; and these, with the glittering of the looking-glasses as they twirl round in the sun, invite the other larks down. The card which communicates with the net is then to be drawn, in order to bring the net over the birds so attracted to the spot. The places best adapted for daring larks are open fields remote from any trees and hedges, except one for the concealment of the fowler.

DORIS, the smallest state of ancient Greece, was bounded north by Thessaly and Locris, east by Phocis, south by the Locri Ozolæ, and west by Ætolia. The country itself, which is very limited in extent, is surrounded on every side by spurs of the mountain ranges of Œta and Parnassus, and intersected by the river Pindus (now the *Apostolia*), a tributary of the Cephissus. The cities of the Doric tetrapolis, which were all situated in the vale of this river, were Boium, Cytinium, Erineus, and Pindus.

The original name of Doris is said to have been Dryopis—so named from its inhabitants the Dryopes, who were expelled from the country when the Dorians took possession of it. In addition to the small territory to which they gave name, these Dorian adventurers are said to have occupied a great tract of the adjoining country: a supposition all the more probable as it is nearly incredible that Doris Proper should have maintained a population capable of subduing the Peloponnese. An account of this expedition will be found under the head Dorians. The most powerful state which owed its origin to this expedition was Sparta, which in after times acknowledged her Doric descent by assisting Doris when hard pressed by her more powerful neighbours. Besides Laconia, however, all the other states of the Peloponnese, except Elis and Arcadia, and a few detached spots of small importance, were equally proud of tracing their origin to the Dorian invaders. From the Peloponnese the Dorians spread in all directions. Corinth. Corcyra, Syracuse, Gela, Agrigentum, Selinus, and Tarentum were all colonized by them; and all retained, with certain modifications, the constitution of the parent state. These colonies all subsequently attained so great importance as completely to eclipse the parent state, which in the historical times of Greece is seldom mentioned. In the second Persian invasion it submitted to Xerxes and his hosts, and its towns were therefore spared. In the wars which subsequently harassed Greece it suffered so severely, that it was matter of wonder that any of its cities maintained their very existence.

DORKING, a market-town in the county of Surrey, 21 miles S.S.W. of London. It occupies the side of a sandstone hill, in a picturesque valley, and is a neat and clean town, with wide and well-paved streets. The parish church, recently rebuilt, is a spacious structure, surmounted by a spire. The surrounding country is well wooded and remarkable for its beauty, having numerous fine seats, including Deepdene, the residence of the late Mr Hope, author of Anastasius, and the Rookery, where Malthus was born. A considerable trade is carried on in lime and chalk from adjacent pits. Market-day Thursday. Dorking is famous for its breed of fowls, which have five claws on each foot. Pop. (1851) 3490.

DORMANT, in *Heraldry*, denotes the posture of a lion, or other beast, lying in a sleeping attitude, with the head on the fore paws; by which it is distinguished from the *couchant*, where the beast, though lying, has its head elevated.

DORMER Window, in *Architecture*, a window standing vertically on the sloping roof of a house.

DORMITORY, a gallery in convents divided into several cells, in which the inmates sleep; and hence also applied to the sleeping apartments in other great establishments.

DORMOUSE. See *Myoxis* in index to Mammalia.

DORNBIRN, a market-town of the circle of Bregentz, and Austrian province of Tyrol. It stands on the river Fussach, and is a flourishing place, owing to its manufactories of muslins and cotton cambrics, and its mills for spinning flax. Pop. 4600.

DORNOCH, a parliamentary borough of Scotland, and capital of the county of Sutherland, is situated on the N.E. of the Firth of the same name, 14 miles N. of Cromarty. It unites with Dingwall, &c., in sending a member to parliament. Pop. (1851) 599. Dornoch was formerly the principal seat of the Bishop of Sutherland and Caithness, and was made a royal burgh by Charles I. in 1628. The cathedral, now the parish church, was built about the middle of the thirteenth century, and has recently been restored by the late Duchess of Sutherland. The palace or castle was a large building of most massive structure, of which only the picturesque western tower now remains. On its site a handsome new prison and court-house have recently been erected.

Dornoch *Firth*, an arm of the sea on the E. coast of Scotland, serving as the boundary between the counties of Ross and Sutherland. It is about 15 miles broad at its mouth, and here has more the character of a bay than of a firth. It gradually becomes narrower, till, about three miles west from the town of Dornoch, its breadth decreases to two miles. Above this point it becomes much broader, forming an inner harbour or bay.

DORPAT, or Derpt, a town of Russia, in the government of Livonia, and capital of a circle of the same name, on the Embach, here crossed by a handsome stone bridge of three arches; and also on the road between Riga and St Petersburg, 140 miles N.E. of the former, and 170 S.W. of the latter. Pop. (1851) 12,683. This town is neat, clean, and well-built, the streets are wide and regular, and the houses generally of one story, built of brick, or wood painted in showy colours. It consists of the town proper, and the suburbs of Riga and St Petersburg. The old fortifications have been converted into gardens and public walks. The cathedral is now in ruins, having, with the entire town, been destroyed by a great fire in 1775. Dorpat is the seat of a university originally founded by Gustavus Adolphus in 1632, when Livonia belonged to the Swedish crown. After undergoing numerous vicissitudes during the wars between Russia and Sweden, and having been removed to Pernau, it was re-established here in 1802 by the Emperor Alexander. It has faculties of theology, law, medicine, and philosophy; a library of upwards of 60,000 volumes; a noble observatory, botanical garden, and extensive collections in mineralogy, zoology, anatomy, pathology, &c. In 1852 it was attended by 607 students. Dorpat has also a veterinary school with 37 pupils, a gymnasium, normal school, &c. Lat. 58. 22. 44. N.; Long. 26. 42. 19. E.

DOROGOBUSH, a town of Russia, capital of a cognominal circle in the government of Smolensk, and 46 miles E.N.E. of the town of that name. It is situated on the left bank of the Dnieper, is surrounded by walls, and had 5677 inhabitants in 1850. On 12th October 1812 the French were defeated here by the Russians.

DORSETSHIRE, an English county, situated on the south-western coast. In British times, and previous to the landing of Cæsar, it was inhabited by the Durotriges and Morini, two appellations derived from the British language, and signifying dwellers on the coasts of the ocean. Under the Romans this county constituted a portion of *Britannia Prima;* and the Saxons called it Dorsetta (a word having

the same meaning as the above British appellation), and included it in the kingdom of Wessex. Kingston Hall and Corfe Castle are mentioned as royal residences.

On the north Dorsetshire is bounded by Somersetshire and Wiltshire, on the east by Hampshire, on the west by Devonshire and a part of Somersetshire, while the British Channel bounds it on the south. Its form is very irregular: the northern boundary has a considerable angular projection in the middle; the southern coast runs out in various points and headlands; and the western coast inclines towards Devonshire, with an irregular line. Its greatest length from north to south is about 35 miles, and its breadth from east to west 55. Its circumference, including about 632,025 acres, is nearly 160 miles. In 1851 the population was found to be 184,207; being an increase of 61 per cent. in fifty years. The number of inhabitants to a square mile was 186; to a house 5·1. The total number of houses was 37,940; 36,138 being inhabited, 1587 uninhabited, and 215 in the course of erection.

Dorsetshire is divided into thirty-four hundreds, containing more than 390 parishes, nine boroughs, twenty-two liberties, and nineteen market-towns, the principal of which are Dorchester, Bridport, Sherborne, Lyme-Regis, Shaftesbury, Wareham, Weymouth, Melcombe-Regis, Poole, and Blandford. Only thirteen members are returned to parliament, instead of twenty as formerly. The county itself sends three; Dorchester, Bridport, and Poole, two each; Melcombe-Regis and Weymouth two between them; and Lyme-Regis, Shaftesbury, and Wareham, one each. Dorsetshire forms part of the see of Bristol. Its bishop was established at Sherborne by Henry VIII., but was shortly added to the diocese of Bristol. In remote times it had been a part of the sees of Oxford, of Salisbury, and of Winchester successively.

The surface of Dorsetshire is hilly and uneven. A great portion of the county has the appearance of downs, open and uninclosed pasture land covered with sheep, the stock of which averages from 600,000 to 700,000. More sheep are pastured in the neighbourhood of Dorchester than in any other district, though great numbers of both sheep and oxen are fed in the valley of Blackmore, which is celebrated as rich pasture land, and comprises upwards of 170,000 acres. There are also in this district several orchards, producing excellent cider. On the south-western side there are many vales of great luxuriance; but on the south-eastern there is much waste land, dreary and barren, hardly supporting, even in the summer months, a few sheep and cattle, and supplying the neighbouring villages with heath for fuel. Even in this region, however, cultivation is advancing, and detached portions are improved. The turnpike-roads in this county are numerous, rendering travelling easy and agreeable.

The downs are principally of a light chalky soil, with a turf remarkably fine, producing hay, in the inclosed parts, of an excellent quality, on which beasts will thrive well in winter without any other food. About Bridport the lower lands are mostly a deep rich loam; but on the hills, throughout the western district, the soil is a sandy loam, intermixed with flint, well adapted for the growth of beech. To the north of Sherborne, where is some of the best land in the county for the plough, it is a stone *brack*, which is the case in the Isle of Portland and the Isle of Purbeck. In the centre of the county the soil is good and the land well managed. About a third of the soil is chalk, a fifth clay, a sixth sand, a ninth waste, and the remainder gravel, loam, &c.

Dorsetshire is not a well-wooded county; and, in general, native timber is scarce and dear. In some local spots, where the land is cold and wet, such as Duncliff in the vale of Blackmore, Heycombe Wood in the vale of Sherborne, and others of a similar nature, some plantations may be seen.

The air of Dorsetshire is remarkably mild and salubrious; which, added to the beauty of its scenery, has obtained for it the appellation of the Garden of England. Weymouth has long been celebrated as a fashionable watering-place; and, owing to the general calmness of the sea there, its pleasant situation, and its commodiousness for bathing, it has risen to great consequence.

The chief port in the county is Poole, situated on an estuary formed by the mouth of the Frome. Its entrance is defended by Brownsea Castle, and it is very secure in all winds. It is the chief place for equipping ships for the Newfoundland fishery; and considerable trade is carried on from it with Spain, Portugal, and the Mediterranean. Swanage, Weymouth, Bridport, and Lyme, have harbours capable of admitting small vessels only.

The rivers of Dorsetshire are the Frome, the Stour, the Piddle, and the Ivel. The Frome rises in the north-western part of the county, near Evershot; and, passing by Dorchester, reaches Poole, and falls into its bay. The Stour enters this county from Wiltshire, near Gillingham, and, pursuing a southern and south-eastern direction, enters Hampshire. The Piddle rises in the north, and, flowing to the south-east, falls into Poole Bay. The Ivel, anciently the Yoo, has its origin from several springs near Horethorn, in a hill north-east from Sherborne, from which town it flows into Somersetshire, and falls into the Parret.

Although neither coal nor any metallic ores have ever been found in Dorsetshire, the stone quarries of Purbeck and Portland have long been celebrated. Purbeck, though called an island, is more properly a peninsula, of an irregular oval form, about twelve miles in length and seven in breadth. It consists, according to Mantell, of cretaceous, wealden, and oolitic strata, in their regular order of succession, and highly inclined in their section toward Swanage Bay, where they are easily detected. At Handfast Point the chalk is discovered, its lower division dipping at a considerable angle; then comes a layer of firestone, next galt, and then greensand—all inclined; then, at Swanage Bay, a thick wealden bed; to the south of which are the Purbeck Hills, with their peculiar strata; and, a little further on, the Portland oolite. The soil is altogether calcareous, and for the most part a continued mass, either of white or a brownish limestone, the latter having a mixture of sea-shells. The quarries on the south side of the isle afford an inexhaustible fund of natural curiosities. The best quarries are at Kingston, Worth, Langton, and Swanwick. The Swanwick stone is white, full of shells, takes a polish, and looks like alabaster. About Wareham and Morden is found a stone of an iron colour, called firestone. Near Dunshay, marble of various colours, blue, red, gray, and spotted, is dug up; but all of a coarse grain. Much of the stone of this district was used in the building of St Paul's Cathedral, Westminster Bridge, and Ramsgate Pier, and may be discovered in many of our ancient cathedrals, churches, gravestones, and monuments. One of the most valuable products of Purbeck is a white clay used for making pipes, and very extensively applied to the manufacture of china. Large quantities of it are dug, and many vessels loaded with it for Staffordshire, at Russell Quay, within the port of Poole.

The cliffs in the Isle of Portland rise frequently to 100 or 150 feet in height, and large masses lie scattered on the shore. These are composed of calcareous grit, containing moulds or forms of various shells, and emitting, when rubbed with steel, a bituminous smell. The grit is cemented together by a calcareous paste. The quarries are scattered among these rocks, more or less, in every part of the isle; but those of most repute are at Kingston. At this place there is a pier, whence upwards of 6000 tons of stone, on an average, are supposed to be shipped off annually. The first stratum in these quarries is about one foot of blackish or reddish earth; then six feet of stone, not fit for exportation. Below this is the bed of good stone, ten or twelve feet

deep, and beneath it chert or clay. The stratum of stone that is worked for sale lies nearly parallel with the upper surface of the island, and without much earth or rubbish on it. When the beds are cleared, the quarrymen proceed to cross-cut the large flats, which is done with wedges. The beds being cut into distinct lumps, are squared by the hammer to the largest size which it will admit; and blocks are thus formed from half a ton to six or eight tons weight. The colour of the Portland stone (or freestone as it is sometimes called, from the freedom with which it may be broken into any shape), is well known as almost white, and as composing the materials of the most splendid erections in London, as well as in other parts of the British empire.

The general practice and management of tillage in this country is less attended to than any part of agriculture; for it appears to be the plan of the farmers to put the seed into the ground with as few ploughings as possible. The sowing of wheat is often effected with one ploughing; and symmetry and neatness are not much regarded. The plough used is called a *sull*, and is long, large, and heavy, with one small wheel at the side of the beam, and is worked by four horses or six oxen, two abreast. In the neighbourhood of the towns, land lets for from forty to fifty shillings the acre; and, in general, arable land from twenty to thirty.

Barley is found to make the best returns, yielding about 30 bushels to the acre. Flax and hemp are objects of great importance about Bridport, Bradford, and Beaminster. The flax seed is imported from Riga, and the average crop is from fifty to sixty dozen pounds per acre, worth from four shillings and sixpence to seven shillings per dozen. It is a precarious crop, depending very much on the season; and hence the quantity cultivated has of late years been gradually diminished. The farms are mostly large. Leases generally run from 10 to 20 years. Agriculture is certainly backward in the county, but it is improving.

The sheep of Dorsetshire have long been celebrated. They are horned, white faced, with long small white legs, the carcass rather long and thin, the mutton fine-grained and of good flavour, weighing per quarter, in wethers at three years and a half old, from sixteen to twenty pounds. Their wool is fine and short; and the breed has the peculiar property of producing lambs at any period. There is a small breed in Portland and Purbeck, the quarter of which weighs about eight pounds.

Many fine Devonshire oxen are fattened for the market in Dorsetshire. In the hilly districts a hardy race of half long-horned cattle, with brindled sides, and white on the underparts, exists. Great quantities of butter are sent to the London market. The skimmed-milk cheese is much esteemed, though very little of it is exported.

Vast numbers of mackerel are taken near Abbotsbury, and along the shore from Portland to Bridport. The season for taking them is from the middle of March till midsummer, in nets or seines. Herrings and other fish common in these seas are also taken in abundance.

The manufactures of Dorsetshire are not extensive. The principal are those of flax and hemp, in the neighbourhood of Bridport and Beaminster, and also on a smaller scale in the Isle of Purbeck; of all sorts of buttons, chiefly at Blandford, and to a smaller extent at Shaftesbury; and of a sort of flannel or coarse woollen cloth, called swanskin, at Sherminster. At Stalbridge is a manufacture for spinning silk, and at Sherborne is another upon a larger scale. Some worsted stockings are made at Wimborne.

On the extended downs in the neighbourhood of Dorchester several tumuli are thrown up in all directions, proving this town to have been an important place in British times. Maiden Castle, situated on the apex of a hill about one mile south of the town, is undoubtedly the remains of an original British fortress. Nearly two miles N.W. of Kingston Hall, in the parish of Chapwicke, is a large British encampment called Bradbury Rings, which occupies the summit of a considerable eminence. This camp is of a circular form, with treble ramparts and ditches, having two entrances, one on the N.E. and another on the western side. The circumference of the outer rampart is nearly a mile. In the parish of Lullworth is another British fortification, consisting of three ramparts and ditches, including an area of about five acres. It is generally called Flowers' Barrow, from the prevalence of these ancient sepulchres within its compass. Many of these barrows have been opened, and found to contain burnt bones, corroded metal, and remains of ancient warlike instruments. A barrow was opened some years ago at Stowborough, in which a body was discovered in an excavated oak trunk, wrapped in folds of skin. Between three and four miles from Corfe Castle eastward is Nine Barrow Down, an eminence which derives its name from the nine large barrows situated on it in a line. About a mile from Winterbourn Abbas is a small circle of stones, the diameter of whose area is twenty-eight feet; and the adjacent downs are much fuller of Celtic barrows than even Salisbury plains. There is an endless field in many parts of the country for those fond of British antiquities.

The *Via Iceniana*, or Icennine Way, enters the county near Woodyates; and, passing through Dorchester, takes its course to Seaton in Devonshire. There are several smaller ways proceeding from Dorchester, Wimborne-Minster, and some other places in the county. The Roman stations in Dorsetshire appear, from the best authorities, to have been *Londinis*, now Lyme-Regis; *Canca-Arixa*, Charmouth; *Durnovaria*, Dorchester; *Vindogladia*, Winborne; *Clavinio*, Weymouth; *Morinio*, Wareham; and *Bolclannio*, Poole. Near Dorchester are the remains of a Roman amphitheatre, which is computed to have held nearly 13,000 spectators. A large circular entrenchment may be traced upon Woodbury Hill, supposed to have been the *Castra Stativa* of the Romans. On Hambledon Hill is another encampment; and also the remains of what has been thought to be a labyrinth. In the parish of Rampisham a beautiful tessellated pavement, about fourteen feet by ten, was discovered in 1799; and in the vale between Maiden-Newton and Frampton, at the distance of 150 yards from the river Frome, another of much larger dimensions was found in 1794. At Sturminster-Newton are the ruins of a castle, in the form of the letter D.

The remains of ancient castles are numerous in Dorsetshire. The principal are, Corfe, whose ruins are large, and allowed to be among the noblest and grandest in the kingdom; Abbotsbury, a little north of East Bexington; Brownsea Castle, in the island of the same name; and Portland Castle.

The abbeys whose ruins may yet be discovered, are those of the monastery of Benedictines at Cranborne, a part of which now forms the parish church, one of the oldest in the county; Cerne Abbey, said to be founded by St Augustin, the remains of which though not extensive are interesting; Abbey Milton, whose church is now converted into a private chapel; and the monastery of Shaftesbury, the ruins of which are discernible near the mansion of Sir Thomas Arundel. Some parts of the cloister and domestic buildings of the Abbey of Sherborne are now occupied by silk machinery; besides inconsiderable remains of several more.

The church of Fordington is partly in the Saxon style; that of Corfe is Gothic. The churches of Dorchester, Sherborne, Millbourne, St Andrew, Rapisham, Weymouth, and Shaftesbury, are all venerable buildings; but Dorsetshire cannot boast of many ancient ecclesiastical structures.

Amongst the modern erections of this county should be mentioned the new jail of the county town. It was built according to Howard's plan, under the direction of Bradburn the architect. In its external appearance it is peculiarly handsome and characteristic; and the interior possesses every convenience appropriate to its purpose.

This county affords the following titles to different noble families: Duke of Dorset, to the family of Sackville; Duke of Portland, to that of Bentinck; Earl of Dorchester, to that of Carleton; Earl of Sherborne, to that of Dutton; Earl of Shaftesbury, to that of Ashley Cooper; Earl of Digby, to that of Digby; and Viscount Bridport, to that of Hood.

Bishop Stillingfleet was born at Cranborne; Prior the poet at Wimborne; and Hussey, the artist, who drew by the proportions of the musical scales, at Marnhull, in Dorsetshire.

Places of worship belonging to Church of England 304, sittings 94,097; day schools 664, day scholars 25,004; Sunday schools 386, Sunday scholars 27,676.

DORSAL (Lat. *dorsum*, the back), pertaining to the back; as the *dorsal fin* of a fish, &c.

DORSIFEROUS, in *Botany*, bearing seeds on the back of the leaves, as the ferns.

DORT or DORDRECHT, an important commercial city of Holland, capital of a cognominal district in the province of South Holland, 10 miles S.E. of Rotterdam. It is situated on an island of the Meuse, said to have been separated from the mainland in 1421, by an inundation which swept away 72 villages, and about 100,000 inhabitants. This is one of the oldest cities of Holland, but the period of its rise is uncertain. It was surrounded by walls in 1231 by Florent IV. Count of Holland, who made it his residence, and granted it many important privileges. In 1457, almost the entire town, including the church of Notre Dame, founded in 1366, and other public buildings, was destroyed by fire. It was one of the first towns to embrace the Reformed religion, and to throw off the yoke of the Spanish king. In 1572 a meeting of deputies was held here when the independence of the United Provinces was first declared: and in 1618 and 1619 sat the celebrated synod of Dort. The town-hall is a handsome building; and the principal church is an old Gothic structure 300 feet long by 125 wide, with a heavy square tower, and numerous monumental stones, some of great antiquity. The hall in which the synod was held is now a public house. The houses are generally of an antique fashion, with the gables turned outwards, and many of them date from the period of the Spanish occupation. Dort possesses a good harbour, from which two canals lead to the centre of the town, and thus facilitate the conveyance of goods to the warehouses. It carries on an extensive trade in corn, flax, salt fish, train oil, and timber, brought down the Rhine; and has shipbuilding docks, saw-mills, sugar and salt refineries, tobacco factories, linen bleaching, and white-lead works. Dort is the birthplace of the brothers De Witt. Pop. (1850) 20,878.

DORTMUND, a walled town in the Prussian province of Westphalia, capital of a cognominal circle, in the government of Arnsberg. It is situated in a fertile district on the Emscher, and on the Minden and Dusseldorf railway, 29 miles W.N.W. of Arnsberg. Pop. (1849) 10,532. It is the seat of a superior mining board, and has manufactures of woollens, linens, velvets, tobacco, nails, and cutlery, and some trade.

DORYPHORI (δόρυ, *spear*, and φέρω, *I bear*), in *Antiquity*, the body-guard of kings and tyrants, of which the spear was the characteristic weapon. In imitation of the Greeks, the Roman emperors had similar body guards. The Prætorian bands likewise were thus designated.

DOSITHEANS (*Dosithei*), an ancient sect among the Samaritans in the first century of the Christian era. On the subject of the Dositheans, see Archbishop Usher.

DOSSER (Fr. *dos*, the back, or *dossier*, a bundle), a pannier or basket to be borne on the shoulders of men; sometimes used in fortification for carrying earth.

DOSSIL, in *Surgery*, a pledget of lint made into a cylindric form.

DOTIS or TATA, a town of Hungary, county of Komorn, and 12 miles S.E. of the town of that name. It consists of the Upper and the Lake town, the latter so called from a small lake in its vicinity. In the neighbourhood are several mineral springs, and stone and marble quarries. Pop. about 8000.

DOTTARD, a tree kept low by cutting; a pollard.

DOUAI, or DOUAY, an ancient and strongly fortified town of France, capital of a cognominal arrondissement in the department of Nord, situated on the Scarpe, 18 miles south of Lille, with which, as well as with many other large towns both in France and Belgium, it is connected by railway. Old walls flanked with towers surround the town, which is farther defended by a detached fort on the left bank of the river, about 2 miles distant. Douai contains numerous literary and scientific institutions, including a university; academy; royal college; college for the education of English Roman Catholic priests, founded by Cardinal Allen; a royal school of artillery; school of drawing and music; museum of natural history; collection of paintings; botanic garden; and a public library, with about 30,000 volumes. It was formerly the seat of a university, founded in 1562. It contains also one of the three royal cannon foundries of the kingdom, an arsenal, and large establishments of artillery; and is the seat of royal court for the departments of Nord and Pas-de-Calais. Its railways and canals open up to Douai an extensive trade in corn, wine, brandy, cattle, wool, hops, flax, and its manufactured produce, chiefly lace, gauze, cottons, linens, thread, earthenware, glass, soap, sugar, salt, and paper. According to some, Douai existed in the time of the Romans; but this seems to be very doubtful. It, however, rose to considerable importance under the Counts of Flanders, and passed with that country into the hands of the king of Spain. In 1667 Louis XIV. took possession of Douai. In 1710 it was taken by the allies under Marlborough and Eugene, but was retaken by the French the following year. Douai gives name to an edition of the Holy Scriptures with copious notes by Roman Catholic divines, prepared for the use of the members of that communion. Pop. (1851) 18,013.

DOUBLE-BASS. See MUSIC, § *Musical Instruments*.

DOUBLET, among lapidaries, a counterfeit stone composed of two pieces of crystal, with a colour between them; so that they present the same appearance to the eye as if the whole substance of the crystal were coloured.

The crystal or glass is first cut in the manner of a brilliant, except that the figure must be composed of two separate pieces. After the two plates have been thus cut, and fitted with the utmost exactness, the upper part is to be polished ready for setting. The colour is then put between the two plates by the following method:—To two scruples of Venice turpentine add one scruple of the grains of very pure mastich previously powdered; melt them together in a small silver spoon, add to them gradually any of the coloured substances mentioned below, in a state of fine powder, and stir them well together as the colour is put in. Then warm the doublets to the same temperature as the melted mixture, apply it to the surface of the lower plate; and put the upper one instantly upon it, and press them to each other, taking care that they be conjoined perfectly even. When the cement is quite set, the redundant part of it, which has been pressed out of the joint, should be scraped off. In the setting, the mounting should cover the joint, in order to prevent the separation of the pieces.

The colour of the ruby may be imitated by mixing a fourth part of carmine with some of the finest crimson lake; the sapphire, by very bright Prussian blue, mixed with a minute portion of crimson lake; the emerald, by distilled verdigris, to which is added a little powdered aloes; the garnet, by dragon's blood, with the addition, if necessary, of a very small quantity of carmine; the amethyst, by mixing some Prussian blue with crimson lake; the yellow

topazes, by mixing powdered aloes with a little dragon's blood, or by good Spanish arnotto; the chrysolite, hyacinth, vinegar garnet, aqua-marine, and such other weaker or diluted colours, may be formed in the same manner, by lessening the proportions of the colours, or by compounding them together so as to correspond with the hue of the stone to be imitated.

DOUBLETS, a game on dice within tables. The men, fifteen in number, are placed thus:—Upon the six, cinque, and quatre points, there stand three men a-piece; and upon the trey, deuce, and ace, only two. He who throws highest has the benefit of throwing first, and what he throws he lays down, and so does the other: what the one throws and has not, the other lays down for him, but on his own account; and thus they proceed until all the men are down, and then they "bear," as it is called. He who is first down bears first, and will doubtless win the game if the other throws not doublets to overtake him; which he is sure to do, since he advances or bears as many as the doublets make, namely, eight for two fours.

DOUBLING, in the military art, the putting of two ranks or files of soldiers into one. Thus, when the word of command is *double your ranks*, the second, fourth, and sixth ranks march into the first, third, and fifth, so that the six ranks are reduced to three, and the intervals between the ranks become double what they were before.

Doubling, in *Navigation*, the act of sailing round or passing beyond a cape or promontory.

DOUBLOON, or Doblon, a Spanish and Portuguese coin, being the double of a pistole.

DOUBS, one of the eastern frontier departments of France, bounded on the E. by Switzerland, from which it is separated partly by the Jura chain of mountains, and partly by the river Doubs, and on the N., W., and S. by the departments of Upper Rhine, Upper Saône, and Jura. It is formed of part of the ancient province of Franche-Comté, and the ancient German principality of Montbéliard. Four parallel chains of the Jura mountains traverse it from N.E. to S.W. In the highest and most eastern of these, the principal summit, Mont Luchet, attains a height of 5283 feet; but in the most western the highest points do not exceed 1000 feet. These chains are all of calcareous formation, and present numerous rocky crags, grottoes, caverns, and other natural curiosities. The river Doubs, which gives name to the department, rises at the foot of Mount Rixon, in the arrondissement of Pontarlier, and, after twice traversing this department through its entire length, passes through the department of Jura, enters that of Saône-et-Loire, and joins the Saône. It has an entire course of about 250 miles, 195 of which are in this department. Near Morteau it forms a magnificent cataract, having a perpendicular fall of 88 feet. From Besançon to near Montbéliard it forms part of the navigable canal between the Rhine and the Rhone. Doubs is abundantly watered by numerous smaller rivers and rivulets. The differences in its elevation give it a very variable climate, but the general character is cold, with long and severe winters. The prevailing winds are the north-east and south-west. The surface may be divided into three distinct regions. The highest region, on which the snow usually lies for six months in the year, is mostly covered with vast forests of fir trees, and affords good pasturage to numerous herds of cattle. The second or less elevated region is chiefly occupied by forests of oak, beech, sycamore, the walnut-tree, &c., and the intervening valleys are susceptible of cultivation. The plain region is the most fertile, producing wheat, rye, maize, hemp, pulse, fruits, and wines. Of its entire area of 525,212 hectares (2020 square miles), 191,577 hectares are arable; 120,646 in wood; 101,688 in heath and pasture; 79,892 in meadow; and 8011 in vineyards. Agriculture is in a very backward state—cattle-rearing and dairy produce, particularly cheese, receiving a great share of attention. It has numerous iron foundries; manufactures of cotton and woollen cloths, hardware, cutlery, watches, paper, glass, leather; and a considerable trade in cattle, hides, timber, and dairy produce. There are also mines of iron, coal, and lignite; and quarries of gypsum, marble, building stone, &c. It is divided into four arrondissements, which, with their subdivisions and population, are as follows:

Arrondissements.	Cantons.	Communes.	Pop. 1851.
Besançon,............	8	203	110,826
Pontarlier, ...	5	89	52,195
Baume,...............	7	187	68,354
Montbéliard,.........	7	161	65,304
	27	640	296,679

The capital is Besançon.

DOUCHE (French), a jet of water directed upon some part of the body, as a cure for local weakness, rheumatism, &c.

DOUGLAS, Gavin, bishop of Dunkeld, was the third son of Archibald earl of Angus, and of Elizabeth the daughter of Robert Lord Boyd, who for some time filled the office of high chamberlain. He appears to have been born in 1474, or the ensuing year. With the place of his birth or education we are not acquainted, but we may suppose his course of study to have been suitable to his profession. Having entered into holy orders, he was collated to the rectory of Hawick;[1] and as the dormant energies of the human mind are awakened by external objects, his early residence amid the fine pastoral scenery of Teviotdale may have had a strong tendency to cherish in his imagination the seeds of genuine poetry. In the year 1509, we find him described as provost of the collegiate church of St Giles in Edinburgh.[2] This preferment was in the gift of the crown: it placed him in a situation of no small dignity and emolument, and he appears to have held it with his other benefice. It was while he occupied these less elevated stations that he composed the very ingenious works which have rendered his name so conspicuous in the literary annals of his country.

His father, who is sometimes denominated the great earl of Angus, and sometimes *Bell-the-cat*, followed the standard of James the Fourth when he invaded England; but finding his prudent counsels disregarded, he excused himself on account of his advanced age, and withdrew from the army. His two eldest sons, George and William, together with about two hundred gentlemen of the name of Douglas, perished in the fatal battle of Flodden-field. This calamity to the nation in general, and to his own family in particular, made so deep an impression on his heart, that having retired to St Mains, a religious house in Galloway, he died there within the space of twelve months.[3] His title and estates descended to his grandson Archibald, a young nobleman whose personal attractions were so unrivalled that he speedily obtained the tender regard of the widowed queen, and their nuptials were solemnized before she had completed the year of mourning. This precipitate match, which had been concluded without the concurrence of the principal nobility, excited general indignation: the queen was no longer willingly acknowledged as regent; the pre-eminence of her husband rendered him odious in the eyes of the more powerful subjects; and the house of Douglas was involved in persecutions which this resentful spirit of jealousy excited.

[1] Alexandri Myln Vitæ Episcoporum Dunkeldensium, p. 72. Edinb. 1823, 4to.
[2] Keith's Catalogue of the Scottish Bishops, p. 93.
[3] Hume's History of the Houses of Douglas and Angus, p. 235. Edinb. 1644, fol.

Among those who perished at Flodden were the archbishop of St Andrews, the bishop of the Isles, the abbot of Kilwinning, the abbot of Inchaffray, and other warlike sons of the church. The archbishop of St Andrews, Alexander Stewart, who was the king's natural son, and a young man of very promising talents, had likewise held the abbacies of Aberbrothock and Dunfermline, together with the priory of Coldingham. In a letter addressed to Pope Leo the Tenth, the queen, after extolling Gavin Douglas as second to none in learning and virtue, earnestly requested that he might be secured in the possession of the abbacy of Aberbrothock, till his singular merit should be rewarded by some more ample preferment.[1] After the death of the late primate, William Elphinstone, bishop of Aberdeen, had been nominated to the vacant see; but his modesty or infirmities induced him to decline this splendid offer, and the queen afterwards attempted to elevate Douglas to the primacy. Confiding in the royal nomination, and in the influence of his own family, he took possession of the archiepiscopal palace; but his claims were disputed by two powerful rivals, John Hepburn, prior of St Andrews, and Andrew Foreman, bishop of Moray in Scotland, and archbishop of Bourges in France. Hepburn having prevailed upon the canons to elect him to the see, laid siege to the castle, and after meeting with some resistance, expelled the retainers of his competitor; nor did the earl of Angus, with a party of two hundred horse, succeed in his attempt to recover the possession of this strong hold.[2] In the mean time, Foreman, who was a person of great influence, found means to obtain from Rome a grant of the archbishopric of St Andrews, and the other preferments which had been held by the late primate.[3] Douglas, actuated by a decent spirit of moderation, resolved to abandon the pursuit of this high object of ecclesiastical ambition; but the other competitors seem to have been alike insensible to motives of private virtue and of public decorum. Foreman being afraid to publish the papal bulls, prevailed upon Lord Hume, by bestowing on his brother the priory of Coldingham, to undertake the support of his cause; and this border chieftain enabled him to appear at Edinburgh, attended by ten thousand men in arms. Having performed the necessary ceremony, they hastened to St Andrews in order to complete their pious task, but they found the prior sufficiently prepared for their reception: in the castle and in the cathedral he had placed so considerable a garrison, that Foreman was unwilling to hazard an attack, and deemed it more prudent to adjust their claims by an amicable negociation; it was finally stipulated that he should be put in quiet possession of the primacy, that Hepburn should receive a yearly pension from the bishopric of Moray, and should retain such rents as he had already levied from the archbishopric of St Andrews.[4]

From this negociation Douglas derived no advantage; and, to complete the measure of his disappointments, the abbacy of Aberbrothock, which he had regarded as secure, was transferred to James Beaton, archbishop of Glasgow, and chancellor of the kingdom. The death of George Brown, bishop of Dunkeld, which occurred in the month of January 1515, presented him with new prospects, and exposed him to new mortifications. The queen nominated him to the vacant see, and, as is supposed, by the intervention of her brother the king of England, obtained a papal bull in his favour. But, in the mean time, the earl of Athole had induced the chapter to postulate his brother Andrew Stewart, prebendary of Craig, who had not yet taken subdeacon's orders.[5] The enemies of the queen did not neglect this opportunity of disgracing an individual so nearly allied to her husband: Douglas was cited before the competent judges, and was accused of having violated the laws, by procuring bulls from Rome. Such practices had indeed been prohibited by several statutes, but these had very seldom been enforced. Of this offence he was however convicted; and being committed to the charge of his former rival Hepburn, he was successively confined in the castles of Edinburgh, St Andrews, and Dunbar, and again in that of Edinburgh. Before the period of his trial, the queen's party had almost entirely lost its influence: the duke of Albany, who was the grandson of James the Second, and the cousin of the late king, arrived from France on the 10th of May, and within the space of about two months was declared regent of the kingdom. A compromise at length took place between the two parties: Douglas obtained his liberty after an imprisonment of more than twelve months; and his claim to the bishopric was secured by Beaton's mediation with the new regent. He was consecrated at Glasgow by the same prelate, who defrayed the expenses attending this ceremony; and having paid a visit to the metropolitan city of St Andrews, he proceeded to Dunkeld, where the clergy and laity testified the utmost joy at the arrival of so noble, learned, and pious a bishop. The bulls having with the usual solemnities been read at the high altar, he retired to the residence of the dean, George Hepburn, by whom he was suitably entertained. The episcopal palace was still occupied by the retainers of Stewart; and the bishop finding next day that they had likewise seized the tower of the cathedral, was obliged to perform divine service at the deanery. In the afternoon he held a consultation with the nobility, gentry, and clergy, by whom he was attended; but their deliberations were speedily interrupted by the intelligence that Stewart had taken up arms, and was advancing to support his adherents; and at the same time they were alarmed by the commencement of a fire from the palace and the cathedral. Lord Ogilvy, with the eldest son of the earl of Crawford, and many other friends, including a considerable number of ecclesiastics, with the dean among the rest, immediately began to prepare for action; and messengers having been dispatched to the neighbouring districts, his party was next day strengthened by the arrival of a formidable reinforcement of armed men. Stewart, who did not find himself strong enough to hazard an attack, retired into the woods. His retainers, who garrisoned the palace and the cathedral, were now summoned to surrender, under the pain of excommunication; and on their refusing to obey this summons, the bishop's servants, led by a valiant prebendary, and by James Carmichael,

[1] Epistolæ Regum Scotorum, vol. i. p. 183. Edinb. 1722-4, 2 tom. 8vo.
[2] Buchanani Rerum Scoticarum Hist. p. 256. Pinkerton's Hist. of Scotland, vol. ii. p. 124.
[3] Epistolæ Regum Scotorum, vol. i. p. 269.
[4] Buchanan. p 257. Lindsay's Cronicles of Scotland, vol. ii. p. 291.
[5] It may not be unnecessary to remark, that in the popish church there are seven orders, namely, those of porter, lector, exorcist, acolyte, subdeacon, deacon, and priest; and that no person can regularly be elected a bishop, unless he has at least taken subdeacon's orders. Although he cannot be elected, he may however be postulated by the chapter; and if this postulation is admitted by the pope, he is then considered as elected and confirmed. "Postulatio est ejus, qui eligi non potest, in prælatum concors capituli facta petitio." (Lancelotti Institutiones Juris Canonici, lib. ii. tit. viii.) There are other canonical impediments, which we need not enumerate; for Stewart's disqualification is particularly specified by Myln.

took possession of the cathedral. Intimidated by this event, those who occupied the palace requested that a truce might be granted, and the sentence of excommunication delayed for a few hours; but when the stipulated time had elapsed, they still refused to surrender. The interference of the regent at length enabled Douglas to take possession of his palace without the effusion of blood; a circumstance, as one of his biographers has remarked, which "was certainly very acceptable to the good bishop; who in all the actions of his life discovered a gentle and merciful disposition, regulating the warlike and heroic spirit of his family by the excellent laws of the Christian religion."[1] After these events, Stewart hastened to the court, accompanied by his brother the earl; and Douglas having likewise made his appearance, their respective claims were taken into consideration by the regent and council. It was finally agreed that Stewart should relinquish his pretensions to the see of Dunkeld, but should retain such rents as he had already levied, and should be confirmed in the possession of the two benefices of Alyth and Cargill, under the condition of paying the bishop a certain annual contribution in grain.[2] Although Douglas had so recently been punished for soliciting bulls from Rome, yet the regent did not scruple to apply to the pope for a ratification of this agreement: in a letter dated on the 28th of September 1516, he entreated his holiness that all informalities might be removed, and the stipulations rendered valid by his sanction.[3]

Having at length been installed in his cathedral, he was speedily called from the discharge of his episcopal functions. During the ensuing year, an ambassador arrived from France, with a proposition for the renewal of the ancient league between the two kingdoms; and it was thought expedient that the duke of Albany should himself repair to Paris, accompanied by Bishop Douglas, and by Patrick Panter, chancellor of Dunkeld, and secretary of state. The negociation having been brought to a satisfactory conclusion, the bishop was employed to convey the earliest intelligence to Scotland.[4] His professional duties seem again to have been interrupted during some part of the year 1518: in the British Museum there is an original letter, signed by the earl of Angus and others, and recommending him to the English king as a proper person to transact certain affairs in which they were concerned.[5] Though thus exposed to occasional distractions, he yet presided over his diocese with exemplary piety. The various troubles in which he was formerly involved had not merely prevented him from accumulating riches, but had even encumbered him with debts; yet the benevolence of his disposition prompted him to perform many acts of charity and munificence.[6] The revenues of this see are represented as ample,[7] and he was again so fortunate as to fix his residence in a delightful part of the country: the situation of Dunkeld, which no intelligent lover of our early literature can visit without recollecting the name of Douglas, has a romantic beauty of which it is difficult to convey an adequate idea.

When the duke of Albany was preparing to quit the kingdom, he delegated his authority to the archbishops of St Andrews and Glasgow, and the earls of Arran, Angus, Argyle, and Huntley: but the predominating power of Angus excited the apprehensions or the jealousy of his colleagues; and they resolved to unite their strength with the view of circumscribing the influence of so formidable a rival. On the 29th of April 1520, Arran with many others of the nobility assembled at Edinburgh in the house of Archbishop Beaton: they formed the resolution of instantly seizing the person of Angus, whose power, they pretended, was so exorbitant that, while he continued at liberty, his fellow-subjects could enjoy no security. Aware of their hostile intentions, he requested his uncle the bishop of Dunkeld to mitigate their resentment, and persuade them to adopt a more lawful method of redress. He accordingly addressed himself to the archbishop, whom he found in the church belonging to the monastery of the black friars, and entreated him to act the part of a peacemaker: the crafty and turbulent prelate protested that he was at once ignorant of their designs, and unable to prevent them from being carried into execution; and to confirm this averment, he made a solemn appeal to his conscience, but having too forcibly applied his hand to his breast, he discovered to his indignant companion, that his sacred habit concealed a coat of mail. "My Lord," exclaimed the bishop, "I perceive your conscience is not good, for I hear it *clattering*," that is, telling tales. He next accosted Sir Patrick Hamilton, requesting him to interpose with his brother the earl of Arran: this gentleman was inclined to peaceable measures, when the earl's natural son Sir James, a man of a ferocious disposition, rudely upbraided him with cowardice. This charge he repelled with indignation; and having drawn his sword, he rushed furiously into the street, where the earl of Angus had stationed a numerous body of his retainers: perceiving him advance before the other assailants, the earl called aloud to his followers to save Sir Patrick Hamilton's life; but in the heat of battle it is difficult to spare those who are eager to destroy, and he was speedily slain, together with the eldest son of the earl of Eglintoun. The encounter, which was long and fierce, was at length decided by the interference of some of the citizens, who were favourably disposed to the queen, and therefore espoused the cause of her husband. Seventy-two of his antagonists perished in the battle. During this scene of disgraceful violence, the bishop of Dunkeld had retired to his chamber, and spent the anxious interval in a manner suitable to the profession; but when the contest was decided, he hastened to prevent the wanton effusion of blood. The archbishop, who appears to have been personally engaged, had taken refuge behind the altar of Black-friars church, and the rocket was already torn from his shoulders, when the interposition of Douglas saved his life.[8]

The duke of Albany, after an absence of upwards of four years, returned to Scotland in 1521; and one of his earliest measures was to reduce the inordinate power of the Douglasses. Angus and his principal adherents, having been summoned to answer for their violent proceedings, fled for refuge to the Kirk of Steill. The bishop of Dunkeld was dispatched to London as their accredited agent,

---

[1] Sage's Life of Douglas, p. 7.
[2] Myln, Vitæ Episcoporum Dunkeldensium, p. 75.
[3] Epistolæ Regum Scotorum, vol. i. p. 222.
[4] Leslæus de Rebus gestis Scotorum, p. 385–9. Pinkerton's Hist. of Scotland, vol. ii. p. 165.
[5] Pinkerton's List of the Scotish Poets, p. xcv.
[6] Myln, p. 75.
[7] Winton's Cronykil of Scotland, vol. i. p. 167. Pinkerton's Hist. of Scotland, vol. ii. p. 127. The bishopric of Dunkeld was reckoned the third see in the kingdom.
[8] Buchanan. p. 261. Lindsay's Cronicles of Scotland, vol. ii. p. 285. Hume's Hist. of the Houses of Douglas and Angus, p. 245.—Lindsay refers this event to the year 1515, but other historians, with greater probability, add five years to the number. The encounter was long remembered in Edinburgh by the name of *Cleanse the Causey*.

and was instructed to represent their safety as necessarily connected with that of their young sovereign.[1] At the court of Henry the Eighth, where his poetical talents had probably found many admirers, he experienced a gracious reception; and the king is said to have provided for his maintenance by the grant of a liberal pension.[2] He now contracted a friendship with Polydore Virgil, who was engaged in composing a history of England. The recent publication of Mair's history of Scotland, in which he ventured to expose the Egyptian fables of his predecessors, had excited the indignation of such of his countrymen as delighted to trace their origin to the daughter of Pharaoh. Douglas was studious to warn his Italian friend against the opinions of this worthy doctor of the Sorbonne;[3] and presented him with a brief commentary, in which he pursued the fabulous line of our ancestry from Athens to Scotland; nor was a poet to be easily induced to relinquish so fine a tissue of romantic narrative. This tract, which was probably written in Latin, seems to have shared the common fate of the manuscripts entrusted to Polydore; who, in order to secure the errors of his work from detection, is said to have destroyed many valuable monuments of antiquity.[4] Vossius has stated that Douglas wrote a history of Scotland, consisting of several books;[5] but Bishop Bale, to whose authority he refers, only mentions a single book;[6] and it is evident that the historical work to which both these writers and Dempster[7] allude, is merely the brief commentary quoted by Polydore Virgil.

While the accomplished prelate was thus employed in England, his enemies were not inactive in Scotland. His mission to the English king furnished a sufficient pretext for accusing him of treason: on the 21st of February 1522 he was declared a traitor, and the revenues of his see were placed in a state of sequestration; the king's subjects were prohibited, under the pain of treason, from affording him any pecuniary assistance, or maintaining with him any correspondence either by letters or messages. An account of these proceedings was transmitted to the pope, accompanied with a remonstrance against the nomination or recommendation of the traitor Gavin Douglas to the archbishopric of St Andrews and the abbacy of Dunfermline, or to either of those preferments.[8] The extent of his influence had manifestly excited the alarm of Beaton, who was determined at all hazards to secure these ample prelacies, recently become vacant by the death of Foreman. Nor were these the only expedients to which he resorted: as chancellor of the kingdom, he addressed a letter to the king of Denmark, entreating him to represent Douglas to the sovereign pontiff as a person altogether unworthy of his favour and protection.[9] Beaton became archbishop of St Andrews, and Douglas died in exile. He had been cited to appear at Rome, and, according to his own declaration, he intended to obey the summons;[10] but in the course of the same year, and before he began to decline from the vigour of manhood, he was seized with the plague, and speedily fell a victim to its dreadful contagion.[11] He died at London in 1522, and was interred in the Savoy church, on the left side of Thomas Halsay, bishop of Leighlin in Ireland; whose monument also contained a short inscription of his name and addition.[12] The character which he left behind him was that of a "man learned, wise, and given to all vertue and goodness."[13] With the splendour of his birth and the dignity of his person he united many accomplishments and many virtues. Although he lived in an age of lawless violence, and was connected with a powerful and turbulent family, he was uniformly distinguished by the moderation of his conduct.[14] The fruits produced by the celibacy of the Romish clergy are sufficiently known: the bishop of Dunkeld left a natural daughter, from whom Semple of Foulwood derived his lineage.[15] Transgressions of this nature were so common, that they must almost have ceased to be regarded as criminal: Patrick Hepburn, bishop of Moray, had two sons legitimated in one day, and five daughters in another.

It is the secular learning of Bishop Douglas that has chiefly attracted the attention of posterity; but Myln,

---

[1] In the British Museum, Calig. B. vi. 223, there is an original paper, dated "at the Kirk of the Steill," 14 December 1521, and containing "Instructions and Commissioun for my Lord of Dunkeld, to be schawin vnto the Kyngis Grace of Ingland, on the behalf of my Lord of Anguss, his kyn and frendis, Lord Hwme, Lord Sommervel, thar kyn and frendis." This document states that, for the fulfilment of the articles mutually agreed upon, the said lords are bodily sworn upon the gospels, "befor a reuerend fader, Gawin Bischop of Dunkeld, and Thomas Lord Dacre."

[2] Holinshed's Chronicles, vol. iii. p. 872.

[3] Polydori Virgilii Anglica Historia, p. 52. edit. Basil. 1556, fol.

[4] Peacham's Compleat Gentleman, p. 51. edit. Lond. 1634, 4to.—"He is said to have borrowed books out of the publick library at Oxford, without taking any care to restore them: upon which the university (as they had good reason) declined lending any more, till forced to it by a mandate which he made a shift to procure from the king. In other places he likewise pillaged the libraries at his pleasure; and, at last, sent over a whole ship-load of manuscripts to Rome." (Nicolson's English Historical Library, p. 70.)

[5] Vossius de Historicis Latinis, p. 686.

[6] Balei Scriptores Britanniæ, cent. xiv. p. 218.

[7] Dempsteri Hist. Ecclesiast. Gent. Scotor. p. 221.

[8] Epistolæ Regum Scotorum, vol. i. p. 328.

[9] Ibid. vol. p. 333.

[10] Pinkerton's Hist. of Scotland, vol. ii. p. 194.—In a letter from the bishop of Bath to Cardinal Wolsey, dated at Rome on the 19th of March, the following passage occurs: "The bishope of Dunkell his servant is come; and I doo the best I cane to helpe and assist hyme in his masters causes, accordyng your grace is commandment." (H. Ellis's Original Letters, second series, vol. i. p. 316.) See likewise p. 323. The earl of Morton was accused of treason, and, among other grounds, "for the tresonable counsale, help, supportacioun, and assistance, gevin to Gawyne bischop of Dunkeld, in his tresonable passing in Ingland:" but an act of parliament, passed in 1524, declared the charge against him, "in all the punctis it contenit, vane, vntrew, and had na veritie." (Acts of the Parliaments of Scotland, vol. ii. p. 290.)

[11] Polydori Virgilii Anglica Historia, p. 53.—According to Hume's calculation, he had reached the forty-sixth year of his age in 1520. His testament may be found in the appendix to Mr Riddell's Reply to the Misstatements of Dr Hamilton, in his late *Memoirs of the House of Hamilton corrected*. Edinb. 1828, 4to. On the 19th of September 1522, it was proved by one of the executors, Mathew Geddes, vicar of Tippermuir, his chaplain. The inventory of the bishop's goods was taken "apud hospitium Domini Dacris." In the British Museum, Calig. B. i. 27, there is an original letter from Douglas to Lord Dacre, in which he says, "our houssys ar of the auld allyat." Mr Riddell has suggested that the testament makes no allusion to the pension mentioned by Holinshed; and that "the bishop seems to have been reduced to straits, as he is obliged to pawn some of his silver plate." But as his mission to England was considered as treasonable, he had an obvious reason for avoiding the mention of an English pension; and in most cases there is no great difficulty in supposing a man's expenses to exceed his income.

[12] Weever's Ancient Funeral Monuments, p. 446.

[13] Spotswood's Hist. of the Church of Scotland, p. 101.—This historian states that "he died of the plague at London in Savoy House."

[14] Buchanani Rerum Scoticarum Historia, p. 262.

[15] Hume's Hist. of the Houses of Douglas and Angus, p. 220.

who was one of the canons of his cathedral, represents him as eminently skilled in divinity and the canon law. He was perhaps the most learned of the early Scottish poets. Among the ancient poets, his favourites were apparently Virgil and Ovid; among the Christian fathers, his favourite was St Augustin, whom he denominates the chief of clerks. Of the Latin language his knowledge was certainly extensive; and as he states that Lord Sinclair had requested him to translate Homer, we may venture to infer that he was not unacquainted with Greek. It is highly probable that he had completed his education on the continent, and had thus given his studies a more elegant and classical direction. Nor were his talents less conspicuous than his learning. In all his writings he evinces an excursive fancy, with much of the fervour of genius. His allegorical sketches are efforts of no common ingenuity; but what chiefly renders his works interesting is the frequent occurrence of those picturesque and characteristic touches, which can only be produced by a man capable of accurate observation and original thinking. He exhibits perpetual vestiges of a prolific and even exuberant imagination, and his very faults are those of superabundance rather than deficiency. In his descriptions, which are often admirable, he occasionally distracts the attention by a multiplicity of objects, nor is he sufficiently careful to represent each new circumstance in a definite and appropriate manner. His style is copious and impetuous, but it cannot be commended for its purity. In his translation of Virgil he professes to be scrupulous in rejecting Anglicisms, and indeed his diction is often remote from that of the English poets: but he has imported many exotic terms from another quarter; his familiarity with the Latin language betrays itself in almost every page of his writings. His verses, though less smooth and elegant than those of Dunbar, are not unskilfully constructed.

Of Douglas's original compositions the longest is the *Palice of Honour;*[1] an allegorical poem which displays much versatility of fancy and a ready command of striking imagery. Still however it is to be considered as a Gothic structure, and as exhibiting many of the peculiarities which belong to that order: ancient and modern usages, classical and Christian subjects, are almost constantly blended together; and a nymph of Calliope's train expounds the scheme of human redemption. This poem appears to have been composed in 1501, when the author was twenty-six or twenty-seven years of age. It has been surmized that Douglas's work is probably founded on the *Sejour d'Honneur* of Octavien de St Gelais.[2] The titles have indeed an obvious resemblance to each other, but there is little or no affinity in the plan and execution of the two poems. The successive appearance of the different courts described in the Palice of Honour, may possibly remind some readers of the Triumphs of Petrarch, in which various shadowy trains succeed each other in a somewhat similar manner; but notwithstanding these different suggestions, Douglas's poem must still be regarded as entitled to the praise which belongs to an original design.

King Hart, another allegorical poem of the same author, exhibits a very ingenious adumbration of the progress of human life.[3] It is a singular composition, and may remind the reader of Phineas Fletcher's *Purple Island;* a work which furnishes a striking example of the misapplication of fine poetical talents. From the occurrence of several incorrect passages, it has been supposed to be one of Douglas's earliest performances. Incorrect passages we may expect to find in all the vernacular poetry of that age; and the versification appears to us superior to that of the Palice of Honour. As he has not enumerated it among his early works, we may perhaps venture to conclude that it was written after his translation of Virgil. The heart, being the fountain of vital motion, is here personified as man himself, and is conducted through a great variety of adventures.

But the most remarkable of Douglas's works is perhaps his translation of the Æneid.[4] In the original poems which accompany it, he has fortunately specified the origin and progress of this undertaking: he there informs us that it was begun at the request of his cousin Lord Sinclair, whom he represents as a zealous collector of books, and protector of science and literature; and that it was the labour of only sixteen months, being completed on the 22d day of July 1513, about twelve years after he had composed the Palice of Honour. This task must apparently be understood to comprehend, not merely a version of Virgil's twelve books, but likewise of the supplementary book of Mapheus Vegius, together with the original poems which he has interspersed in the volume. Whether we consider the state of British literature at that period, or the rapidity with which he executed so extensive a work, it is impossible to withhold from this version a large share of our approbation. In either of the sister languages, few translations of classical authors had hitherto been attempted. Even in England, it has been remarked, no metrical version of a classic had yet appeared; except of Boethius, who scarcely merits that appellation.[5] On the destruction of Troy, Caxton had published a kind of prose romance, which he professes to have translated from the French; and the English reader was taught to consider this motley composition as a version of the Æneid. Douglas bestows severe castigation on Caxton for his perversion of the classical story; and affirms that his work no more resembles Virgil than the devil resembles St Austin. He has however fallen into one error which he exposes in his precursor; proper names are so completely disfigured in his translation, that they cannot be recognized without some degree of difficulty. In various in-

[1] The Palis of Honoure, compeled by Gawyne Dowglas, Bysshope of Dunkyll. Imprinted at London in Fletstret, at the sygne of the Rose garland, by Wyllyam Copland. 4to. This edition, which is without a date, was probably printed about the same time with the author's translation of Virgil. They are uniformly printed, and both title-pages have the same ornamental border. Another early edition bears the following title: "Heir beginnis ane treatise callit the Palice of Honovr, compylit be M. Gawine Dowglas, Bischop of Dunkeld. Imprentit at Edinburgh be Iohne Ros for Henrie Charteris, anno 1579. *Cum Privilegio Regali.* 4to. The epistle "To the Reidar" begins thus: "Quhen we had sene and considderit the diuers impressiones befoir imprentit of this notabill werk, to haue bene altogidder faultie and corrupt, not onlie that quhilk hes bene imprentit at London, bot also the copyis set furth of auld amangis our selfis." Copland's edition is however the earliest which bibliographers have been able to trace. The Edinburgh edition has lately been reprinted for the Bannatyne Club. Edinb. 1827, 4to.

[2] Le Seiour d'Honneur, composé par reuerend Pere en Dieu Messire Octouien de Sainct Gelaiz, Euesque d'Angoulesme, nouuellement imprimé. Paris, 1519, 8vo.

[3] King Hart was first printed in Mr Pinkerton's Ancient Scotish Poems, vol. i. Lond. 1788, 2 vols. 8vo.

[4] The xiii. bukes of Eneados of the famose poete Virgill, translatet out of Latyne verses into Scottish metir, bi the Reuerend Father in God, Mayster Gawin Douglas, Bishop of Dunkel, & vnkil to the Erle of Angus: euery buke hauing hys perticular Prologe. Imprinted at London, 1553, 4to. Another edition, with a life of the translator by Sage, and a glossary by Ruddiman, appeared after a long interval. Edinb. 1710, fol.

[5] Warton's Hist. of English Poetry, vol. iii. p. 112.

stances, he has been guilty of modernizing the notions of his original: the Sibyl, for example, is converted into a nun, and admonishes Æneas, the Trojan baron, to persist in counting his beads.

Douglas's translation of Virgil is certainly executed with no mean ability; it is the effort of a bold and energetic writer, whose knowledge of the original language,[1] and prompt command of a copious and variegated phraseology, qualified him for the performance of so arduous a task. It is indeed to be regretted that he did not devote a much longer period to this undertaking: he might thus have been enabled to render his versification more terse and finished; but the work, in its present state, is a singular monument of his genius and industry. One of his principal objects was to write in plain and intelligible language, so that his favourite poet might be readily understood by his countrymen; and by keeping this object constantly in view, he has frequently attained to less elevation of style than might have been expected. His translation possesses one merit which he probably did not contemplate: as a version of a well-known classic, it presents an ample fund of philological information; and Ruddiman's excellent glossary has long recommended it to all those who have paid any particular attention to the etymology of the Scottish language. The felicity of this translation has been very warmly commended by another Scottish prelate, Dr Lesley, the celebrated bishop of Ross; who, in enumerating its various excellencies, has stated that it always renders one verse by another. But this regularity of correspondence, for which it has likewise been praised by Dempster, must not be too literally understood; and it may be proper to recollect that the verses of the two poets, although they might be equal in number, could not be equal in length, as a hexameter line may consist of seventeen, and cannot consist of fewer than thirteen syllables.

The bishop of Dunkeld's version of the Æneid seems to have suggested a similar plan to the earl of Surrey, who translated the second and fourth books into English. In this translation he has exhibited the earliest specimen of blank verse that occurs in the history of English poetry. Dr Nott has remarked that "we meet with so many expressions which Surrey has evidently borrowed, with so many lines adopted with hardly any other alteration than that which the difference of the dialect, and the measure made necessary, and so many taken without any alteration at all, that all doubt ceases. It becomes a matter of certainty that Surrey must have read and studied the Scottish translation before he began his own."[2] This assertion he has verified by a long series of parallel passages, which it is impossible to read without acquiescing in his opinion.

The several books of Douglas's translation are introduced by prologues, which, in the opinion of Warton, are often highly poetical, and shew that his proper walk was original poetry. They have likewise received warm commendation from Hume of Godscroft, who was himself a scholar and a poet. "In his prologues before every book," he remarks, "where he hath his liberty, he sheweth a natural and ample vein of poesy, so pure, pleasant, and judicious, that I believe there is none that hath written before or since, but cometh short of him. And, in my opinion, there is not such a piece to be found as his prologue to the eighth book, beginning *Of drevilling and dreams*, &c. at least in our language."

These are the only works of Bishop Douglas with which we are now acquainted. On concluding his translation of Virgil, he avowed a resolution to devote his future days to the service of the commonwealth and the glory of God. The earliest of his poetical performances appears to have been a translation of Ovid *De Remedio Amoris;* but of this translation no copy is known to be extant.

> Lo thus, followand the floure of poetry,
> The battellis and the man translate haue I,
> Quhilk zore ago in myne undantit zouth,
> Unfructuous idilnes fleand, as I couth,
> Of Ovideis Lufe the Remede did translate,
> And syne of hie Honour the Palice wrate.

Bale mentions another of his compositions under the title of "Aureæ Narrationes;" which Sage supposes to be the short commentary noticed in the concluding address to Lord Sinclair:

> I haue also ane schorte commend compyld,
> To expone strange historiis and termes wylde.

This comment, as the same biographer conjectures, may have been merely a brief explanation of the classical mythology. If we may rely on the authority of Bale and Dempster, he likewise composed comedies; but both these writers are apt to multiply books as well as authors. Another biographer is inclined to suppose that he may have written the Flowers of the Forest, a song which displays no small portion of pathetic simplicity. "It may be conjectured," says Mr Scott, "that he was the author of that celebrated elegaic song, which describes the devastation occasioned by the battle of Flowdon, in that part of the country with which he had long been well acquainted."[3] It was published by Mr Lambe in the year 1774, and is described by him as an old Scotish song;[4] and Mr Ritson, who thought it "as sweet and natural a piece of elegaic poetry as any language can boast," had no hesitation in believing it to have been composed immediately after the battle of Flodden-field;[5] a decision which sufficiently evinces that, notwithstanding his confidence in his own judgment, and his undisguised contempt for almost all his predecessors, his critical opinions on such subjects were very far from being infallible. According to a more authentic account, the tune and two detached verses of this song are ancient; and all the others were composed by a lady connected with the county of Roxburgh.[6] The language and versification are evidently of a more recent date than the year 1513; nor could such a composition be safely referred to any period preceding the last century. (D. I.)

DOUGLAS, the capital of the Isle of Man, situated on a fine bay on the east coast of that island, in Lat. 54. 10. N., Long. 4. 27. W. Pop. (1851) 9880. In summer it is much frequented as a watering-place by parties from Liverpool and other places, and in consequence it has of late years undergone considerable improvements; but many of its old streets are irregular, narrow, and dirty. A fine square, several handsome terraces, and numerous detached villas, are among its recent improvements. Castle Mona, a large and handsome building, formerly one of the seats of

[1] See however the remarks of Francis Junius, which are contained in a letter published in "The Life, Diary, and Correspondence of Sir William Dugdale," p. 383. Lond. 1827, 4to.

[2] Nott's Dissertation on the State of English Poetry before the Sixteenth Century, p. cciv.

[3] J. Scott's Life of Douglas (p. xxvi.), prefixed to his Select Works. Perth, 1787, 12mo.

[4] History of the Battle of Floddon, with notes by Robert Lambe, Vicar of Norham upon Tweed, app. p. 129. Berwick upon Tweed, 1774, 12mo.

[5] Ritson's Ancient Songs, p. 117.

[6] Scott's Minstrelsy of the Scottish Border, vol. iii. p. 127.—This lady is elsewhere said to have been Jane Elliot, who was born at Minto in the year 1726.

the Duke of Atholl, is now used as an hotel. Among the public buildings may be noticed the custom-house, court-house, market-house, house of industry, odd-fellows' hall, and public hospital. Douglas has an ancient parish church, partially rebuilt in 1773, several chapels, and places of worship for Catholics, Methodists, &c.; national, infant, and other schools; mechanics' institute; museum; and several libraries. It has some coasting trade and fisheries. Liverpool, Glasgow, and Irish steamers, frequently touch here. The harbour is dry at low water; but vessels drawing from 10 to 14 feet may enter, the former at high water neaps, the latter at high water springs. The pier—520 feet in length, and upwards of 40 in breadth—has a lighthouse at its northern extremity.

DOULEIA (from δοῦλος, *a slave*), in *Antiquity*, denoted the condition of the subject allies of the Athenians; and was also used to designate the servile class generally.

DOUNE, a village of Perthshire, Scotland; situated on the left bank of the Teith, 6 miles N.W. of Stirling. Pop. (1851) 1459, mostly employed in the extensive cotton works of Deanston, in the immediate vicinity. The ruins of Doune Castle, a large and massive fortress, built about the fourteenth century, are situated on the point of a steep and narrow elevation, washed on one side by the Teith, and on the other by the Ardoch. It was anciently the seat of the earls of Menteith; but about the beginning of the fifteenth century it was forfeited to the crown, and became the favourite residence of the dukes of Albany, who governed Scotland during the captivity of James I. Queens Margaret and Mary are also said to have frequently resided in this fortress. It was held for Prince Charles in 1745; and here he confined his prisoners taken at Falkirk, and among the rest the author of the tragedy of *Douglas*.

DOUR, a town of Belgium, province of Hainault, and arrondissement of Mons, 8 miles W.S.W. of the town of that name. Pop. (1850) 6783, chiefly employed in the coal mines and iron-works of the vicinity.

DOURO, a river of Spain. See SPAIN, and PORTUGAL.

DOUW, GERHARD, a celebrated painter, was born at Leyden in 1613, and received his first instructions in drawing and design from Bartholomew Dolendo, an engraver, and from Peter Kouwhoorn, a painter on glass. At the age of fifteen he became a disciple of Rembrandt; and in that famous school he continued for three years.

From Rembrandt he learned the true principles of colouring, and obtained a complete knowledge of chiaroscuro; but to that knowledge he added a delicacy of pencil, and a patience in working up his colours to the highest degree of finish. He was more pleased with the early pictures of Rembrandt than with those by which he was distinguished in his more advanced age; because the first seemed finished with greater care and attention than his later works, which displayed more boldness, freedom, and negligence—a style that was quite contrary to the taste of Douw. But although the manner of Gerhard Douw appears so different from that of his master, yet it was to Rembrandt alone that he owed that excellence in colouring by which he triumphed over all the contemporary artists of his own country.

His pictures are usually of a small size, with figures so exquisitely touched, so transparent, so wonderfully delicate, as to excite astonishment as well as pleasure. He designed every object after nature, and with an exactness so singular, that each object appears a perfect transcript of nature in respect to colour, freshness, and force. His general manner of painting portraits was by the aid of a concave mirror, and sometimes by looking at the object through a frame crossed with many exact squares of fine silk thread. But this custom is now abandoned, as the eye of a good artist seems a more competent rule, though the use of the mirror is still practised by some painters in miniature.

It is almost incredible what sums have been given, and are still given, for the pictures of Douw, both in his own and in other countries; for he was exceedingly careful in giving them the highest degree of finish, and patiently assiduous beyond example. Of that patience Sandrart gives a very strong proof in a circumstance which he mentions relative to this artist. Having once, in company with Bamboccio, visited Gerhard Douw, they could not forbear admiring the exquisite minuteness of a picture which he was then painting, and in particular noticed a broom, at the same time expressing their surprise at the excessive labour bestowed on such an unimportant object; upon which Douw told them he would spend three days more in working on that broom before he should consider it entirely complete. The same author relates that the wife of his great patron, M. Spiering, sat to Douw five days for the finishing of one of her hands. In consequence of his tedious style of painting, few persons would sit to Douw for their portraits; and he therefore devoted his labours chiefly to works of fancy, in which he could introduce objects of still life, and employ as much time on them as suited his own inclination. Houbraken states that M. Spiering allowed him a thousand guilders a-year, and paid besides whatever he demanded for his pictures, having purchased some of them for their weight in silver; but Sandrart, with more probability, assures us that the thousand guilders a-year were paid to Gerhard on no other consideration than that the artist should give his benefactor the option of every picture he painted, for which he was immediately to receive the utmost he demanded. This celebrated painter died in 1674, aged sixty-one.

DOVE. See ORNITHOLOGY.

DOVE-TAILING, in *Carpentry*, a method of joining together boards or timbers by cutting on the end of one piece projections in the form of a dove's tail spread, or a wedge reversed, and inserting these projections into hollows of a corresponding shape in the other piece. This forms the strongest of all joints, because the tenons or projecting pieces, from their form, cannot be drawn out.

DOVER (the ancient *Dubris*), a municipal and parliamentary borough, and one of the Cinque Ports of England, in the county of Kent, 71 miles E.S.E. of London. It is situated on the N.W. coast of the Straits of Dover, in a deep valley formed by an opening in the chalk hills which surround it in the form of an amphitheatre. On one of these hills, to the eastward of the town, and rising abruptly to the height of 320 feet above the sea, stands the ancient castle. The walls of this castle inclose an area of nearly 35 acres; containing towers and other buildings of various ages from the time of the Romans to recent times, and having accommodation for a garrison of from 3000 to 4000 men. Other portions of the heights around the town are also fortified. The town has been greatly extended of late years. A continuous line of buildings now unite it with the villages of Charlton and Buckland, which are included within its boundaries. Between the east end of the town and the castle cliffs is what may be called the new town, where superior houses have been erected for the accommodation of visitors. The old part of the town is irregularly built, and the streets are narrow and dirty. Dover has two ancient parish churches, St Mary's and St James's, the former having a Norman tower; two recently built churches; a Roman Catholic, and several Dissenting chapels; national, free, and infant schools; reading-rooms, and libraries; theatre; assembly rooms; and public baths. Many attempts have been made to improve the harbour, but with comparatively little success, from the constant accumulation of sand and shingle at its mouth. The entrance is narrow, and is between two piers. The vessels registered at the port on 31st December 1853 were 70, of the aggregate burden of 3926 tons: of these 48 vessels of 1369 tons were under 50 tons each, and 1 was a steamer of 54 tons. The vessels entered and cleared at the port during 1853 were

as follows: Coasting trade, inwards, 443, tonnage 34,310; outwards 104, tonnage 5348; colonial trade, inwards 3, tonnage 252; outwards 1, tonnage 260; foreign trade, sailing vessels, inwards 69, tonnage 5870; outwards 45, tonnage 2097; steamers, inwards 90, tonnage 11,960; outwards 1, tonnage 140. Dover is the principal station and the seat of government of the Cinque Ports. It is governed by a mayor, 6 aldermen, and 18 councillors; and returns 2 members to parliament. Pop. (1851) 22,244.

DOVER, a town in the state of New Hampshire, North America, and capital of the county of Strafford, is situated on the W. side of Piscataqua river, and watered by its tributaries the Cocheco and the Black river; 60 miles N. of Boston. The Cocheco has here a sudden descent of 32½ feet, producing a great water-power, and being at the head of tide-water and 12 miles from the sea, sloops can come up to within a short distance of the mills. It has numerous and extensive manufactures, chiefly of cotton goods; a considerable shipping; and is one of the most flourishing towns in the state. Dover is the oldest town in this state, having been settled in 1623. Pop. (1850) 8186.

DOVER, the capital of the state of Delaware, and of the county of Kent, is situated on high ground, between the two principal branches of Jones's Creek, ten miles above its entrance into Delaware Bay. It is regularly laid out, with wide streets crossing each other at right angles. The principal public building is the state house, an elegant and commodious edifice. There is also a splendid monument erected to the memory of Colonel John Haslett, who fell in the battle of Princeston. Pop. 3932.

DOWAGER (Fr. *douairière*, *dower*, from Lat. *doto*, to *endow*), a widow with a jointure; a title more particularly given to the widows of princes and persons of rank. *Queen-dowager* is the designation of the widow of a king.

DOWEL, a wooden or iron pin or tenon, used for joining together two pieces of wood, &c. Corresponding holes being made in the edge of each of the two pieces, one half of the dowel is inserted into the hole in the one piece, and the other piece is then driven home on it.

DOWER (Lat. *dos*, and *dotarium*), that portion of lands or tenements of a man which his widow enjoys during her life, after the death of her husband; and which, at her death, descends to his heirs. It also signifies the property which a woman brings to her husband in marriage, and likewise any endowment or gift. It is sometimes written dowry.

DOWLAS, a kind of coarse strong linen cloth.

DOWLETABAD, a celebrated city and fortress of Hindustan, province of Hyderabad, deemed impregnable by the natives. The fort stands on the summit of a mountain, which is surrounded with several stone walls, the lowest of which incloses the town. The two lower fortifications are in this manner completely commanded by the upper. Like all the other hill forts of India, it is unhealthy, but is still considered as the key of the Deccan. This place, notwithstanding its strength, has been frequently taken. When the Mohammedan powers carried their arms into this part of the Deccan, about the year 1203, it was the residence of a powerful rajah, and was plundered of immense riches. In 1306 it was reduced by Mallek Naib, the emperor of Delhi's general. In the early part of the fourteenth century, the Afghan emperor Mohammed III. attempted to render this place, as its present name implies, the "abode of prosperity," and with this view he endeavoured to force the inhabitants of Delhi to quit their habitations and to emigrate to the Deccan; but he was unable to carry this violent scheme into effect. About the year 1595 Dowletabad surrendered to Ahmed Nizam, shah of Ahmednuggur; and on the fall of his dynasty it was taken possession of by Mallek Amber, an Abyssinian slave. His successors reigned till 1634, when it was taken by the Moguls; and it is now comprehended in the territories of the Nizam, but has much declined since the foundation of Aurungabad in its vicinity. The district of Dowletabad is situated chiefly between the 19th and 20th degrees of north latitude, and extends along the north side of the Godavery. The city is in Lat. 19.57.; Long. 75.18. (E. T.)

DOWN, a maritime county in the south-eastern part of the province of Ulster, in Ireland; bounded N. by the county of Antrim and Belfast Lough, E. and S. by the Irish Sea, and W. by the county of Armagh. Down comprises 967 square miles, or 612,495 acres; of which 514,180 are arable, 78,317 uncultivated, 14,355 in plantations, 2211 in towns, and 3432 under water.

On the authority of Ptolemy, this county is supposed to have been anciently inhabited by the tribes of the Vinderii and Voluntii, but afterwards formed part of the ancient principality of Ulidia or Dalriada, from which colonies branched into Scotland, where they afterwards united with the Scottish monarchy, and became historically more important than the parent stock. After the arrival of the English, who, under the leadership of the celebrated John de Courcy, overran the district, it was parcelled out among the English families of White, Savage, Riddel, Poer, Sendall, Chamberlain, Russell, Audley, Copeland, &c., descendants of some few of which remain at the present day in the county. Down formed two counties, Newtownards in the north and Down in the south, from the period of the English settlement to the Irish revolt in 1333, when the English settlers were driven into the maritime baronies of Ards, Lecale, and Mourne, of which they in part retained possession. The remainder of the district fell into the hands of Irish families, the O'Neills of Clandeboy, the MacArtans, MacRorys, and MacGinnises, whose possessions, however, reverted to the crown on the attainder of Shane O'Neill, in the latter half of the sixteenth century; but having afterwards submitted to the government, they received back their former estates. In 1602 the O'Neill estates were again forfeited, and granted to Sir Hugh Montgomery and Mr Hamilton, who planted Scottish colonies on the land. The estates of the remaining old Irish and Anglo-Norman families were mostly forfeited in the rebellion of 1641, or subsequently at the Revolution.

The county is now divided into eleven baronies, Ards Lower and Upper, Castlereagh Lower and Upper, Dufferin, Iveagh Lower and Upper, Kinelearty, Lecale, Mourne, and Newry lordships: these baronies are subdivided into 70 parishes, forming the diocese of Down, which includes all the sea-coast and eastern part of the county, the greater portion of that of Dromore, and the lordship of Newry, which is exempt from episcopal jurisdiction, a privilege which it enjoys from having appertained to a monastery before the Reformation. On the dissolution of the monastery the powers and privileges of the lord-abbot were transferred to the temporal proprietor, Sir Nicholas Bagnall, to whom a patent was granted by Edward VI. "on account of his excellent services as marshal of Ireland." The proprietor of the present patent, the Earl of Kilmorey, is entitled the Lord Abbot, and is *ex officio* rector of Newry, and, by his vicar-general and surrogate, grants probates of wills, letters of administration, marriage licenses, &c., and transacts the business of an ecclesiastical court, with as full power as that of any other ecclesiastical court in Ireland.

The union workhouses are at Banbridge, Downpatrick, Kilkeel, Newry, and Newtownards. Portions of the county are also included in the neighbouring unions of Belfast, Lisburn, and Lurgan. The net annual value of property rated to the poor is L.637,989, and the amount of property valued under the 6th & 7th Wm. IV., cap 84, amounts to L.455,697. The county is within the military district of Belfast. There are 24 coast-guard stations, with about 160 men and officers. The assizes are held at Downpatrick, where the county prison and county infirmary are situated. The district lunatic asylum is at Belfast, in the county of

Antrim. There are savings-banks at Newry and Hillsborough, with deposits amounting to about L.45,000.

The chief towns are as follows:—Downpatrick (pop. 4098), of very ancient foundation, supposed to be the oldest town in Ireland), and a parliamentary borough, situated within a mile of Strangford Lough; Newtownards (pop. 9567), formerly a parliamentary borough, and in the neighbourhood of numerous religious foundations, now a flourishing town, belonging to the Marquis of Londonderry, whose residence, Mount Stewart, is within three miles distance; Banbridge (pop. 3301), the centre of the linen trade of Ulster, standing on a hill on the left bank of the Bann, from which, and the bridge by which it is crossed, the name originated; Donaghadee (pop. 2818), the nearest port to Scotland, formerly a packet-station, now a trading-port and pleasant sea-bathing place; Bangor (pop. 2850), a small ancient seaport, with a good harbour, and fine beach adapted for bathing; Rathfriland (pop. 2053); Portaferry (pop. 2074); and Newry (pop. 13,491, of which number 3875 are in the county of Armagh), a place of considerable trade, and with great natural advantages of situation.

The population of the county of Down, which Beaufort in 1792, estimated as amounting to 201,500, has been found, according to the parliamentary returns at various periods, to have been as follows:—in 1821, 325,410; in 1831, 352,012; in 1841, 361,446; and in 1851, 320,817.

In 1824–26 the number of children receiving education in 550 schools was 13,456 boys and 8375 girls; the total number amounting to 22,828, of whom 4347 were Protestants of the Established Church, 6120 were Roman Catholics, and 11,615 Dissenters, chiefly Presbyterians; and a remaining number of 411, whose religious persuasion was not ascertained. In 1851, according to the census returns, the state of education of the population, five years old and upwards, was as follows:—

	Rural Districts.	Civic Districts.	Total.	Propor. per cent. in 1851.	Propor. per cent. in 1841.
Could read and write..	107,597	16,731	124,328	44	39½
Could read only.......	81,108	11,085	92,193	31½	33
Could neither read nor write..	61,689	7,786	69,475	24½	27½

The diocesan grammar-school of Down, at Downpatrick, is now formed into a joint district school for Down and Dromore.

The Presbyterian form of worship predominates, especially in the towns and low country. In the mountainous part the Roman Catholic religion prevails to a great extent. In 1834 the population, divided according to their religious persuasion, was ascertained to consist of 27,662 Churchmen, 98,961 Presbyterians, 3530 other Protestant Dissenters, and 58,405 Roman Catholics.

Previous to the union with Great Britain, Down returned fourteen members to the Irish parliament; two for the county at large, aud two for each of the boroughs of Bangor, Downpatrick, Hillsborough, Newry, Newtonards, and Killileagh. Since the union it has been represented by four members, two for the county, one for Downpatrick, and one for Newry, the Reform act having made no change in the number or distribution of the representatives.

So far as inequality of surface is essential to scenic beauty, this county, presenting every variety of plain, hill, and mountain, has strong claims to it. The plains are chiefly confined to the vicinity of rivers, the hills occupy the greater portion of the surface, and the mountains are accumulated together in one immense mass in the southern barony of Mourne. Slieve Donard, the highest summit of the Mourne mountains, is 2796 feet above the level of the sea, and, excepting Lugduff in Wicklow and several summits near Killarney, it is not exceeded in height by any other mountain in Ireland.

The Mourne Mountains and their subordinate branches give rise to the four principal rivers. The Bann (lower) rises near the Irish sea, and flows north-eastward by Banbridge and Portadown into Lough Neagh; the Lagan rises on the northern declivities of the Slieve Croob mountains, four miles south of Ballinahinch, and flowing in various directions to the boundary of the county, continues its course through an eminently beautiful country to Belfast; the Annacloy, or Ballinahinch river, rises near Hillsborough, and discharges its waters into the southern extremity of Strangford Lough, about a mile below Downpatrick; the Newry Water is an insignificant stream, except where it is affected by the influence of the tide, and would be unworthy of notice but that it is the commencement of a water communication by canal with Lough Neagh. The Newry navigation or canal, which was the first completed in Ireland, opens a water communication with the counties of Antrim, Armagh, Derry, Down, and Tyrone; and, by means of the Ulster Canal (which connects Lough Erne and Lough Neagh), Cavan, Fermanagh, and Monaghan export and import their merchandise through the port of Newry.

Lakes, properly so called, are numerous, but insignificant in extent. Strangford Lough, with its numerous islands, old castles, abbeys, and ornamented shores, is a spacious gulf extending ten miles northwards into the land, and affording a secure roadstead to large vessels in its interior. Strangers, however, are unwilling to have recourse to it, on account of the rapid current of the tide, which rushes through the narrow strait between Portaferry and Strangford at the rate of eight or ten miles an hour, which, with sunken rocks and shoals, renders the navigation dangerous. This gulf is studded with numerous islands, some beautifully wooded, others affording rich pasturage. Bangor, Killough, and Ardglass, have each a harbour for fishing-boats and small craft. An artificial harbour was constructed at Donaghadee for the accommodation of the packet-boats to Scotland; but the introduction of steam navigation has rendered it comparatively useless. Near the coast of the Ards, a long narrow peninsula between Strangford Lough and the sea, are the Green Island, Bird Island, and Burr Island; and at the entrance of Carrickfergus Bay is a group of three, called the Copeland Islands, upon the lesser of which stands a lighthouse. There is also a lighthouse at Haulbowling Rock off Carlingford Bay, one at Ardglass Harbour, one at St John's Point near Ardglass, and another on a sunken reef called the South Rock, near the northern entrance of Strangford Lough. At the northern extremity of the county is Belfast Lough; and on the south, dividing Down from Louth, is Carlingford Bay or Lough—a highly picturesque marine inlet, forming a perfectly safe harbour of refuge, but obstructed by a bar at its entrance.

The mineral springs found here are of two qualities, sulphuro-chalybeate and purely chalybeate. The most celebrated of the former kind is at the foot of Slieve Croob Mountain, which rises to the height of 1800 feet—about two miles from Ballinahinch. In appearance, taste, and effects, it strongly resembles the waters of Aix-la-Chapelle. It is used both externally and internally, and has been found peculiarly effective in scorbutic affections. The town is much frequented in summer by invalids. Chalybeate springs are numerous, and widely scattered through the county. On the sea-coasts are many places admirably adapted for sea-bathing and summer residence. Dundrum, on the bay of the same name, is a small retired watering-place, owned by the Marquis of Downshire; Ardglass, formerly one of the chief seats of trade in Ulster, and a parliamentary borough, is delightfully situated, and, besides being the chief fishing port on this coast, ranks high as a bathing place; Holywood, on the eastern shore of Belfast Lough, is much frequented; Warrenpoint, at the head of Carlingford Lough, is much frequented by the inhabitants of Newry; Newcastle, on

Dundrum Bay, is also a fashionable marine summer residence; Kilkeel, close by the open coast and backed by the Mourne Mountains, is a thriving town and agreeable bathing place; but above all others in attraction is Rosstrevor, which is not exceeded in beauty of situation by any place in Ireland. "Were such a bay lying upon English shores," says Mr Thackeray in his Irish Sketch-Book, "it would be a world's wonder; perhaps if it were on the Mediterranean or the Baltic, English travellers would flock to it in hundreds.

The predominating soil is a loam of little depth, in most places intermixed with considerable quantities of stones of various sizes; but differing materially in character according to the nature of the subsoil. Clay is mostly confined to the eastern coast of the Ardes, and to the northern parts of Castlereagh. Of sandy soil the quantity is small; it occurs chiefly on the sea-coasts, especially near Dundrum. Moor grounds are mostly confined to the skirts of the mountains. Bogs, though frequent, are scarcely sufficient to form a supply of fuel to the population. There are several quarries of fine sandstone. The best is that on Scrabb Hill, near Newtownards, where a very close-grained, clear-coloured, and hard and durable stone is raised. Limestone is not very general. The quarries of Kilwarlin afford flags of large dimensions, varying in hue from a clear stone colour to a brownish red; the former being superior in beauty and hardness. Slates are raised in several parts, inferior to the Welsh in lightness and colour; large blocks of a yellowish magnesian limestone are found near Holywood. This kind, however, is inferior to the white species as a manure. Near Comber, on the shores of Strangford Lough, is a very hard and sparkling kind of reddish granular limestone. But the greatest magazine of this rock is in the vicinity of Moira. It is supposed to be a continuation of that bed which is perceptible, with little interruption, from Magilligan in Londonderry, round the headlands of Antrim, to the range of mountains that lie north of Lisburn, whence turning westward, it is lost in the acclivities that border the Lagan between Moira and Magheralin. Here the stone lies very near the surface. It is found in horizontal strata intermixed with chert, in some cases in layers, in others in detached pieces of different form and size, containing various kinds of shells and other marine exuviæ. Granite occurs in many places in detached masses, but the great body of it is confined to the southern and western regions, chiefly in the Mourne Mountains, where it differs in mineral character from the Wicklow granite, in containing hornblende and felspar of a reddish colour. Though it is here the prevailing rock, it does not wholly exclude the schist or slate, which is often seen in contact with it. In the granite of Slieve Donard, the highest of the Mourne Mountains, crystals of topaz and beryl are found. Indications of lead have been discovered near Castlewellan, Killough, Newtownards, and Warrenpoint; and traces of copper in the Mourne Mountains near Rosstrevor.

The land is very unequally portioned out among the inhabitants; the number of holdings in 1853 not exceeding 1 acre in extent being 1793, and those above 1 acre 29,289, of which 5000 were between 1 and 5 acres, 12,568 between 5 and 15, 7259 between 15 and 30, 2879 between 30 and 50, 1296 between 50 and 100, 207 between 100 and 200, 59 between 200 and 300, and 21 above 500 acres in extent. There are many landed proprietors, mostly resident, each of whom holds large tracts in his own hands. Under these is a numerous tenantry of every grade, from those who deem themselves entitled to rank on nearly an equal footing in society with the proprietors of the soil, to the holders of a few acres, who depend on their manual labour for the support of their families. The great bulk of the population is orderly and industrious. Their dwellings are better constructed and furnished than those of a similar class in most other parts of Ireland. The processes of agriculture, owing in a great degree to the example set by the resident gentry, are as skilfully carried on as in any part of Ireland. The crops chiefly cultivated are wheat, rye, barley, oats, peas, flax, and potatoes. Barley is extensively grown, particularly in the light soil of Lecale. Green crops are also in general use. Much attention is paid to the culture of grass, particularly on the borders of the larger rivers, where extensive tracts of fine meadow land are annually enriched, by the overflowing of the banks, with deposits of the finer particles of mould washed down from the higher grounds. The extent of land under crops in 1853 was 308,100 acres—viz. corn, beans, and peas, 174,204; potatoes, 42,085; turnips, mangold-wurzel, carrots, and other root crops, 28,126; cabbage, vetches, and other green crops, 3353; flax, 26,957; and meadow clover and rape, 33,375 acres. The mean rate of produce per acre exceeds the average of productiveness for all Ireland in beans, peas, potatoes, turnips, mangold-wurzel, and cabbage; the cereal crops of the county being below the average. The total produce of corn, beans, and peas in 1853 was 118,958 tons, or 823 lb. per head of the population, the average for Ireland being 700 lb.; of potatoes 2,452,075 barrels were grown in 1853, averaging 151 barrels per head, or 11 barrels above the general average. In an inquiry instituted for the purpose of ascertaining the condition of the farms in the 32 counties of Ireland, Down stands number six on the list; and in another as to the comparative condition of the road sides, this county appears third in order, and therefore may be considered as one of the best cultivated and least neglected in Ireland.

Horned cattle are principally reared for dairies, and therefore the same attention to figure and flesh is not paid as in some other agricultural districts. The resident gentry are, however, laudably emulous in the improvement of their respective stocks. The breed of horses is also an object of much attention, and some of the best racers in Ireland have been bred in this county. The native breed of sheep, a small hardy race, is confined to the mountains. Many of this breed are well made and finely woolled. The various other kinds of sheep have been much improved by judicious crosses from the best British breeds. Hogs are reared in great numbers, chiefly for the Belfast market, where the large exportation occasions a constant demand for them—hams of very superior quality being prepared from them in that town. Rabbits also form a part of farm stock in the sandy southern tracts.

In 1841 the live stock of the county consisted of 31,174 horses and mules, 70,601 horned cattle, 25,530 sheep, 59,427 pigs, 279,696 head of poultry, and 260 asses; the estimated value of all being L.817,917; while in 1852 on 29,595 holdings there were 31,453 horses, 1330 mules and asses, 119,309 cattle, 45,968 sheep, 54,254 pigs, 9702 goats, 402,963 head of poultry, of the total value of L.1,163,308.

Manufactures, of which linen is the staple, are carried on largely in the neighbourhood of Belfast and Newry, and several of the smaller towns have risen to importance as places of manufacture. The finer fabrics of linen are the chief articles of manufacture. In 1850 there were eleven flax mills in the county employing 4352 persons. The woollen manufacture is confined to a coarse cloth wrought solely for home consumption.

The fisheries are by no means so extensive or flourishing as the great extent of sea-board would warrant. Belfast market is chiefly supplied from Carrickfergus, yet fish of every description abound on the coast of Down. The fishery districts of Donaghadee, Strangford, Newcastle, and Carlingford comprise 139 miles of maritime boundaries, having, in 1853, 1468 registered fishing vessels, employing 4642 men and boys. Shoals of herrings frequently go up to Strangford Lough, but these are not so much esteemed as those caught in the open sea. Smelts are taken in large quantities at the entrance of the same lough. Shell-fish abound along the rocky shores, particularly in the neighbourhood of the Copeland Islands. Oysters of superior quality are dredged at Ringhaddy, Carlingford, and Bangor; and mussels in inexhaustible numbers cover the shallow banks that stretch out before Holywood.

Several remains of antiquity, coeval with the rudest ages of society, are to be found in this county. At Slidderyford, near Dundrum, is a group of pillar stones, consisting of ten or twelve, from eight to ten feet in height, forming a circle. A remarkable cairn, on the summit of Slieve Croob, is nearly eighty yards in circumference at the bottom and fifty at the top, forming a platform, on which several cairns of various heights and dimensions are erected. Another cairn near the village of Anadorn was found to cover a cave containing ashes and a number of human bones. Several cromlechs, or altars so called, also exist, the most remarkable of which is in the Giant's Ring, on the summit of a hill between Lisburn and Belfast. It is formed of an unwrought stone seven feet long by six and a half broad, resting in an inclined position on several rude pillars from two to three feet high. It stands nearly in the centre of an inclosure about one-third of a mile in circumference, formed of a rampart of earth about twenty feet high, sloping on each side, and broad enough at the top for two persons to ride abreast. Near Downpatrick is a rath or mound of earth three quarters of a mile in circumference, its exterior consisting of three artificial ramparts, the largest of which is thirty feet broad. In its vicinity are the ruins of Saul Abbey, said to have been founded by

St Patrick; and Inch Abbey, founded by Sir John de Courcy in 1180. The number of monastic ruins is also considerable. The most ancient and celebrated is the Abbey or Cathedral of Downpatrick, supposed to have been founded by St Patrick soon after his arrival here in 432, and said to contain his remains, together with those of the other favourite saints of the Irish, St Columb and St Bridget. It was restored in 1790, when the adjoining round tower was taken down. Beneath the foundation of the round tower a wall was found to proceed to the main building of the abbey. Struel, or as it is sometimes called, St Patrick's Wells, to the east of Downpatrick, merits notice from its connection with former religious observances. These wells are four in number, each covered by a stone vault, and having the water conveyed from the others by subterraneous aqueducts. Great numbers of people from various parts of Ireland resort to this place on Midsummer eve, and on the Friday before Lammas, to perform religious ceremonies, chiefly consisting of penances, and to obtain relief from bodily complaints. The ruins of many castles, particularly upon the coast, are still visible. Amongst the most remarkable is Greencastle, built on an islet in the barony of Mourne, by De Burgo Earl of Ulster, and intended to maintain a communication between the English settlers in this county and those in the county of Louth. This castle was considered of much importance; and in consequence of the rapid assimilation of manners and the sympathy usually found to exist between the natives and the descendants of settlers, no person but one of English birth was permitted to be its constable. (H. S—R.)

Down, the fine feathers on the breasts of several birds, particularly of the duck kind. That of the eider duck is the most valuable. These birds pluck the down from their breasts and line their nests with it. Three pounds of this down may be compressed into a size scarcely larger than one's fist; yet it is afterwards so dilatable as to fill a quilt five feet square. That found in the nests, and termed *live down*, is most valued; being much more elastic than that plucked from the dead bird.

DOWNHAM, a market-town of England, county of Norfolk, on the right bank of the Ouse, which is here crossed by a stone bridge, 11 miles S. of Lynn. Pop. (1851) 2867. The town is situated on an acclivity, the summit of which is occupied by the parish church, an ancient Gothic edifice, with a low embattled square tower surmounted with a spire. The market is held on Saturday, and is noted for its supply of fish and wild fowl.

DOWNPATRICK, a municipal and parliamentary borough and market-town of Ireland, capital of the county of Down, 74 miles N.N.E. of Dublin. It is situated in the bottom of a valley formed by hills of some elevation, near the S.W. extremity of Strangford Lough, and is divided into the English, Irish, and Scotch quarters. It consists of four main streets meeting near the centre, the principal of which are the Irish and English streets. In the former all business is carried on; the latter is well built, and contains several neat private residences. The principal buildings are the cathedral parish church, Roman Catholic chapel, two Presbyterian and three Methodist meeting-houses, diocesan school, county court-house, prison, alms-houses, widows' houses, barracks, infirmary, and fever hospital. A small trade is carried on at Strangford Lough by means of vessels of 100 tons, which discharge at Quoil quay, about a mile from the town; it is, however, projected to deepen the Quoil river, and make a harbour close to the town. The linen manufacture is carried on to a small extent, as well as brewing, tanning, and soap-making. Market-days Tuesday and Saturday. Adjoining the town are the ruins of Inch Abbey, a large rath in good preservation, and a race-course. Pop. (1851) 4098. Downpatrick returns a member to parliament; constituency (1853) 222. Previously to the Reform act it was the most open borough in Ireland; as all the persons who paid scot and lot, or boiled a pot, in the town, were electors.

DOWNS, a bank or elevation of sand, which the sea gathers and forms along its shores, and which serves it as a barrier. The word is formed from the French *dune*, or the Celtic *dun*, a mountain. Charles de Visch (*Compend. Chronolog. Exord. et Progress. Abbat. Clariss. B. Mariæ, de Dunis*) says, *Vallem reperit arenarum collibus, quos incolæ* Duynen *vocant, undique cinctam.*

It is also applied to a large open plain, primarily on elevated land.

Downs is particularly applied to a famous roadstead for ships along the eastern coast of the county of Kent, from Dover to the North Foreland, where both outward and homeward bound ships frequently make some stay, and squadrons of men-of-war rendezvous in time of war. It affords excellent anchorage, and is defended by the castles of Deal, Dover, and Sandwich.

DOWNTON, a town of Wiltshire, formerly a parliamentary borough, but disfranchised by the Reform act. It is situated on the Avon, which is here divided into three branches, each of which is crossed by a bridge, 6 miles S.S.E. of Salisbury. It consists chiefly of one long irregularly built street. The principal building is the parish church, a large cruciform edifice with a tower. The market formerly held here has long been discontinued. Pop. (1851) 2727.

DOWRY, the money or fortune which the wife brings her husband in marriage. It is otherwise called *maritagium*, or marriage goods, and is considered to differ from dower; but this distinction is merely arbitrary. See Dower.

DOXOLOGY, a hymn used in praise of the Almighty, and distinguished by the title of *greater* and *lesser*. The lesser doxology was anciently only a single sentence, without response, running in these words, "Glory be to the Father, and to the Son, and to the Holy Ghost, world without end, Amen." Part of the latter clause, "As it was in the beginning, is now, and ever shall be," was inserted some time after the first composition. Some read this ancient hymn, "Glory be to the Father, and to the Son, with the Holy Ghost;" and others, "Glory be to the Father in or by the Son, and by the Holy Ghost." This difference of expression occasioned no dispute in the church till the time of the Arian heresy; but when the followers of Arius began to make use of the latter as a distinguishing character of their party, it was entirely laid aside by the Catholics, and the use of it was enough to bring any one under suspicion of heterodoxy. The doxology was used at the close of every solemn office. The Western church repeated it at the end of every psalm, and the Eastern church at the end of the last psalm. Many of their prayers were also concluded with it, particularly the solemn thanksgiving or consecration prayer at the eucharist. It was also the ordinary conclusion of their sermons. The greater doxology, or angelic hymn, was likewise of much consequence in the ancient church. It began with these words, which the angels sung at our Saviour's birth, "Glory be to God on high," &c. It was chiefly used in the communion service, and in private devotions. Both the doxologies have a place in the Church of England, the former being repeated after every psalm, and the latter used in the communion service.

DRABLER, in seamen's language, a small sail or piece of canvas laced to the bonnet of a sail to give it more drop.

DRABS, wooden boxes used in saltworks for holding the salt when taken out of the boiling pan. The bottoms of the drabs are shelving or inclining, that the moisture may drain off.

DRACHMA, an ancient Greek silver coin, in value about 9¾d., or equivalent to the French franc. The weight of the Attic drachma was about 66 grains; and the Eginetan was 1⅔ of the Attic. An Alexandrian drachma weighing 126 grains has also been found. The weight called drachm, used by the modern apothecary, is equivalent to the eighth part of an ounce, or 60 grains, or 3 scruples.

DRACO, the Athenian legislator, flourished B.C. 622. See Attica.

Draco, in *Astronomy*. See Dragon.

DRACONARIUS, in *Antiquity*, a standard-bearer. Several nations, as the Persians, Parthians, and Scythians, bore dragons on their standards; and hence the standards themselves were called *dracones*, or dragons. The Romans are generally supposed to have borrowed the same custom from the Parthians; though Casaubon thinks they took it from the Daci, and Codin that they derived it from the Assyrians.

The Roman *dracones* were figures of dragons painted in red upon the flags, as appears from Ammianus Marcellinus; but amongst the Persians and Parthians they were, like the Roman eagle, figures in full relievo.

DRACONTIC MONTH, the time of the revolution of the moon from her ascending node, called *caput draconis*, to her return thither.

DRAGOMAN, or DROGUEMAN, an interpreter; a term of general use in the Levant and throughout the East. There are dragomans attached to the embassies and consulates of Christian nations residing at the Porte. The word is formed from the Arabic *targeman* or *targiman*, of the verb *taragem*, "he has interpreted." From *dragoman* the Italians formed *dragomanno*, and, with a nearer relation to its Arabic etymology, *turcimanno*; whence comes *truche-man*, as well as *dragoman* and *drogueman*.

DRAGON (Lat. *draco*, Gk. δράκων), a fabulous kind of fiery winged serpent, or nondescript creature, much celebrated in the romances of the middle ages. The dragon, in heraldry, is borne in coats, crests, and supporters. Dragon is also the name of a constellation in the northern hemisphere. See ASTRONOMY. The name *Draconidæ* is likewise applied to a genus of small Saurian reptiles.

DRAGON'S Head and Tail (*caput et cauda draconis*), are the nodes of the planets, or the two points in which the ecliptic is intersected by the orbits of the planets, and particularly that of the moon, making with it angles of 5 degrees and 18 minutes. One of these points looks northward, the moon beginning then to have north latitude; and the other southward, where she commences south. Thus her deviation from the ecliptic seems, according to the fancy of some, to made a figure like that of a dragon, whose belly is where she has the greatest latitude; the intersection representiug the head and tail, from which resemblance the denomination arises. But these points abide not always in one place, but have a motion of their own in the zodiac, and retrograde 3 minutes 11 seconds per day, completing their circle in 18 years 225 days; so that the moon can be but twice in the ecliptic during her monthly period, and at all other times she will have a latitude or declination from the ecliptic. It is about these points of intersection that all eclipses happen. They are usually denoted by these characters, ☊ dragon's head, ☋ dragon's tail.

DRAGON'S Blood, a resinous substance much used for tinging spirit and turpentine varnishes, for preparing gold lacquer, staining marble, &c. It is the produce of several trees,—as *Calamus draco*, *Dracæna draco*, *Pterocarpus draco*, &c.; and is imported from the East Indies, Africa, and South America, in dark red lumps, in rolls, and in irregular cakes. When pulverized it is of a bright red colour. Its solvents are alcohol, ether, and oils.

DRAGONNEE, in *Heraldry*, is said of a lion or other beast of which the hinder half terminates like the hinder part of a dragon.

DRAGOON, in military affairs. See ARMY.

DRAGOONING (Fr. *dragonnade*), abandoning to the rage of soldiers; one of the methods that have been used for converting refractory heretics, and bringing them within the pale of "the true church." The manner of dragooning the French Protestants, after the revocation of the edict of Nantz, under Louis XIV., is described as follows in a French work translated in 1686. "The troopers, soldiers, and dragoons, went into the Protestants' houses, where they marred and defaced their household stuff, broke their looking glasses, and other utensils and ornaments, let their wine run about their cellars, and threw about their corn and spoiled it. And as to those things which they could not destroy in this manner, such as furniture of beds, linen, wearing apparel, plate, and the like, they carried them to the market-place, and sold them to the Jesuits and other Roman Catholics. By these means the Protestants in Montaubon alone were, in four or five days, stripped of above a million of money. But this was not the worst. They turned the dining-rooms of gentlemen into stables for their horses; and treated the owners of the houses where they quartered with the highest indignity and cruelty, lashing them about from one to another, day and night, without intermission, not suffering them either to eat or drink; and when they began to sink under the fatigue and pains they had undergone, they laid them on a bed, and when they thought them somewhat recovered, made them rise, and repeated the same tortures. When they saw the blood and sweat run down their faces and other parts of their bodies, they drenched them with water, and, putting over their heads kettle-drums turned upside down, they made a continual din upon them till these unhappy creatures lost their senses. When one party of these tormenters were weary, they were relieved by another, who practised the same cruelties with fresh vigour."

DRAGUIGNAN, a town of France, capital of the department of Var, as well as of a cognominal arrondissement, situated in a fertile valley surrounded by vine and olive-covered hills. The town is tolerably well built, and is ornamented with numerous public fountains. The principal buildings are the court-house, prison, clock-tower, and hospital. Draguignan has a public library of 15,000 vols., botanic garden, natural history museum, communal college, and a society of agriculture, besides manufactures of broad cloths, silks, stockings, soap, leather, brandy, and earthenware. There are also several oil mills in the town. Pop. (1851) 8009.

DRAINAGE.

Drainage of Towns.

UNDER this head we shall commence with the drainage of towns and other inhabited places, with more particular reference to the removal and discharge of cloacal and other foul matters in a liquid state from human habitations.

We shall then notice the drainage of lands for agricultural purposes, and the drainage of fens, marshes, &c.

The first of these subjects has been already referred to in the supplement to ARCHITECTURE (vol. iii.), and the remarks made in that place may be taken as introductory to the present article. For the drainage of fields for farming operations, see also AGRICULTURE.

It was there shown that the removal of sullage by means of sub-surface sewers, whereby it has acquired the name of sewage, is of comparatively recent introduction. Towns are commonly built upon sites of which the immediate subsoil is percolable by liquids, and into which the excreta arising in and from human habitations have been dejected into cesspools formed in it; and no volatile and active gases are thrown out, under such circumstances, in quantities sufficient to produce any sensibly injurious effect upon the atmosphere. The gases which are evolved are deadly; but are comparatively innocuous while undisturbed.

Drainage of Towns.

The foulness of old towns which stand upon dry sand or gravel, or other percolable stratum of soil, may be referred rather to accumulations in and about the buildings of such corruptible animal and vegetable refuse as may not be thrown into the cesspool, and which cannot be made to pass away by drains: so that, in truth, effective scavengering is the first essential to wholesome ventilation, when excreta are dejected upon or into a soil which will absorb the liquids, and such must be the case indeed whatever system of sewering may be applied. It is not to be overlooked, nevertheless, that such soils as allow the liquid parts of excreta to pass away, do but filter them down into the water, for the sake of which, probably, the site was originally chosen, and that these liquid excreta are thus apt to reappear in the wells, and to poison one of the supports of life in another direction. But, however, disgusting this idea may be upon reflection, it does not always occur to the mind; and it is not until the close crowding together of human beings into the commonly small space which the original site of an old town comprises, that any effect really injurious to health can arise from that source; nor is it, indeed, to the source referred to that the most disgusting apprehension is traced, but to the deposit of the mortal remains of humanity within the strata from which springs of water are derived. Nor has the necessity of drainage, as a means of relieving towns of sullage, and of the exhalations consequent upon its exposure to heat and air, become recognised because of the defects of the system which retained the solids of human excreta within or immediately about the buildings in a town situated upon a bed of dry gravel, but because towns have outgrown their sites, and extended their buildings to the clay which so commonly occurs under beds of sand or of gravel. It has been seen that London has in this manner outgrown the limits of the gravel bed, and has been thrown upon the blue clay underlying the fine stratum of gravel which forms the banks and bed of the Thames in its course through London, and which comes to the surface at from one to two miles inland on each side of the river. No sooner was the clay touched by buildings, than the necessity of providing for the immediate removal of sullage became apparent; and in the endeavour to secure such removal by drainage in places where drainage is absolutely essential to allow of the occupation of the site for human habitation at all, a system deficient in a most important particular has been carried out to the serious detriment of those parts and places which had been already closely built over, and the air of which is injured more by the exhalations of the steaming sullage drain, than by anything emitted from a close cesspool dry-steined in gravelly soil.

But sewering will not supersede the necessity of scavengering, nor, indeed, if due regard be paid to the wholesomeness of the locality, ought sewering to be preferred to the dry cesspool, where a dry cesspool is available to the effect already indicated, unless provision be first made for scouring the contents away, and for removing directly to the upper air the gases which they will evolve in their passage.[1]

It is obviously esssential to the effectual relief of a town by drainage, that no building in or out of which matters requiring to be carried off by drains can arise, be built at so low a level, with reference to the eventual removal from the town of such matters, that the perfect drainage of the building cannot be effected by existing and available means of discharge; and no system of drainage can be carried out in any town lying low with reference to the outfall, unless provision be made by authority to the effect that when existing buildings cannot be otherwise fully relieved, artificial means shall be employed to relieve the low-level sewers.

It is further requisite to the effectual drainage of a town that there be such a supply of water to all buildings occupied for the purposes of life, that all matters entering their drains may be attended or be followed by water enough to carry the sullage onward without depositing in the drains, and that there be also such a supply of water to scour the main drains or sewers, either in a constant flow or in frequent and copious flushes, as will prevent the sullage from being arrested within them long enough either to deposit filth or to throw off noxious gases.

The fall of drains and sewers ought to be greater, and may be less, according to the provision available for scouring them, or of keeping up a current within them in any case. Half an inch of fall in every ten feet is the slightest permissible fall for a house-drain under the best circumstances; that is to say, when the supply of water to the house is so ample that the waste will certainly furnish a good scour therefrom; but one, two, or even three inches of fall in every ten feet in length of such a drain may be requisite when the supply of water is scanty and the waste is likely therefore to be slack.

A fall of one and a half inches in every 100 feet in length is fall enough for a main drain or common sewer when it has a well-formed and evenly-built concave bottom, and when a constant flow of water, in quantity sufficient to prevent the sullage from depositing any of its heavier matters in the sewer, may be relied upon; but the fall should be greater when mere flushes of water are to be used as a means of carrying on the sullage. As regards size, house-drains and town-drains,—or private drains and common sewers, to use the terms more commonly applied to them, —do not require to be of the large sizes of which they are usually made for the mere reception and conveyance of the sullage of the building, or of the town or district; but there are sufficient reasons why they should be made larger respectively than would be sufficient for those purposes alone.

It is a good general rule in all matters relating to constructions, that every part of any work liable, in its use, to derangement from any cause, be made accessible for the purposes of repair or of renewal. This rule ought to be especially adhered to in all matters relating to the drainage of buildings; whether it be of water, as liable to affect the structure, or of sullage, as liable to affect the health and comfort of the inhabitants; and what is true of a building is true of aggregations of buildings in a town.

But, in providing for easy access to whatever pipes and drains may occur inside a building, the arrangements to secure that object should be made in such manner as to occasion the smallest possible amount of inconvenience within the building whenever occasion may arise for employing them. And in like manner, as it regards the connexion of private or house drains with the main drains or sewers,—and as to the building and the repair of the sewers themselves, indeed,—arrangements should be devised to such effect that all such works may be executed without interfering, or with the smallest possible amount of interference, with any public way, or with the convenience of the public in the use of the public ways.

In providing for the relief of any place from superfluous waters, the first thing to be secured is an outfall or place at which they may be discharged, or otherwise so disposed of that they shall not return. An outfall must, therefore, be at a lower level than the place to be relieved, but it may be either natural or artificial. A country like Holland, or a place like the Isle of Dogs, east of London—the one fronted by a tidal ocean, and the other almost girt around

[1] In coal countries, where ash and cinder arise in large quantities in even the poorest dwellings, and go to the ash-pit or dust-bin with animal and vegetable refuse, and excreta, the injury to the air of the locality from defective scavengering is not so great as it is in London, and other towns where coal is dear, and ash and cinder therefore scanty.

by a tidal river—finds natural vent for its superfluous waters at intervals, though at the expense of artificial works, and subject to whatever inconvenience may arise from the retention of the waters during the intermediate periods. The outfalls obtained in these cases are not such as would be chosen when better are obtainable, nor would such be rejected when they present themselves at a level available to the relief of the surface of a site, although they may not be at a level low enough to relieve subterranean conduits of whatever they may contain.

An outfall being obtained, whether it be natural or artificial, means are to be devised for collecting the liquid waste and bringing it together to the outfall for discharge. If this be so much below the level of the area to be relieved as to allow of fall enough in channels or other conduits,—and the receptacle at the point of discharge be such as to allow of such disposal,—the waste waters may be permitted to carry with them not only matters in solution, as culinary and cloacal refuse from the dwellings of men, but even the muddy washings of the streets of a town. If, however, the available outfall be not so low, or the eventual receptacle be not of such a character as to admit matters liable to deposit silt, prudence will dictate the propriety of keeping the foul matters, though solved in water, from becoming entangled with what may check their course to the outfall, and providing for the removal of the comparatively clean, though heavy dirt, being the street washings, by another channel. That is to say, a town situated on high ground and near, for instance, to the sea, may be relieved of its surface waters, the washings of its streets, and its sullage, being its cloacal refuse, kitchen and washing waste, by the same sewers without any inconvenience, and consequently at less cost than a town can be relieved of its waste under other and less advantageous circumstances, in respect of relative level of outfall and area to be relieved. In the case last supposed, a single system of sewers may suffice; but in the other case a double system ought to be formed, that the heavy and insoluble washings of the street may not mingle with and delay the solved and soluble domestic refuse.

Taking the more difficult case of a town of which the available outfall for its sullage is low with relation to the general area, the question naturally presents itself, what rate of fall is sufficient to secure relief, in the particular case contemplated, by or through the given outfall? And the obvious answer is, that the rate must depend upon the degree of fluidity of the sullage, and the condition as to smoothness or otherwise of the surface over which it is to run. Tar or treacle will not run so fast upon a surface of glass as oil will travel over a surface of lead laid at the same inclination; and water will make its way over a rough surface of brickwork laid with a like fall more rapidly than either of the viscid liquids can travel over the smoother surfaces assigned to them. The rate of inclination proper for drains or other conduits for the ready relief of a town of its liquid waste depends, therefore, firstly, upon the degree of fluidity of the waste, and, secondly, upon the condition as to smoothness of the surface over which it is to make its way to the outfall. Hence the objects to be aimed at when the outfall is bad, that is to say, high with reference to the area to be relieved, are to bring the waste as nearly as may be to the condition as to fluidity of unclogged water, and to provide drains the inside surface of which shall offer the least possible degree of resistance to the fluid by roughnesses or inequalities of surface, especially as regards the transverse section of the drain. It is to be borne in mind, at the same time, that although the fluidity of waste water, bearing sullage in solution, cannot be too perfect, having regard to the more effectual removal of the solved foul matters, the rate of fall may be too great for the conduits, whether they are open channels or covered drains. Open channels may be overfilled by a too rapid backwater, and the sullage run over before it has time to reach the outfall, as rivers are apt in their lower reaches to overflow by flushes of water coming into them too rapidly from their upper and more steeply inclined reaches; whilst in the case of barrelled or tunnelled drains, the sullage will be choked back to its source when the structure of the drains is strong enough to resist the pressure of the head that may be formed, or, the structure being weak the drain gives way, and a filthy bog is formed. Subterranean *built* drains, whether large or small, when they are well built of brick or stonework, and of substance enough to withstand the pressure of the ground about them, are generally found to be strong enough to resist whatever head may be formed by backwater hurrying down from upper reaches; but drains composed of pipes of pottery, or other substance strong enough, it may be, to bear the pressure of the ground, are weak at the joints, which commonly give way to a comparatively slight head of water acting within the drains, in which case the soil in which the pipes are laid is softened by the ejected liquid, the joints are drawn, and the above-stated result follows. But every part in the length of a drain is lower than the part above, and is liable, therefore—irrespective of obstructions arising from the casual presence within the drain, in any part below, of foreign and uncontemplated substances—to be exposed to pressure from a head of backwater sufficient to destroy a weakly-built drain, or a pipe drain of which the joints are so weak as to be unable to withstand the pressure of a head equal to that of the overflow level at which relief may be obtained. But such relief to the insufficient or ill-disposed drain is purchased by the inhabitants of the place at which the overflow may occur at too high a price in annoyance to be suffered; and to avoid this contingency, all drains ought to be made large enough in every part to give free passage onwards, and to the eventual outfall, of everything that can pass into them under the most exigent circumstances possible in any case. And this consideration is irrespective again of that which regards the larger drains or common sewers under public ways, or near to heavy buildings, or elsewhere, at a great depth in the ground, which are with great advantage made larger than their purposes as conduits for waste waters might require them to be made, that there may be roomy access within them for workmen to form inlets from branches, to amend possible defects in the structure, or to remove casual obstructions.

It often happens that, as in the cases of much of the area of Holland, and all the Isle of Dogs before alluded to—except, indeed, as to the sea and the river walls or embankments respectively—the waste waters accruing within the area to be relieved between half, or even three-quarters ebb, and quarter or half flood of the tide in either sea or river, must be penned back in the sewers, or be lifted out by artificial power applied through pumps; and under such circumstances it is most important that nothing that can be deposited by the still waters should pass into the sewers. For in such case, it is no longer a removal of casual obstructions that has to be provided for, but a certain and often-recurring necessity of sending labourers into the sewers to collect and remove deposits which must always be foul, having regard to the company into which, when suspended, they had travelled, and always, therefore, offensive, and probably noxious upon being disturbed. No mere run of backwater as a scour will remove such deposits, even if they are mere slime; but when they consist, as they commonly do of grit and cementitious matter, they are apt to form a concrete that cannot be removed except by means which act upon the substance of the sewer itself, and tend to wear it out. The nidus of slime in sewers is soap-suds, a waste that must be allowed to pass by house drains, and so into and by the sewers; but it is only under the circumstance first above supposed that the washings of the streets of a town ought to be permitted to pass into the sullage drains

Drainage of Towns.

and sewers at all. It seems certain, therefore, that as a rule, the drainage of towns should be effected by a double system of drains—one part applied to the surface drainage being the rainfall upon the roadways, carrying with it the not necessarily offensive, but heavy and insoluble silt, the result of the wear and tear of the road material, and the droppings of graminivorous animals used in the service of man—and the other part devoted to the relief of the particular habitations of men of liquid refuse, and matters soluble in water, but commonly offensive, and capable of becoming noxious, and requiring, moreover, to be led to points of discharge at or from which they may be dissipated. When a single system adapted to the former purpose only has been extended so as to include the latter, and a whole town has become inextricably involved in the vicious mesh, the best that can be done is to lead the commingled silt and sullage together to points of temporary lull, where the sand, the heaviest part of the silt, may deposit, and to draw off or pump out, as the case may require, and lead to the eventual points of discharge, the liquid sullage over it.

The practice of drainage, so far as regards the structure of sewers and drains, is mere matter of construction, and is both simple and easy. Drains as structures may be divided into three classes—the tunnel sewer drain, the barrel drain, and the pipe drain. There are varieties of each class, and the classes continually blend one into another, but the classes are, nevertheless, sufficiently distinct for general description.

The tunnel sewer is built of brick-work or of masonry, cylindrical or of some conic section in form transversely, and of such size that men may pass into and through it. The barrel drain, smaller in size than the tunnel, is in like manner *built*, and the best and most available form is the egg shape, with the small end downwards. The pipe drain is formed of pipes or tubes laid together in short lengths, various expedients being employed for connecting the pipes by their ends.

The tunnel sewer (and by the term tunnel a drifted or tunnelled work is not necessarily implied) though simple in its form and of easy construction, is an important work of hydraulic architecture, and as such must be dealt with as a construction requiring to be laid or placed evenly upon a well-resisting foundation, and to be either sustained within itself as a bridge or as a church must be, or be so laid in the ground that it shall be pressed upon in every direction with reference to the power its form and the mode of construction employed may give it of resisting pressure for the security of its own structure.

The barrel drain must be laid, in like manner, on an unyielding foundation, and be so placed within and under the ground that the pressure upon it shall act in every direction alike.

What is above referred to as a pipe drain, may be a constructed barrel drain of the smallest size that can be built with brick in the form of a cylinder; but brick-built drains of small size, that is to say, of less than fourteen or fifteen inches internal diameter, will not be employed when pot-pipe of fitting kind and quality can be obtained, unless the drain is near the surface, and under a roadway exposed to heavy carriage traffic.

The use of tubes or pipes of pottery for drains is by no means new, but the removal of cloacal refuse from the habitations of man by underground conduits, whether as pipes or otherwise, is of recent introduction into the general service of towns; and of all the devices hitherto recurred to for such purpose there is none equal to pot-pipe rendered inabsorbent by glazing. Such pipes may be made of sufficient strength to resist the dead pressure of the ground in which they are, for the most part, laid up to a bore of twelve or fifteen inches in diameter, and they may be and are made, with ease and economy, in lengths of about two feet, which length, indeed, cannot be much exceeded in practice. Elongated drains of pot-pipe involve, therefore, a multiplicity of joints; and as pot-pipe drains, as well as brick-built drains, are exposed to the intrusion of uncontemplated substances which tend to obstruct the free passage through them of legitimate matters, whilst pottery is very liable to be broken even in the laying and under the process of filling in over them, it has been sought to make the joints in such manner that they shall be water-tight, and at the same time easily opened and easily re-made. The common practice is to make them spigot and faucet fashion, or socketted, in rough resemblance to the jointing of a flute, one end of every length of pipe being widened out into a faucet or socket, and the other adapted to run into the socket, as the spigot does into the faucet, the hollow way being preserved when the joint is made. Such a joint in pot-pipes must be a loose one, and therefore not water-tight; and if it be packed with a cementitious mortar, the adhesion of the mortar will prevent the separation of the parts when occasion requires it, whilst in the rough workmen's hands the mortar is often pressed into the pipes, and dries into a hard and obstructive ridge, where the way should be smooth and free throughout. Mere plastic clay is used therefore to pack the joints, it being a substance easily softened and broken down into mud by the passing liquids; but it is also so weak against any force, that if from any cause a head of water or other liquid is formed within a socketted pipe drain, the clay soon gives way, the joints are, in technical phrase, *blown;* and the liquid is not merely let out, it is driven out into the soil in which the pipe is embedded. But, as it has been already intimated, pot-pipe is liable to be broken in laying the pipes—the liability arising mainly out of the process of punning or ramming the ground in, about, and over the pipes, after they have been placed and the joints formed. The consciousness of this liability, and of the equally mischievous result of ramming over and about such a structure as a pot-pipe drain laid in the usual manner in and on the naked earth, leads to a mere filling in of the earth about the pipes, and over them to such a depth that the rammer cannot be felt through the bed of earth, unless it be felt through the agency of a piece of gravel or a spall of hard stone casually dropped in over a pipe, by which from the blow above, a hole may be punched in the pipe, or the pipe broken throughout, and in either case the newly-formed drain is choked up, and made worse than useless. The more common case, however, is the blowing of the clay-stopped joints and the softening of the loosely packed soil about the drain, when the pipe sinks at the loosened joint, which is thus drawn, and the drain is a drain no longer. It is to be repaired—the floor must be taken up if the course of the drain is within a building, or the pavement above it if out of doors; and the ground is to be dug out along the line, until the point of failure be reached. The already loosened lengths of pipe are pulled asunder, or broken up if the small ends have been run too well up in the sockets, the penned-back filth in the upper reach obtains vent, and it is either allowed to go on by the hitherto unobstructed lower reach, carrying with it all of the sodden clay that it can render liquid enough to flow, or the filthy bog is baled out and carted away. The pipes have now to be relaid; but, as the joints are socketted, it is physically impossible to make good (as it is technically termed) without beginning at the beginning and taking up all the pipes above the *fault* to get lengths enough in again. Relaid in the same manner, the structure is liable to the same occurrence again and again; and whether the pipes are large or small, if they are no larger in the bore than barely suffices for the passage of the calculated waste, pipe drains laid upon naked and soluble soil—the commonest kind of soil—and jointed with soluble material, are all liable to the casualties above described

Drainage of Towns.

The foregoing observations have reference to one great defect in the pot-pipe system of drainage, but that one is in all essential particulars the result of a mistaken aim at cheapness. Pottery, like all other substances produced by or under the action of heat, is most liable to be defective at such parts of the thing produced as are larger in any particular direction. Socketted cast-iron pipes are liable to be unsound in the sockets where the metal is of different and unequal thickness and the body of greater extent in circumference, because of the unequal cooling of the metal; and socketted pot-pipes are liable to be unsound in the sockets, because the whole body of the pipe cannot, because of the socket, expand and again cool simultaneously throughout. Simple hollow cylinders, whether of iron or of pottery, are more likely, with the same care in the manufacture, to be sound, than socketted pipes of either substance; and for this reason, if for no other, pot-pipes should be simple hollow cylinders, and some other expedient ought to be employed for making the joints than that by which the pipe is liable to be rendered both unsound in its manufacture, and impracticable when the work requires to be repaired. Expedients have been devised to this effect, and are gradually making their way into use;[1] while, at the same time, the mischievous influence of a bad practice is shown by that which is immediately superseding it—the practice of cutting off half the round of the socket, so that any one length of pipe may indeed be taken up and relaid without disturbing any other length, but the effect of the operation upon the pipe is that the part of the socket remaining detracts more than the whole socket does from the soundness of the structure of the pipe, and the upper half of every joint remains uncovered.

But the soundest pipes jointed in the soundest manner will not produce a sound and certainly effective drain without truth and stability in the construction of the drain.

The exclusive advocates of pot-pipe drains, which they endeavour to distinguish by the term tubular, stigmatize brick-built drains as sewers of deposit. This, however, is absurd, since the same cause which renders brick-built drains occasionally faulty in their course does the same by the pipe drain, with this difference against the latter, that whereas the brick-built drain is of the same kind of structure throughout, and strong enough to bear the rude process of filling in, and is essentially larger than the pipe, whereby a deposit in a casually depressed part is not necessarily an impracticable obstruction to the course of the drain, nor is a head of water above such a defect the certain means of destroying it. The pipe is laid in lengths—weak in the joints—both weak and fragile in its structure, and liable to the defects above described when defectively constructed. But all that either brick-built sewers or pot-pipe drains require, when good materials and skilful workmanship are employed, to make sound, effective, and trustworthy conduits, free alike from liability to be choked or blown by water or by liquid waste, are an unyielding and even foundation, a firm seat, and truth in the setting of the work. All this is easily attainable, and is commonly attained in the modern practice of building sewers of brickwork. The broader base afforded by brickwork will find a resisting foundation upon a soil into which a mere pipe of the same internal capacity would sink; and a brick structure will bear the ground to be forced in around and above it by a process that pot-pipes of the strongest make may not be exposed to. But if, instead of a false economy under the name of cheapness, true economy be embraced, the trench in which a pipe drain is to be laid will be dug out from six to twelve inches deeper than is required for the drain, and a layer of concrete of that thickness, and of the full breadth of the trench, placed in it, and formed with the fall required for the inside of the drain. This can be done under the eye, and will be open to the correction, of the supervisor, as in building a brick-drain; and the pipes may be laid, and the joints formed, upon the firm and evenly laid concrete with truth and certainty, even though the joints be socketted. Concrete being filled in under and about the pipes when so laid, up to half the diameter of the round body, the ground may be filled in over the drain, with confidence that it will possess the great requisites of truth and strength, with the peculiar excellence which the pipe possesses of smoothness of surface in the run of the drain. A pipe drain so laid will not be *cheaper* than a drain of the same size of brickwork; but it will be strong against everything short of crushing pressure. Light weight *is* crushing pressure to pot-pipes, however, and pipes of pottery may not, therefore, be laid under carriage roads, nor anywhere else, indeed, of such large size as to break under any dead weight that can come upon them, or under any impact to which they may be exposed. The strength of the strongest pottery pipes is, nevertheless, but weakness as compared with the thinnest brickwork in tubular drains.

In fine, with careful workmanship and a good foundation, either brick and mortar, or sheet-iron collared pipes, will make a good, lasting, and serviceable drain; whilst with careless or bad workmanship, and an infirm bed, a brick drain *may* be bad, but a pipe drain under the same circumstances *must* be so.

But the best built and best laid and jointed sewers and drains, of whatever materials or however put together, and with the best outfall, are but the means by which the *material* parts of cloacal and other foul refuse in a liquid state are made to pass away; the *immaterial* parts are not thereby ejected. The hot waste-water of the scullery helps, by diluting it, to hurry on the more sluggish matters which enter the same drain from the cloaca; but the heat in the culinary waste not only throws off in a gaseous form, and often enveloped in steam, the sickening odour which the water has taken out of the esculents boiled in it, but it induces the evolution of faint but foul gases from the cloacal filth itself, and these rise and run back to the highest attainable level, and seek egress into the upper air. This is commonly obtained through some faulty sink, or by crannies in the drain within the house from which the matters had proceeded, the escape being aided powerfully by the kitchen, and in winter time by the focal, fires; and in the streets of sewered towns the reeking stench rises through gully gratings; or if these are effectually trapped, then through holes made for the purpose in the carriage-roadway, where, however, they are very commonly clogged up with road stuff, which now and then drops down into the sewer, and forms an obstruction to the turbid stream there. By some or other of these vents, however, the stench escapes from drains and sewers, rises and mingles with the air, to be again inhaled by human beings. And thus it is that the air is circulated and the sewers ventilated in our best sewered towns!

Now, the course proper to be pursued is almost the reverse of that commonly practised, from which the inhabitants of sewered towns suffer in comfort and in health, more perhaps than the inhabitants of unsewered towns, in which there is commonly no such concentration of foulnesses. Give freedom to the foul gases of the drains, as freedom is given to the air which has served the purposes of combustion in the

[1] The best expedient known to the present writer is one recently patented by Mr Jennings, a London manufacturer. Mr Jennings makes the pipes simple hollow cylinders, and lays their ends upon half-round chairs, and covers the joint with a half-round saddle which completes the circuit. The chair and saddle are both rebated, and form together a short length of pipe. Much depends upon the strength and soundness of the chair; but these qualities being secured, the joints may be made upon them in mortar with confidence. This is better than the sheet-iron collar which the writer has heretofore advocated.

Agricultural Drainage.

chimney-grate. Make a flue for the foul air of the drain of every house, at or near to its upper end, as a flue is made for the escape of the burnt air of the smokeless coke or charcoal fire, as well as for the combined burnt air and dirty, but harmless, smoke of the coal fire to pass off by, and both will alike rise into the upper air, to be dissipated by the winds of heaven and prepared by nature's chemistry to reappear as the course of nature prescribes.

A lofty shaft built at the head of every main line of sewer, and provided with the means of securing an up-draught through the shaft—means to which the wind will always give effect in even the stillest weather—would give vent to all the emanations which arise in the sewer itself; but to assure this result there must be no trapping or flapping of the inlets to the sewer—the air must be allowed to pass down freely, which it will do, firstly, by its own gravity, and, secondly, by the draught established in the sewer by the upper draughting shaft and by the house drain flues. But the mechanical details involved in the practice of drainage is matter for technical and professional consideration.

The frequent and careful removal of all dirt and filth from the surfaces of the streets by scavengering—the constant flow to an efficient outfall in subdrains of all liquid waste and foul matters soluble in water, and rendered fluid by a copious backwater, may make and keep a town clean; but neither a town as a whole, nor any place in a town,—be it palace or cottage,—can be sweet and wholesome unless the drains and sewers are swept by constant currents of air, or, in other words, thoroughly ventilated from the lower into the upper air.—The metropolis of the British empire, the home of the Sovereign, the seat of the Legislature, the place of birth and the constant residence of more than a million and a half of human beings who consider themselves high in the scale of civilization, is but indifferently scavengered, is drained and sewered upon a wholly defective system, and its drains and sewers reek with filth and pour out under our nostrils foul air for want of legitimate outfalls for the one, and elevated outlets for the other.[1] (W. H—G.)

AGRICULTURAL DRAINAGE.

To drain land is to rid it of its superfluous moisture. The rivers of a country with their tributary brooks and rills are the natural provision for removing the rain water which either flows directly from its surface, or which, after percolating through porous strata to an indefinite depth, is again discharged at the surface by springs. The latter may thus be regarded as the outlets of a natural underground drainage. This provision for disposing of the water that falls from the clouds is usually so irregular in its distribution, and so imperfect in its operation, that it leaves much to be accomplished by human labour and ingenuity. The art of the drainer accordingly consists—

1st, In improving the natural outfalls by deepening, straightening, or embanking rivers; and by supplementing these, when necessary, by artificial canals and ditches; and,

2d, In freeing the soil and subsoil from stagnant water, by means of artificial underground channels.

Trunk drainage.

The first of these operations, called *trunk drainage*, is the most needful; for until it be accomplished there are extensive tracts of land, and that usually of the most valuable kind, to which the secondary process either cannot be applied at all, or only with the most partial and inefficient results. Very many of our British rivers and streams flow with a sluggish and tortuous course through valleys of flat alluvial soil, which, as the coast is approached, expand into extensive plains, but little elevated above the level of the sea. Here the course of the river is obstructed by shifting shoals and sand banks, and by the periodic influx of the tides. The consequence is, that immense tracts of valuable land are at all times in a water-logged and comparatively worthless state, and on every recurrence of a flood are laid entirely under water. In a preceding volume (see AGRICULTURE) some account has already been given of the extent of this evil, and of the efforts that have been successfully devoted to its remedy. Some of these fen-lands and estuary drainage works have been accomplished in the face of natural obstacles of the most formidable character, and constitute trophies of engineering talent of which the country may well be proud. Great as the natural difficulties are which have to be encountered in such cases, there are others of a different kind which have often proved more impracticable. It has been found easier to exclude the sea and restrain land-floods, than to overcome the prejudices and reconcile the conflicting interests of navigation companies, commissioners of sewers, owners of mills, and landed proprietors. Although all these classes suffer the most serious losses and inconveniences from the defective state of many of our rivers, yet it is found extremely difficult to reconcile their conflicting claims, and to allocate to each their proper share of the cost of improvements by which all are to benefit. A most interesting and instructive illustration of the urgent necessity for improving the state of our rivers, of the difficulties to be encountered in doing so, and of the incalculable benefits thus to be obtained, has been published in an essay on Trunk Drainage by John Algernon Clarke, Esq., published in vol. xv., part 1st, of the *Journal of the Royal Agricultural Society of England.* Mr Clarke, after some most important observations on trunk drainage, describes in detail works projected under powers granted in an act of parliament, passed in 1852, "constituting commissioners for the improvement of the river Nene and the navigation thereof."

There is not a district of the kingdom in which works similar in kind are not absolutely indispensable, before extensive tracts of valuable land can be rendered available for profitable cultivation by means of underground drainage. It is interesting to know that the necessity for trunk drainage, and the means of accomplishing it, were distinctly set before the public 200 years ago by a practical draining engineer, to whose writings the attention of the agricultural community has been frequently directed of late by Messrs Parkes, Gisborne, and others. From the third edition (1652) of *The Improver Improved*, by Walter Blithe, the author referred to, in which the true principles of land drainage are stated as distinctly, and urged as earnestly, as by any of our modern writers, we here quote the following remarks:—

"A strait watercourse, cut a considerable depth, in a thousand parts of this nation, would be more advantageous than we are aware of, or I will task myself here to dispute further. And though many persons are interested therein, and some will agree, and others will oppose; one creek lyeth on one side of the river, in one lord's manor, and another lyeth on the other side, and divers men own the same; why may not one neighbour change with another, when both are gainers? If not, *why may they not be compelled for their own good, and the commonwealth's advantage?* I daresay thousands of acres of very rich land may hereby be gained, and possibly as many more much amended, that are almost destroyed; but a law is wanting herein for the present, which I hope will be supplied if it may appear advancement to the public; for to private interests it is not possible to be the least prejudice, when every man hath benefit, and each man may also have an equall allowance if the least prejudiced.

"But a word or two more, and so shall conclude this chapter—and

[1] This is not the first time that the writer of this article has called attention to the means above indicated of ventilating house drains and common sewers respectively. In evidence before the State of Large Towns Commission in 1843, in his joint report under the preliminary Inquiries Act in 1847—in his "Guide to the proper Regulation of Buildings in Towns, otherwise Healthy Houses," in 1848–49—and in his place as a Metropolitan Commissioner of Sewers in 1852–53, he has earnestly urged the necessity of ventilation as applied to drains and sewers, and pointed out the means above indicated of effecting it.

Agricultural Drainage.

it is a little to further this improvement through a great destruction (as some may say); it is the removing or destroying of all such mills, and none else, as drown and corrupt more lands than themselves are worth to the commonwealth, and they are such as are kept up or dammed so high as that they boggyfie all the lands that lye under their mill-head. Such mills as are of little worth, or are by constant great charges maintained, I advise to be pulled down; the advance of the land, when the water is let run his course, and not impounded, will be of far greater value many times. But in case the mills should be so necessary and profitable too, and far more than the lands they spoil, I shall then advise, that under thy mill-dam, so many yards wide from it as may prevent breaking through, thou make a very deep trench all along so far as thy lands are putrefied, and thereinto receive all the issuing, spewing water, and thereby stop or cut off the feeding of it upon thy meadow, and carry it away back into thy back-water or false course, by as deep a trench, cut through the most low and convenient part of thy meads. But put case that thou shouldst have no convenient fall on that side thy mill-dam, then thou must make some course, *or plant some trough under thy mill-dam*, and so carry it under into some lower course that may preserve it from soaking thy meadows or pastures under it; and by this means thou maist in a good measure reduce thy land to good soundness, and probably wholly cure it, and preserve thy mill also."

It is painful to reflect, that after the lapse of two centuries, we should still see, as Blithe did, much "gallant land" ruined for want of those draining operations which he so happily describes.

Underground draining.

A clear outfall of sufficient depth being secured, the way is open for the application of *underground draining*. And here it may be proper to state, that there is very little of the land of Great Britain naturally so dry as not to be susceptible of improvement by artificial draining; for land is not in a perfect condition with respect to drainage, unless all the rain that falls upon it can sink down to the minimum depth required for the healthy development of the roots of cultivated crops, and thence find vent, either through a naturally porous subsoil or by artificial channels. Much controversy has taken place as to what this minimum depth is. Suffice it to say, that opinion is now decidedly in favour of a greater depth than was considered necessary even a few years ago, and that the best authorities concur in stating it at from three to four feet. There are persons who doubt whether the roots of our ordinary grain or green crops ever penetrate to such a depth as has now been specified. A careful examination will satisfy any one who makes it that minute filamentary rootlets are sent down to extraordinary depths, wherever they are not arrested by stagnant water. It has also been questioned whether any benefit accrues to crops from this deep descent of their roots. Some persons have even asserted that it is only when they do not find food near at hand that they thus wander. But it must be borne in mind that plants obtain moisture as well as nourishment by means of their roots, and the fact is well known that plants growing in a deep soil resting on a porous subsoil seldom or never suffer from drought. It is instructive, too, on this point, to observe the practice of the most skilful gardeners, and see the importance which they attach to trenching, the great depth at which they often deposit manure, and the stress which they lay upon thorough drainage. On the other hand, it is well known that soils which soonest become saturated, and run from the surface in wet weather, are precisely those which parch and get chapped the soonest in drought. The effectual way to secure our crops at once from drowning and parching, is to put the land in a right condition with respect to drainage.

All soils possess more or less the power of absorbing and retaining water. Pure clays have it in the greatest degree, and gritty siliceous ones in the smallest. In dry weather this power of attracting moisture is constantly operating to supply from below the loss taking place by evaporation at the surface. In heavy rains, as soon as the entire mass has drunk its fill, the excess begins to flow off below; and therefore a deep stratum, through which water can percolate, but in which it can never stagnate—that is, never exceed the point of saturation—is precisely that in which plants are most secure from the extremes of drought and drowning.

If a perfect condition of the soil with respect to drainage is of importance for its influence in preserving it in a right condition as respects moisture, it is still more so for its effects upon its *temperature*. All who are conversant with rural affairs are familiar with that popular classification of soils in virtue of which such as are naturally dry are also invariably spoken of as *warm* and *early*; and conversely, that wet soils are invariably described as being *cold* and *late*. This classification is strictly accurate, and the explanation of it is simple. An excess of water in soil keeps down its temperature in various ways. In passing into the state of vapour it rapidly carries off the heat which the soil has obtained from the sun's rays. Water possesses also a high radiating power; so that, when present in the soil in excess, and in a stagnant state, it is constantly carrying off heat by evaporation and radiation. On the other hand, stagnant water conveys no heat downwards; for, although the surface is warmed, the portion of water thus heated being lightest, remains floating on the surface, and will give back its heat rapidly to the atmosphere, but conveys none downwards. When the surface of stagnant water becomes colder than the general mass, the very opposite effect immediately ensues; for as water cools its density increases, and thus causes an instant sinking of the portion that has been cooled, and a rising of a warm portion from below to take its place—this movement continuing until the whole has been lowered to 42°, at which point water reaches its maximum density, after which it will freeze at the surface if the cold be great enough. It is thus that soil surcharged with water is kept at a lower temperature than similar soil that has a sufficient natural or artificial drainage.

But while the presence of stagnant water in a soil has this injurious power of lowering its temperature, a very different effect ensues when rain-water can sink freely into it to a depth of several feet, and then find a ready exit by drainage; for in this case the rain-water carries down with it the heat which it has acquired from the atmosphere and from the sun-heated surface, and imparts it to the subsoil. There is as yet a lack of published experiments to show the ordinary increase of temperature at various depths and in different soils, as the result of draining wet land. Those conducted by Mr Parkes, in a Lancashire bog in June 1837, showed, as the mean of 35 observations, that the drained and cultivated soil at 7 inches from the surface was 10° warmer than the adjoining undrained bog in its natural state at the same depth. It is understood that recent experiments conducted by the same gentleman on an extended scale fully establish the fact that an increased temperature of the soil is an unfailing accompaniment of thorough draining. The importance of this result cannot well be overrated. The temperature and other conditions of the atmosphere, which we call climate, are placed beyond human control; but this power of raising the temperature of all wet, and consequently cold soils, becomes tantamount in some of its results to a power of improving the climate. There are, accordingly, good grounds for stating that in numerous cases grain crops have ripened sooner by 10 or 12 days than they would have done but for the draining of the land on which they grew.

The points which we have thus briefly touched upon are so essential to an intelligent appreciation of the subject, that we have felt constrained to notice them, however meagrely. But our space forbids more than a mere enumeration of some of the many evils inseparable from the presence of stagnant water in the soil, and of the benefits that flow from its removal. Wet land, if in grass, produces only the coarser grasses, and many sub-aquatic plants and mosses, which are of little or no value for pasturage; its herbage is late of

Agricultural Drainage.

coming in spring, and fails early in autumn; the animals grazed upon it are unduly liable to disease, and sheep, especially, to the fatal rot. When used as arable land, tillage operations are easily interrupted by rain, and the period always much limited in which they can be prosecuted at all; the compactness and toughness of such land renders each operation more arduous, and more of them necessary than in the case of dry land. The surface must necessarily be thrown into ridges, and the furrows and cross-cuts duly cleared out after each process of tillage, on which surface expedients as much labour has probably been expended in each thirty years, as would now suffice to make drains enough to lay it permanently dry. With all these precautions, the best seed-time is often missed, and this usually proves the prelude to a scanty crop, or to a late and disastrous harvest. The cultivation of the turnip and other root crops, which require the soil to be wrought to a deep and free tilth, becomes either altogether impracticable, and must be abandoned for the safe but costly bare fallow, or is carried out with great labour and hazard; and the crop, when grown, can neither be removed from the ground, nor consumed upon it by sheep without damage by poaching. The dung, lime, and other manure, that is applied to such land, is in a great measure wasted; and the breaking of the subsoil and general deep tillage, so beneficial in other circumstances, is here positively mischievous, as it does but increase its power of retaining water. Taking into account the excessive labour, cost, and risk, inseparable from the cultivation of wet land, and the scanty and precarious character of the crops so obtained, it would in many cases be wiser to keep such lands in grass, than to prosecute arable husbandry under such adverse circumstances. These very serious evils can either be entirely removed, or, at the least, very greatly palliated by thorough draining. It often happens that naturally porous soils are so soaked by springs, or so water-logged by resting upon an impervious subsoil, or, it may be, so drowned for want of an outfall in some neighbouring river or stream, that draining at once effects a perfect cure, and places them on a par with the best naturally dry soils. In the case of clay soils, the improvement effected by draining is in some respects greater than in any other class, but still it cannot change the inherent properties of clay. This has sometimes been overlooked by sanguine improvers, who, hastily assuming that their strong land, when drained, would henceforward be as friable and sound as the more porous kinds, have proceeded to treat it on this assumption, and have found to their cost that clay, however well drained, will still get into mortar and clods, if it is tilled or trodden on too soon after rain. It is entirely owing to such rash and unskilful management that an opinion has sometimes got abroad that clay lands are injured by draining. They merely retain the qualities peculiar to clay; and when they are treated judiciously, show as good a comparative benefit from draining as other soils. The only instances in which even temporary injury arises from draining is in the case of some peaty and fen lands, which are so loose, that they suffer from drought in protracted dry weather. As such lands are usually level and have water-courses near them, this inconvenience admits of an easy remedy by shutting up the main outlets and then admitting water into the ditches. The drains in this way become ready channels for applying the needed moisture by a kind of subterraneous irrigation.

The beneficial effects of thorough draining are of a very decisive and striking kind. The removal of stagnant water from a stratum of 4 feet in depth, and the establishing of a free passage for rain-water and air from the surface to the level of the drains, speedily effects most important changes in the condition of the soil and subsoil. Ploughing and other tillage operations are performed more easily than heretofore, in consequence of a more friable state of the soil. Moderate rains which formerly would have sufficed to arrest these operations do so no longer, and heavy falls of rain cause a much shorter interruption of these labours than they did when the land was in its natural state. Deep tillage, whether by the common or subsoil plough (which formerly did harm), now aids the drainage, and is every way beneficial. Ridges and surface furrows being no longer needed, the land can be kept flat with great benefit to crops, and furtherance to field operations. An earlier seed-time and harvest, better crops, a healthier live stock, and an improved style of husbandry, are the usual and well known sequents of judiciously conducted drainage operations. In short, the most experienced and skilful agriculturists now declare with one consent that good drainage is an indispensable preliminary to good cultivation.

Antiquity of land draining.

Although it has been reserved to the present times to see land draining reduced to a system based on scientific principles, or very great improvement effected in its details, it is by no means a modern discovery. The Romans were careful to keep their arable lands dry by means of open trenches, and there are even some grounds for surmising that they used covered drains for the same purpose. Indubitable proof exists that they constructed underground channels by means of tubes of burned earthenware; but it seems more probable that these were designed to carry water to their dwellings, &c., than that they were used simply as drains. Recent inquiries and discoveries have also shown that it is at least several centuries since covered channels of various kinds were in use by British husbandmen for drying their land. It is, at all events, two centuries since Capt. Walter Blithe wrote as follows:—

Blithe's treatise, 1652.

"Superfluous and venomous water, which lyeth in the earth and much occasioneth bogginesse, mirinesse, rushes, flags, and other filth, is indeed the chief cause of barrenesse in any land of this nature. . . . Drayning is an excellent and chiefest means for their reducement; and for the depth of such draynes, I cannot possibly bound, because I have not time and opportunity to take in all circumstances. . . . And for thy drayning trench it must be made so deepe that it goe to the bottome of the cold, spewing moyst water, that feeds the flagg and the rush; for the widenesse of it, use thine owne liberty, but be sure to make it so wide as thou mayest goe to the bottome of it, which must be so low as any moysture lyeth, which moysture usually lyeth under the over and second swarth of the earth, in some gravel or sand, or else, where some greater stones are mixt with clay, under which thou must goe halfe one spades graft deepe at least; yea, suppose this corruption that feeds and nourisheth the rush or flagg should lie a yard or foure foot deepe, to the bottome of it thou must goe, if ever thou wilt drain it to purpose. . . . And for the drayning trench be sure thou indeavour to carry it as neare upon a straight line as possible. . . . To the bottome where the spewing spring lyeth thou must goe, and one spades depth or graft beneath, how deep so ever it be, if thou wilt drayne thy land to purpose. I am forced to use repetitions of some things, because of the suitableness of the things to which they are applyed; as also because of the slownesse of peoples apprehensions of them, as appears by the non-practice of them, the which wherever you see drayning and trenching you shall rarely find few or none of them wrought to the bottome. . . . Go to the bottome of the bog, and there make a trench in the sound ground, or else in some old ditch, so low as thou verily conceivest thy selfe assuredly under the level of the spring or spewing water, and then carry up thy trench into thy bogg straight through the middle of it, one foot under that spring; . . . but for these common and many trenches, oft times crooked too, that men usually make in their boggy grounds, some one foot, some two, never having respect to the cause or matter that maketh the bogg to take that way, I say away

Agricultural Drainage.

with them as a great piece of folly, lost labour, and spoyle. . . . After thou has brought a trench to the bottom of the bog, then cut a good substantial trench about thy bog; and when thou hast so done make one work or two just overthwart it, *upwards and downwards*, all under the matter of the bog. Then thou must take good green faggots, willow, alder, elme, or thorne, and lay in the bottome of thy works, and then take thy turfe thou tookest up in the top of thy trench, and plant upon them with the green sward downwards; *or take great pebbles, stones, or flint stones, and so fill up the bottome of thy trench about fifteen inches high*, and take thy turfe and plant it as aforesaid, being cut very fit for the trench, as it may join close as it is layd downe, and then having covered it all over with earth, and made it even as thy other ground, waite and expect a wonderfull effect through the blessing of God."

These sagacious arguments and instructions were doubtless acted upon by some persons in his own times and since; but still they had never attained to general adoption, and were ultimately forgotten. Towards the close of last century, Mr Elkington, a Warwickshire farmer, discovered and promulgated a plan of laying dry sloping land that is drowned by the outbursting of springs. When the higher lying portion of such land is porous, rain falling upon it sinks down until it is arrested by clay or other impervious matter, which causes it again to issue at the surface and wet the lower-lying ground. Elkington showed that by cutting a deep drain through the clay, aided when necessary by wells or augur holes, the subjacent bed of sand or gravel in which a body of water is pent up by the clay, as in a vessel, might be tapped, and the water conveyed harmlessly in the covered drain to the nearest ditch or stream. In the circumstances to which it is applicable, and in the hands of skilful drainers, Elkington's plan, by bringing into play the natural drainage furnished by porous strata, is often eminently successful. His system was given to the public in a quarto volume, edited by a Mr John Johnston of Edinburgh, who does not seem to have shared the engineering talents of the man whose discoveries he professes to expound. During the thirty or forty years subsequent to the publication of this volume, most of the draining that took place was on this system, and an immense capital was expended in such works with very varying results. Things continued in this position until about the year 1823, when the late James Smith of Deanston having discovered anew those principles of draining so long before indicated by Blithe, proceeded to exemplify them in his own practice, and to expound them to the public in a way that speedily effected a complete revolution in the art of draining, and marked an era in our agricultural progress. Instead of persisting in fruitless attempts to dry extensive areas by a few dexterous cuts, he insisted on the necessity of providing every field that needed draining at all with a complete system of parallel underground channels, running in the line of the greatest slope of the ground, and so near to each other that the whole rain falling at any time upon the surface should sink down and be carried off by the drains. The distances between drains he showed must be regulated by the greater or less retentiveness of the ground operated upon, and gave 10 feet as the minimum, and 40 feet as the maximum of these distances. The depth which he prescribed for his parallel drains was 30 inches, and these were to be filled with 12 inches of stones small enough to pass through a 3-inch ring—in short, a new edition of Blithe's drain. A main receiving-drain was to be carried along the lowest part of the ground with sub-mains in every subordinate hollow that the ground presented. These receiving-drains were directed to be formed with a culvert of stone work, or of tiles, of waterway sufficient to contain the greatest volume of water at any time requiring to be passed from the area to which they respectively supplied the outlet. The whole cultivated lands of Britain being disposed in ridges which usually lie in the line of greatest ascent, it became customary to form the drains in each furrow, or in each alternate, or third, or fourth one, as the case might require, or views of economy dictate, and hence the system soon came to be popularly called *furrow draining*. From the number and arrangement of the drains, the terms *frequent* and *parallel* were also applied to it. Mr Smith himself more appropriately named it, from its effects, *thorough draining*. The sound principles thus promulgated by him were speedily adopted and extensively carried into practice. The great labour and cost incurred in procuring stones in adequate quantities, and the difficulty of carting them in wet seasons, soon led to the substitution of tiles and soles of burned earthenware. The limited supply and high price of these tiles for a time impeded the progress of the new system of draining; but the opportune invention by the Marquis of Tweeddale of a tile-making machine, followed as this was by a rapid succession of more perfect machines for the same purpose, at once removed this impediment, and gave a mighty stimulus to this fundamental agricultural improvement. The substitution of cylindrical pipes for the original horse-shoe tiles has still further aided the progress of land-drainage, both by lowering the cost and increasing the efficiency and permanency of such works.

Elkington's system.

Smith of Deanston's system.

The system introduced and so ably expounded by Smith of Deanston has now virtually been adopted by all drainers. Variations in matters of detail (having respect chiefly to the depth and distance apart of the parallel drains) have indeed been introduced; but the distinctive features of his system (viz., provision for laying dry the entire area of land operated upon to the minimum depth required for the healthy growth of cultivated crops, by a series of parallel drains running in the line of the greatest slope of the ground) are now recognised and acted upon by all scientific drainers.

Direction of drains.

In setting about the draining of a field, or farm, or estate, the first point is to secure, at whatever cost, a proper outfall. The lines of the receiving drains must next be determined, and then the direction of the parallel drains. The former must occupy the lowest part of the natural hollows, and the latter must run in the line of the greatest ascent of the ground. In the case of flat land, where a fall is obtained chiefly by increasing the depth of the drains at their lower ends, these lines may be disposed in any direction that is found convenient; but in undulating ground a single field may require several distinct sets of drains lying at different angles, so as to suit its several slopes. When a field is ridged in the line of the greatest ascent of the ground, there is an obvious convenience in adopting the furrows as the site of the drains; *but wherever this is not the case the drains must be laid off to suit the contour of the ground, irrespective of the furrows altogether.* When parts of a field are flat and other parts have a considerable acclivity, it is expedient to cut a receiving drain near to the bottom of the slopes, and to give the flat ground an independent set of drains. In laying off receiving drains it is essential to give hedge-rows and trees a good offing, lest the conduit should be obstructed by roots. When a main drain is so placed that parallel ones empty into it from both sides, care should be taken that the inlets of the latter are not made exactly opposite to each other. Indeed, we have found it expedient in such cases to have two receiving drains parallel to each other, each to receive the subordinate drains from its own side only. As these receiving drains act also as ordinary drains to the land through which they pass, no additional cost is incurred by having two instead of one, provided they are as far apart as the other drains in the field. Much of the success of draining depends on the skilful planning of these main drains, and in making them large enough to discharge the greatest flow of water to which they may be exposed. Very long main drains are to be avoided. Nu-

merous outlets are also objectionable, from their liability to obstruction. An outlet to an area of from ten to fifteen acres is a good arrangement. These outlets should be faced with mason-work, and guarded by iron gratings.

Depth of drains.

The depths of the parallel drains must next be determined. In order to obtain proper data for doing so, the subsoil must be carefully examined by digging test-holes in various places, and also by taking advantage of any quarries, deep ditches, or other cuttings in the proximity, that afford a good section of the ground. We have already expressed an opinion that the drains should not be less than four feet deep; but it is quite possible that the discovery at a greater depth than four feet of a seam of gravel, or other very porous material charged with water, underlying considerable portions of the ground, may render it expedient to carry the drains so deep as to reach this seam. Such a seam, when furnished with sufficient outlets, supplies a natural drain to the whole area under which it extends. When such exceptional cases are met with, they are precisely those in which deep drains, at wide intervals, can be trusted to dry the whole area. When the subsoil consists of a tenacious clay of considerable depth, it is considered by many persons that a greater depth than three feet is unnecessary. The greater depth is, however, always to be preferred; for a drain of four feet, if it works at all, not only does all that a shallower one can do, but frees from stagnant water a body of subsoil on which the other has no effect at all. It has indeed been alleged that such deep drains may get so closed over by the clay that water will stand above them. If the surface of clay soil is wrought into puddle by improper usage, water can undoubtedly be made to stand for a time over the shallowest drains as easily as over the deepest. But the contraction which takes place in summer in good alluvial clays gradually establishes fissures, by which water reaches the drains. In such soils it is usually a few years before the full effect of draining is attained. This is chiefly due to the contraction and consequent cracking of clay soils in summer just referred to, and partly, as Mr Parkes thinks, to the mining operations of the common earth-worm. Both of these natural aids to drainage operate with greater force with drains 4 feet deep than when they are shallower. The tardy percolation of water through clay soils seems also a reason why in such cases it should get the benefit of a greater fall, by making the drain deep. Draining is always a costly operation, and it is therefore peculiarly needful to have it executed in such a way that it shall be effectual and permanent. We advocate a minimum depth of 4 feet, because of our strong conviction that such drains carefully made will be found to have both these qualities. And this opinion is the result of dear-bought experience, for we have found it necessary in our own case to re-open a very considerable extent of 30-inch drains in consequence of their having totally failed to lay the land dry, and to replace them by 4-feet ones, which have proved perfectly efficacious. In doing this we have seen a 30-inch drain opened up and found to be perfectly dry, and yet when the same trench was deepened to 4 feet there was quite a run of water from it. We earnestly dissuade all parties who are about to undertake drainage works from giving ear to representations about the sufficiency and economy of shallow drains. These, doubtless, cost somewhat less to begin with, but in thousands of cases they fail to accomplish the desired end, and the unfortunate owners, after all their outlay, are left to the miserable alternative of seeing their land imperfectly drained, or of executing the works anew, and thus losing the whole cost of the first and inefficient ones. The extreme reluctance with which the latter alternative is necessarily regarded will undoubtedly operate for a long time in keeping much land that has been hastily and imperfectly drained from participating in the benefits of *thorough* drainage.

Distance betwixt drains.

The distance apart at which the drains should be cut must be determined by the nature of the subsoil. In the most retentive clays it need not be less than 18 feet. On the other hand, this distance cannot safely be exceeded in the case of any subsoil in which clay predominates, although it should not be of the most retentive kind. In all parts of the country instances abound in which drains cut in such subsoils, from 24 to 30 feet apart, have totally failed to lay the land dry. When ground is once pre-occupied by drains too far apart, there is no remedy but to form a supplementary one betwixt each pair of the first set; and thus, by exceeding the proper width at first, the space betwixt the drains is unavoidably reduced to 12 or 15 feet, although 18 feet would originally have sufficed. It is only with a decided porosity in the subsoil, and in proportion to the degree of that porosity, that the space betwixt drains can safely be increased to 24, or 30, or 36 feet. In those exceptional cases in which drains more than 36 feet apart prove effectual, their success is due to the principle on which Elkington's system is founded. A few years ago an opinion obtained currency, that as the depth of drains was increased their width apart might with safety be increased in a corresponding ratio. And hence it came to be confidently asserted, that with a depth of 5 or 6 feet a width of from 40 to 60 feet might be adopted with a certainty of success, even in the case of retentive soils. We believe that experience has already demonstrated the unsoundness of this opinion. At all events, in recommending a minimum depth of 4 feet, we do so on the ground that (other things being equal) the whole benefits of drainage are more fully and certainly secured by drains of this depth than by those of $2\frac{1}{2}$ or 3 feet. In ordinary cases an increase of depth does not compensate for an increase of the width apart of the drains.

Pipes and collars of earthenware.

Cylindrical pipes with collars are undoubtedly the best draining material that has yet been discovered. The collars referred to are simply short pieces of pipe, just so wide in the bore as to admit of the smaller pipes which form the drain passing freely through them. In use, one of these collars is so placed as to encase the ends of each contiguous pair of tubes, and thus forms a loose fillet around each joining. The ends of these pipes being by this means securely kept in contact, a continuous canal for the free passage of water is infallibly insured; the joinings are guarded against the entrance of mud or vermin, and yet sufficient space is left for the admission of water. Pipes of all diameters, from 1 inch to 16 inches, are now to be had; those from 1 to 2 inches in the bore are used for subordinate drains; the larger sizes for sub-main and main receiving drains. Collars are used with the smaller sizes only, large pipes not being so liable to shift their position as small ones. In constructing a drain it is of much importance that the bottom be cut out just wide enough to admit the pipes and no more. Pipes, when thus accurately fitted in, are much less liable to derangement than when laid in the bottom of a trench several times their width, and into which a mass of loose earth must necessarily be returned. This accurate fitting is now quite practicable in the case of soils tolerably free from stones from the excellence of the draining tools that have lately been introduced. The following cut represents the most important of these tools.

Draining tools.

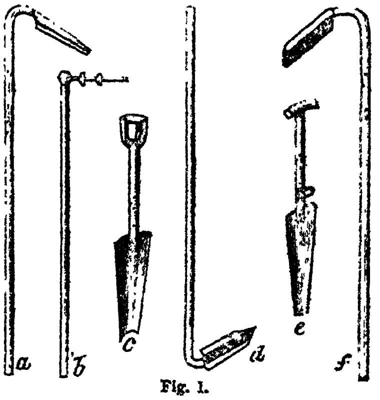


Fig. 1.

c and *e* are long tapering spades for digging out the middle and bottom spits,

Agricultural Drainage.

a, *d*, and *f* recurved scoops for clearing out the debris, and *b* a pipe-layer, by means of which a workman standing at the margin of a drain hooks up a pipe and collar, and deposits them easily and accurately in the deep narrow trench.

How to deal with a quicksand.

If a quicksand is encountered in constructing a drain, it will be found expedient to put a layer of straw in the bottom of the trench, and then, instead of the ordinary pipe and collar, to use at such a place a double set of pipes—one within the other—taking care that the joinings of the inner set are covered by the centres of the outer ones. By such precautions the water gets vent, and the running sand is excluded from the drain. When a brook has been diverted from its natural course for mill-power or irrigating purposes, it often happens that portions of land are thereby deprived of the outfall required to admit of their being drained to a proper depth. In such cases it is frequently practicable to obtain the needed outlet by carrying a main drain through below the water-course, by using at that point a few yards of cast-iron pipe, and carefully filling up the trench with clay puddle, so that there may be no leakage from the water-course into the drain. While this is adoing the water must either be turned off or carried over the temporary gap in a wooden trough.

Cost of draining.

The cost of draining is so much influenced by the ever-varying price of labour and materials, and by the still more varying character of the land to be operated upon, that it is impossible to give an estimate of the cost that will admit of general application. The following tabular data, taken chiefly from Mr Bailey Denton's valuable treatise, are presented to aid those who wish to form such an estimate:—

TABLE I.—*Showing the number of rods of Drain per acre at given distances apart, and the number of Pipes of given lengths required per acre.*

Intervals between the Drains in feet.	Rods per acre.	Twelve-inch Pipes.	Thirteen-inch Pipes.	Fourteen-inch Pipes.	Fifteen-inch Pipes.
18	$146\frac{2}{3}$	2420	2234	2074	1936
21	$125\frac{5}{7}$	2074	1915	1778	1659
24	110	1815	1676	1555	1452
27	$97\frac{7}{9}$	1613	1489	1383	1290
30	88	1452	1340	1244	1161

TABLE II.—*Showing the Cost of Draining per acre at different intervals between the Drains.*

	Eighteen feet apart.			Twenty-one feet apart.			Twenty-four feet apart.			Twenty-seven feet apart.			Thirty feet apart.		
	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.
Labour, cutting and filling in at 6d. per rod	3	13	4	3	2	10	2	15	0	2	8	11	2	4	0
Material, pipes for minor drains, 18s. per 1000	2	5	9	1	19	2	1	14	3	1	10	6	1	7	5
Haulage, two miles, and delivery in fields at 2s. 6d. per 1000	0	6	4	0	5	5	0	4	9	0	4	3	0	3	9
Pipe-laying and finishing, 1d. per rod	0	12	2	0	10	6	0	9	2	0	8	2	0	7	4
Superintendence, foreman	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0
Extra for mains	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Iron-outlet pipes, and masonry, and extra labour	0	1	6	0	1	6	0	1	6	0	1	6	0	1	6
Total	7	6	1	6	6	5	5	11	8	5	0	4	4	11	0
Add for collars, if used	1	2	10	0	19	7	0	17	1	0	15	3	0	13	8
	8	8	11	7	6	0	6	8	9	5	15	7	5	4	8

Various attempts have from time to time been made to lower the cost of draining land by the direct application of animal or steam power to the work of excavation. The most successful of these attempts is the steam-draining apparatus invented by Mr John Fowler of Bristol, usually called *Fowler's draining plough.* A six-horse portable

Fowler's steam draining apparatus.

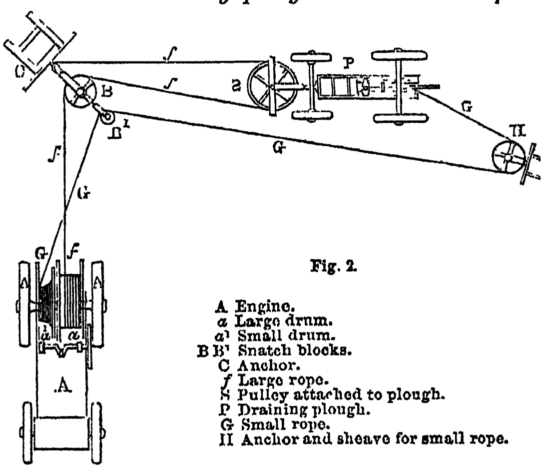


Fig. 2.

A Engine.
a Large drum.
a' Small drum.
B B' Snatch blocks.
C Anchor.
f Large rope.
S Pulley attached to plough.
P Draining plough.
G Small rope.
H Anchor and sheave for small rope.

steam-engine is anchored in one corner of the field to be drained. It gives motion to two drums, to each of which a rope, 500 yards long, is attached, the one uncoiling as the other is wound up. These ropes pass round blocks which are anchored at each end of the intended line of drain, and are attached one to the front and the other to the hind end of the draining apparatus. This consists of a framework, in which is fixed, at any required depth not exceeding $3\frac{1}{2}$ feet, a strong coulter terminating in a short horizontal bar of cylindrical iron, with a piece of rope attached to it, on which a convenient number of drain pipes are strung. This frame being pulled along by the engine, the coulter is forced through the soil at a regulated depth, and deposits its string of pipes with unerring accuracy, thus forming, as it proceeds, a perfect drain. The supply of pipes is kept up by means of holes previously dug in the line of the drain, at distances corresponding to the length of the rope on which they are strung. This machine was subjected to a very thorough trial at the meeting of the Royal Agricultural Society of England, at Lincoln, in 1854, on which occasion a silver medal and very high commendation were awarded to it. In March 1855 it was publicly stated that five of these implements are now at work in different parts of England, and that already 10,000 acres of land have been drained by means of them. At the Lincoln trial it was satisfactorily proved that this implement could work at a depth of $3\frac{1}{2}$ feet. As it moved along, the soil on either side, to the width of 2 or 3 feet, seemed to be loosened. It is therefore probable that this implement, or at least one propelled on the same principle, may yet be used as a subsoil disintegrator.

Land draining companies.

A great stimulus has recently been given to the improvement of land by the passing of a series of acts of parliament, which have removed certain obstacles which effectually hindered the investment of capital in works of drainage and kindred ameliorations. By the first of these acts, passed in 1846, a sum of L.4,000,000 of the public money was authorized to be advanced to landowners to be expended in draining their lands. The Inclosure Commissioners were charged with the allocation of this money, and the superintendence

of its outlay. The most important provisions of this act are, that it enables the possessors of entailed estates (equally with others) to share in the benefits of this fund—that it provides, on terms very favourable to the borrower, for the repayment of the money so advanced by twenty-two annual instalments—that before sanctioning the expenditure of these funds on drainage works, the commissioners must have a report from a qualified inspector, to the effect that they are likely to prove remunerative—and finally, that the works must be performed according to specifications prepared by the inspector, and approved by the commissioners, who have seldom allowed of a less depth of drain than $3\frac{1}{2}$ feet. By the end of the year 1854 the whole of this money was allocated, and more than half of it actually expended. Scottish landowners were so prompt to discern, and so eager to avail themselves of this public fund, that more than half of it fell to their share. The great success of this measure, and the rapid absorption of the fund provided by it soon led to further legislative acts, by which *private capital* has been rendered available for the improvement of land, by draining and otherwise, on conditions similar to those just enumerated. These acts are—

1st, The *Private Money's Drainage Act* (12th and 13th Vict., cap. 100), limited to draining only.

2d, The *West of England, or South-West Land Draining Company's Act* (11th and 12th Vict., cap. 142), for the purpose of draining, irrigation and warping, embanking, reclaiming and inclosing, and road-making.

3d, The *General Land-Drainage and Improvement Company's Act* (12th and 13th Vict., cap. 91), for the purposes of draining, irrigating and warping, embanking, reclaiming and inclosing, road-making, and erecting farm-buildings.

4th, The *Lands Improvement Company's Act* (16th and 17th Vict., cap. 154), for the same purposes as the above, with the addition of planting for shelter. This company's powers extend to Scotland.

By these acts ample provision is made for rendering the dormant capital of the country available for the improvement of its soil. To the owners of entailed estates they are peculiarly valuable, from the power which they give to them of charging the cost of draining, &c., upon the inheritance. If such owners apply their own private funds in effecting such improvements, they are enabled, through the medium of these companies, to take a rent-charge on their estates for the repayment of money which they so expend, over which they retain personal control, so that they can bequeath as they choose the rent-charge payable by their successor. Besides their direct benefits, these drainage acts have already produced some very important indirect fruits. They have led to many improvements in the manner of accomplishing the works to which they relate, to the wide and rapid dissemination of such improved modes of draining, &c., and, in particular, they have had the effect of creating, or at least of greatly multiplying and accrediting, a staff of skilful and experienced draining engineers, of whose services all who are about to engage in draining and similar works will do well to avail themselves. (J. W—N.)

DRAKE, Sir Francis, a celebrated English admiral, was born near Tavistock, Devonshire, in 1545. His father who had been bred a sailor, obtained a naval chaplaincy from Queen Elizabeth, and was afterwards vicar of Upnor church, on the Medway. Young Drake was educated at the expense and under the care of Sir John Hawkins, who was his kinsman; and, at the age of eighteen, he had risen to be purser of a ship trading to Biscay. At twenty he made a voyage to Guinea; and at twenty-two he was made captain of the *Judith.* In that capacity he was in the harbour of San Juan de Ulloa, in the Gulf of Mexico, where he behaved most gallantly in the actions under Sir John Hawkins, and returned with him to England, having acquired great reputation, though with the loss of all the money which he had embarked in the expedition. Having next projected an attack against the Spaniards in the West Indies to indemnify himself for his former losses, he set sail in 1572, with two small ships named the Pasha and the Swan. He was afterwards joined by another vessel; and with this small squadron he took and plundered the Spanish town of Nombre de Dios. With his men he penetrated across the isthmus of Panama, and committed great havoc among the Spanish shipping. In these expeditions he was much assisted by a nation of Indians, who were then engaged in a desultory warfare with the Spaniards. Having embarked his men and filled his ships with plunder, he bore away for England, where he arrived in August 1573.

His success and honourable demeanour in this expedition gained him high reputation; and the use which he made of his riches served to raise him still higher in popular esteem. Having fitted out three frigates at his own expense, he sailed with them to Ireland; and there, as a volunteer, under Walter earl of Essex, the father of the famous but unfortunate earl, performed many glorious actions. After the death of his patron he returned to England, where Sir Christopher Hatton introduced him to Queen Elizabeth, and procured him a favourable reception at court. In this way he acquired the means of undertaking that grand expedition which has immortalized his name. The first proposal he made was to undertake a voyage into the South Seas through the Straits of Magelhaens; an achievement which no Englishman had hitherto ever attempted. This project having been well received at court, the queen furnished him with means: and his own fame quickly drew together a sufficient force. The fleet with which he sailed on this enterprise consisted only of five small vessels, and their united crews mustered only 166 men. Having sailed on the 13th Dec. 1577, he on the 25th fell in with the coast of Barbary, and on the 29th with Cape Verde. On the 18th March he passed the equinoctial, made the coast of Brazil on the 5th of April, and entered the river Plata, where he parted company with two of his ships; but having met them again, and taken out their provisions, he turned them adrift. On the 29th May he entered the port of St Julian's, where he continued two months for the sake of laying in a stock of provisions. On the 20th Aug. he entered the Straits of Magelhaens, and on the 25th Sept. passed them, having then only his own ship. On the 25th Nov. he arrived at Macao, which he had appointed as the place of rendezvous in the event of his ships being separated; but Captain Winter, his vice-admiral, had repassed the straits and returned to England. He thence continued his voyage along the coast of Chili and Peru, taking all opportunities of seizing Spanish ships, and attacking them on shore, till his men were satiated with plunder; and then coasted along the shores of America, as far N. as Lat. 48., in an unsuccessful endeavour to discover a passage into the Atlantic. Having landed, however, he named the country *New Albion,* and took possession of it in the name of Queen Elizabeth. Having careened his ship, he set sail from thence on the 29th Sept. 1579 for the Moluccas. On the 13th Oct. he fell in with certain islands inhabited by the most barbarous people he had met with in all his voyage. On the 4th Nov. he got sight of the Moluccas; and, arriving at Ternate, was extremely well received by the king of that place, who appears from the most authentic relations of this voyage to have been a wise and politic prince. On the 10th Dec. he made the Celebes, where his ship unfortunately struck upon a

Drama.

rock, but was taken off without much damage. On the 16th March he arrived at Java, whence he intended to have directed his course to Malacca; but he found himself obliged to alter his purpose, and to think of returning home. On the 25th March 1580 he put this design in execution; and on the 15th June he doubled the Cape of Good Hope, having then on board only fifty-seven men and three casks of water. On the 12th July he passed the line, reached the coast of Guinea on the 16th, and there watered. On the 11th Sept. he made the island of Terceira, and on the 3d Nov. he entered the harbour of Plymouth. This voyage round the world was thus performed in two years and about ten months. Shortly after his arrival, the queen paid a visit to Deptford, went on board his ship, and there, after dinner, conferred upon him the honour of knighthood; at the same time declaring her entire approbation of all that he had done. She likewise gave directions for the preservation of his ship, that it might remain a monument of his own and his country's glory. In 1585 he sailed with a fleet to the West Indies, and took the cities of St Jago, St Domingo, Carthagena, and St Augustine. In 1587 he went to Lisbon with a fleet of thirty sail; and having received intelligence of a great fleet being assembled in the bay of Cadiz, and destined to form part of the Armada, he with great courage entered the port and there burnt upwards of 10,000 tons of shipping; a feat which he afterwards jocosely called "singeing the king of Spain's beard." In 1588, when the Spanish Armada was approaching our shores, Sir Francis Drake was appointed vice-admiral under Lord Howard, and made prize of a very large galleon, commanded by Don Pedro de Valdez, who was reputed the projector of the invasion. This affair deserves to be particularly stated. On the 22d of July, Sir Francis, observing a great Spanish ship floating at a distance from both fleets, sent his pinnace to summon the commander to yield. Valdez replied, with much Spanish solemnity, that they were four hundred and fifty strong, that he himself was Don Pedro, and stood much upon his honour; and thereupon propounded several conditions upon which he was willing to yield. But the vice-admiral replied, that he had no leisure to parley; that if the Don thought fit instantly to yield, he might; if not, he should soon find that Drake was no coward. Pedro, hearing the name of Drake, immediately yielded, and with forty-six of his attendants came on board the admiral's ship.

It deserves to be noticed that Drake's name is mentioned in the singular diplomatic communication from the King of Spain which preceded the Armada:—

> Te veto ne pergas bello defendere Belgas;
> Quæ Dracus eripuit nunc restituantur oportet;
> Quas pater evertit jubeo te condere cellas:
> Religio Papæ fac restituatur ad unguem.

To these the queen made this extempore response:—

> Ad Græcas, bone rex, fiant mandata kalendas.

In 1589, Sir Francis Drake commanded the fleet sent to restore Dom Antonio, king of Portugal, the land forces being under the orders of Sir John Norris; but they had hardly put to sea when the commanders differed, and thus the attempt proved abortive. But as the war with Spain continued, a more formidable expedition was fitted out, under Sir John Hawkins and Sir Francis Drake, against their settlements in the West Indies, than had hitherto been undertaken during the whole course of it. Here, however, the commanders again disagreed about the plan; and the result in like manner disappointed public expectation. These disasters were keenly felt by Drake, and were the principal cause of his death, which took place on board his own ship, near the town of Nombre de Dios, in the West Indies, Jan. 28, 1595.

Drakenborch || Drama.

DRAKENBORCH, Arnold, a celebrated scholar and editor, was a native of Utrecht, where he was born January 1, 1684. Having studied belles-lettres under Grævius and Burmann, and law under Cornelius Van Eck, he succeeded Professor Burmann in 1716, and continued to hold his professorship till his death in 1748, in the sixty-fourth year of his age. His earliest work was a dissertation entitled *Disputatio philologico-historica de Præfecto urbis*, in 4to, and its intrinsic merit caused it to be reprinted at Frankfort, in 1752, by Professor Uhl, accompanied with a life of its learned author. His next work, entitled *Disputatio de officio præfectorum prætorio*, was published in 1707; and ten years afterwards he gave to the world his edition of Silius Italicus, in seventeen books, 4to. In order to render this edition as perfect as possible, nothing was omitted; and many historical subjects were engraved for the purpose of elucidating the text, to which his own copious and learned annotations greatly contributed. But his splendid edition of Livy, Lugd. Batav. 1738 and 1746, 7 tom., with a life of that eminent historian, is that on which his fame as a scholar chiefly rests. The preface to this work is replete with erudition, and gives a particular account of all the literary men who have at different periods commented on the works of Livy. His edition is based on that of Gronovius; but he made many important alterations on the authority of manuscripts which it is probable Gronovius had either never seen, or not taken the pains to consult. Upon the whole, this edition of Livy is one of the most elaborate, interesting and instructive, ever given to the world.

DRAMA.

A drama (we adopt Dr Johnson's definition, with some little extension) is a poem or fictitious composition in dialogue, in which the action is not related, but represented.

A disposition to this fascinating amusement, considered in its rudest state, seems to be inherent in human nature. It is the earliest sport of children to take upon themselves some fictitious character, and sustain it to the best of their skill, by such appropriate gesture and language as their youthful fancies suggest, and such dress and decoration as circumstances place within their reach. The infancy of nations is as prone to this pastime as that of individuals. When the horde emerges out of a nearly brutal state, so far as to have holidays, public sports, and general rejoicings, the pageant of their imaginary deities, or of their fabulous ancestors, is usually introduced as the most pleasing and interesting part of the show. But however general the predisposition to the assumption of fictitious character may be, there is an immeasurable distance betwixt the rude games in which it first displays itself, and that polished amusement which is numbered among the fine arts, which poetry, music, and painting have vied to adorn, and to whose service genius has devoted her most sublime efforts; whilst philosophy has stooped from her loftier task, to regulate the progress of the action, and give probability to the representation and personification of the scene.

Outline.

The history of Greece—of that wonderful country, whose days of glory have left such a never-dying blaze of radiance behind them—the history of Greece affords us the means of correctly tracing the polished and regulated drama, the subject of severe rule, and the vehicle for ex-

pressing the noblest poetry, from amusements as rude in their outline as the mimic sports of children or of savages. The history of the Grecian stage is that of the dramatic art in general. They transferred the drama, with their other literature, to the victorious Romans, with whom it rather existed as a foreign than flourished as a native art. Like the other fine arts, the stage sunk under the decay of the empire, and its fall was accelerated by the introduction of the Christian religion. In the middle ages dramatic representation revived, in the shape of the homely Mysteries and Moralities of our forefathers. The revival of letters threw light upon the scenic art, by making us acquainted with the pitch of perfection to which it had been carried by the genius of Greece. With this period commences the history of the modern stage, properly so called. Some general observations on the drama, and its present state in Britain, will form a natural conclusion to the article.

Rise of the Grecian drama.

The account which we have of the origin of Grecian theatrical representations, describes them as the fantastic orgies of shepherds and peasants, who solemnized the rites of Bacchus by the sacrifice of a goat, by tumultuous dances, and by a sort of masquerade, in which the actors were disguised like the ancient *Morrice-dancers* of England, or the *Guisards* of Scotland, who have not as yet totally disused similar revels. Instead of masks, their faces were stained with the lees of wine, and the songs and jests corresponded in coarseness to the character of the satyrs and fawns, which they were supposed to assume in honour of their patron Bacchus. Music, however, always formed a part of this rude festivity, and to this was sometimes added the recitations of an individual performer, who, possessed of more voice or talent than his companions, was able to entertain an audience for a few minutes by his own individual exertions.

Out of such rude materials, Thespis is supposed to have been the first who framed something like an approach to a more regular entertainment. The actors under this, the first of theatrical managers, instead of running about wild among the audience, were exalted upon a cart, or upon a scaffold formed of boards laid upon tressels. In these improvements Thespis is supposed to have had the aid of one Susarion, whose efforts were more particularly directed to the comic drama. But their fortunes have been unequal, for whilst the name of Thespis is still united with every thing dramatic, that of Susarion has fallen into oblivion, and is only known to antiquaries.

The drama in Greece, as afterwards in Britain, had scarcely begun to develope itself from barbarism, ere, with the most rapid strides, it advanced towards perfection. Thespis and Susarion flourished about four hundred and forty or fifty years before the Christian era. The battle of Marathon was fought in the year 490 before Christ; and it was upon Æschylus, one of the Athenian generals on that memorable occasion, that Greece conferred the honoured title of the Father of Tragedy. We must necessarily judge of his efforts by that which he did, not by that which he left undone; and if some of his regulations may sound strange in modern ears, it is but just to compare the state in which he found the drama, with that in which he left it.

Æschylus was the first, who, availing himself of the invention of a stage by Thespis, introduced upon the boards a plurality of actors at the same time, and converted into action and dialogue, accompanied or relieved at intervals by the musical performance of the chorus, the dull monologue of the Thespian orator. It was Æschylus, also, who introduced the deceptions of scenery, stationary indeed, and therefore very different from the decorations of our stage, but still giving a reality to the whole performance, which could not fail to afford pleasure to those who beheld for the first time an effort to surround the player, while invested with his theatrical character, with scenery which might add to the illusions of the representations. But this was not all. A theatre, at first of wood, but afterwards of stone, circumscribed, whilst it accommodated, the spectators, and reduced a casual and disorderly mob to the quality and civilization of a regular and attentive audience.

The most remarkable effect of the tragedy of Æschylus was the introduction of the chorus in a new character, which continued long to give a peculiar tone to the Grecian drama, and to make a striking difference betwixt that original theatre and those which have since arisen in modern nations.

The chorus who sung hymns in favour of Bacchus, the musical part, in short, of the entertainment, remained in the days of Thespis, as it had been in the rude village gambols which he had improved, the principal part of the dramatic entertainment. The intervention of monologue, or recitation, was merely a relief to the musicians and a variety to the audience. Æschylus, whilst he assigned a part of superior consequence to the actor in his improved dialogue, new-modelled the chorus, which custom still enjoined as a necessary and indispensable branch of the performance. They were no longer a body of vocal musicians, whose strains were as independent of what was spoken by the personages of the drama, as those of our modern orchestra when performing betwixt the acts. The chorus assumed from this time a different and complicated character, which forms a marked peculiarity in the Grecian drama, distinguishing it from the theatrical compositions of modern Europe.

The chorus, according to this new model, was composed of a certain set of persons, priests, captive virgins, matrons, or others, usually of a solemn and sacred character, the contemporaries of the heroes who appeared on the stage, who remained upon the scene to celebrate in hymns set to music the events which had befallen the active persons of the drama; to afford them alternately their advice or their sympathy; and, at least, to moralize, in lyrical poetry, on the feelings to which their history and adventures, their passions and sufferings, gave rise. The chorus might be considered as, in some degree, the representatives of the audience, or rather of the public, on whose great stage those events happen in reality which are presented in the mimicry of the drama. In the strains of the chorus, the actual audience had those feelings suggested to them as if by reflection in a mirror, which the events of the scene ought to produce in their own bosom; they had at once before them the action of the piece, and the effect of that action upon a chosen band of persons, who, like themselves, were passive spectators, whose dignified strains pointed out the moral reflections to which the subject naturally gave rise. The chorus were led or directed by a single person of their number, termed the coryphæus, who frequently spoke or sung alone. They were occasionally divided into two bands, who addressed and replied to each other. But they always preserved the character proper to them, of spectators, rather than agents in the drama.

The number of the chorus varied at different periods, often extending to fifty persons, and sometimes restricted to *half* that number; but it is evident that the presence of so many persons on the scene, officiating as no part of the *dramatis personæ*, but rather as contemporary spectators, involved many inconveniences and inconsistencies. That which the hero, however agitated by passion, must naturally have suppressed within his own breast, or uttered in soliloquy, was thus necessarily committed to the

confidence of fifty people, less or more. And when a deed of violence was to be committed, the helpless chorus, instead of interfering to prevent the atrocity to which the perpetrator had made them privy, could only, by the rules of the theatre, exhaust their sorrow and surprise in dithyrambics. But still the union which Æschylus accomplished betwixt the didactic hymns of the chorus and the events which were passing upon the stage, was a most important improvement upon the earlier drama. By this means the two unconnected branches of the old Bacchanalian revels were combined together; and we ought rather to be surprised that Æschylus ventured, whilst accomplishing such an union, to render the hymns sung by the chorus subordinate to the action or dialogue, than that he did not take the bolder measure of altogether discarding that which, before his time, was reckoned the principal object of a religious entertainment.

Grecian theatre, and mode of acting.

The new theatre and stage of Athens were reared, as we have seen, under the inspection of Æschylus. He also introduced dresses in character for his principal actors, to which were added embellishments of a kind which mark the wide distinction betwixt the ancient and modern stage. The personal disguise which had formerly been attained by staining the actor's face, was now, by what doubtless was considered as a high exertion of ingenuity, accomplished by the use of a mask, so painted as to represent the personage whom he performed. To augment the apparent awkwardness of this contrivance, the mouths of these masks were frequently fashioned like the extremity of a trumpet, which, if it aided the actor's voice to reach the extremity of the huge circuit to which he addressed himself, must still have made a ridiculous appearance upon the stage, had not the habits and expectations of the spectators been in a different tone from those of a modern audience. The use of the *cothurnus* or buskin, which was contrived so as to give to the performer additional and unnatural stature, would have fallen under the same censure. But the ancient and modern theatres may be said to resemble each other only in name, as will appear from the following account of the Grecian stage, abridged from the best antiquaries.

The theatres of the Greeks were immensely large in comparison to ours; and the audience sat upon rows of benches, rising above each other in due gradation. In form they resembled a horse-shoe. The stage occupied a platform, which closed in the flat end of the building, and was raised so high as to be on a level with the lowest row of benches. The central part of the theatre, or what we call the pit, instead of being filled with spectators, according to modern custom, was left for the occasional occupation of the chorus, during those parts of their duty which did not require them to be nearer to the stage. This space was called the *orchestra,* and corresponded in some measure with the open space which, in the modern equestrian amphitheatres, is interposed betwixt the audience and the stage, for the display of feats of horsemanship. The delusion of the scene being thus removed to a considerable distance from the eye of the spectator, was heightened; and many of the objections offered to the use of the mask and the buskin were lessened or totally removed. When the chorus did not occupy the orchestra, they ranged themselves beside the *thymele,* a sort of altar, surrounded with steps, placed in front of their stage orchestra. From this, as a post of observation, they watched the progress of the drama, and to this point the actors turned themselves when addressing them. The solemn hymns and mystic dances of the chorus, performed during their retreat into the orchestra, formed a sort of interludes, or interruptions of the action, similar in effect to the modern division into acts. But, properly speaking, there was no interruption of the representation from beginning to end. The piece was not, indeed, constantly progressive; but the illusion of the scene was always before the audience, either by means of the actors themselves or of the chorus. And the musical recitation and character of the dances traced by the chorus in their interludes, were always in correspondence with the character of the piece, grave, majestic, and melancholy; in tragedy, gay and lively; in comedy, and during the representation of satirical pieces, wild, extravagant, and bordering on buffoonery. The number of these interludes, or interruptions of the action, seems to have varied from three to six, or even more, at the pleasure of the author. The music was simple and inartificial, although it seems to have produced powerful effects on the audience. Two flute-players performed a prelude to the choral hymns, or directed the movement of the dances, which in tragedy were a solemn, slow, modulated succession of movements, very little resembling anything termed dancing among the moderns.

The stage itself was well contrived for the purposes of the Greek drama. The front was called the *logeum,* and occupied the full width of the flat termination of the theatre, contracted, however, at each extremity by a wall, which served to conceal the machinery necessary for the piece. The stage narrowed as it retired backwards; and the space so restricted in breadth was called the *proscenium.* It was terminated by a flat decoration, on which was represented the front of a temple, palace, or whatever else the poet had chosen for his scene. Suitable decorations appeared on the wings, as in our theatres. There were several entrances, both by the back scene and in front. These were not used indiscriminately, but so as to indicate the story of the piece, and render it more clear to apprehension. Thus, the persons of the drama who were supposed to belong to the palace or temple in the flat scene, entered from the side or the main door, as befitted their supposed rank; those who were inhabitants of the place represented, entered through a door placed at the side of the logeum; while those supposed to come from a distance were seen to traverse the orchestra, and to ascend the stage by a stair of communication, so that the audience were made spectators, as it were, of their journey. The proscenium was screened by a curtain, which was withdrawn when the piece commenced. The decorations could be in some degree altered, so as to change the scene; though this, we apprehend, was seldom practised. But machinery for the ascent of phantoms, the descent of deities, and similar exhibitions, were as much in fashion among the Greeks as on our own modern stage; with better reason, indeed, for we shall presently see that the themes which they held most proper to the stage called frequently for the assistance of these mechanical contrivances.

In the dress and costume of their personages the Greeks bestowed much trouble and expense. It was their object to disguise as much as possible the mortal actor who was to represent a divinity or an hero; and while they hid his face and augmented his height, they failed not to assign him a mask and dress in exact conformity to the popular idea of the character represented; so that, seen across the orchestra, he might appear the exact resemblance of Hercules or of Agamemnon.

The Grecians, but in particular the Athenians, became most passionately attached to the fascinating and splendid amusement which Æschylus thus regulated, which Sophocles and Euripides improved, and which all three, with other dramatists of inferior talents, animated by the full vigour of their genius. The delightful climate of Greece permitted the spectators to remain in the open air (for

there was no roof to their huge theatres) for whole days, during which several plays, high monuments of poetical talent, were successively performed before them. The enthusiasm of their attention may be judged of by what happened during the representation of a piece written by Hegemon. It was while the Athenians were thus engaged that there suddenly arrived the astounding intelligence of the total defeat of their army before Syracuse. The theatre was filled with the relations of those who had fallen; there was scarcely a spectator, who, besides sorrowing as a patriot, was not called to mourn a friend or relative. But, spreading their mantles before their faces, they commanded the representation to proceed; and thus veiled, continued to give it their attention to the conclusion. National pride, doubtless, had its share in this singular conduct, as well as fondness for the dramatic art. Another instance is given of the nature and acuteness of their feelings, when the assembly of the people amerced Phrynicus in a fine of a thousand drachmæ, because, in a comedy founded upon the siege of Miletos, he had agitated their feelings to excess, in painting an incident which Athens lamented as a misfortune dishonourable to her arms and her councils.

The price of admission was at first one *drachma;* but Pericles, desirous of propitiating the ordinary class of citizens, caused the entrance-money to be lowered to two *oboli,* so that the meanest Athenian had the ready means of indulging in this luxurious mental banquet. As it became difficult to support the expense of the stage, for which such cheap terms of admission could form no adequate fund, the same statesman, by an indulgence yet more perilous, caused the deficiency to be supplied from the treasure destined to sustain the expense of the war. It is a sufficient proof of the devotion of the Athenians to the stage, that not even the eloquence of Demosthenes could tempt them to forego this pernicious system. He touched upon the evil in two of his orations; but the Athenians were resolved not to forego the benefits of an abuse which they were aware could not be justified, and they passed a law making it death to touch upon that article of reformation.

It must not be forgotten, that the Grecian audience enjoyed the exercise of critical authority, as well as of classical amusement, at their theatre. They applauded and censured, as at the present day, by clapping hands and hissing. Their suffrage at those tragedies acted upon the solemn feasts of Bacchus, adjudged a laurel crown to the most successful dramatic author. This faculty was frequently abused; but the public, on sober reflection, seldom failed to be ashamed of such acts of injustice, and faithful, upon the whole, to the rules of criticism, evinced a fineness and correctness of judgment, which never descended to the populace of any other nation.

Peculiar character of the Grecian drama.

To this general account of the Grecian stage, it is proper to add some remarks on those peculiar circumstances from which it derives a tone and character so different from that of the modern drama; circumstances affecting at once its style of action, mode of decoration, and general effect on the feelings of the spectators.

The Grecian drama, it must be remembered, derived its origin from a religious ceremony; and, amid all its refinement, never lost its devotional character, unless it shall be judged to have done so in the department of satirical comedy.

When the audience was assembled, they underwent a religious lustration, and the archons or chief magistrates paid their public adoration to Bacchus, still regarded as the patron of the theatrical art, and whose altar was always placed in the theatre.

The subject of the drama was frequently religious. In tragedy especially, Sophocles and Euripides, as well as Æschylus, selected their subjects from the exploits of the deities themselves, or of the demigods and heroes whom Greece accounted to draw an immediate descent from the denizens of Olympus, and to whom she paid nearly equal reverence. The object of the tragic poets was less to amuse and interest their audience by the history of the human heart, or soften them by the details of domestic distress, than to elevate them into a sense of devotion or submission, or to astound and terrify them by the history and actions of a race of beings before whom ordinary mortality dwindled into pigmy size. This they dared to attempt; and, what may appear still more astonishing to the mere English reader, this they appear in a great measure to have performed. Effects were produced upon their audience which we can only attribute to the awful impression communicated by the idea of the immediate presence of the divinity. The emotions excited by the apparition of the Eumenides or furies, in Æschylus's tragedy of that name, so appalled the audience that females are said to have lost the fruit of their womb, and children to have actually expired in convulsions of terror. These effects may have been exaggerated; but that considerable inconveniences occurred from the extreme horror with which this tragedy impressed the spectators, is evident from a decree of the magistrates, limiting the number of the chorus, in order to prevent in future such tragical consequences. It is plain that the feeling by which such impressions arose must have been something very different from what the spectacle of the scene alone could possibly have produced. The mere sight of actors disguised in masks, suited to express the terrific yet sublime features of an antique Medusa, with her hair entwined with serpents,—the wild and dishevelled appearance, the sable and bloody garments, the blazing torches, the whole apparatus, in short, or properties as they are technically called, with which the classic fancy of Æschylus could invest those terrific personages,—nay more, even the appropriate terrors of language and violence of gesture with which they were bodied forth, must still have fallen far short of the point which the poet certainly attained, had it not been for the intimate and solemn conviction of his audience that they were in the performance of an act of devotion, and to a certain degree in the presence of the deities themselves. It was this conviction, and the solemn and susceptible temper to which it exalted the minds of a large assembly, which prepared them to receive the electric shock produced by the visible representation of those terrible beings, to whom, whether as personifying the stings and terrors of an awakened conscience, or as mysterious and infernal divinities, the survivors of an elder race of deities, whose presence was supposed to strike awe even into Jove himself, the ancients ascribed the task of pursuing and punishing atrocious guilt.

It was in consistency with this connection betwixt the drama and religion of Greece, that the principal Grecian tragedians thought themselves entitled to produce upon the stage the most sacred events of their mythological history. It might have been thought that in doing so they injured the effect of their fable and action, since suspense and uncertainty, so essential to the interest of a play, could not be supposed to exist where the immortal gods, beings controlling all others, and themselves uncontrolled, were selected as the agents in the piece. But it must be remembered, that the synod of Olympus, from Jove downwards, were themselves but limitary deities, possessing indeed a certain influence upon human affairs, but unable to stem or divert the tide of fate or destiny, upon whose dark bosom, according to the Grecian creed, gods as well as men were embarked, and both sweeping downwards to

Drama. some distant yet inevitable termination of the present system of the universe, which should annihilate at once the race of divinity and of mortality. This awful catastrophe is hinted at not very obscurely by Prometheus, who, when chained to his rock, exults, in his prophetic view, in the destruction of his oppressor Jupiter; and so far did Æschylus, in particular, carry the introduction of religious topics into his drama, that he escaped with some difficulty from an accusation of having betrayed the Eleusinian mysteries.

Where the subject of the drama was not actually taken from mythological history, and when the gods themselves did not enter upon the scene, the Grecian stage was, as we have already hinted, usually trod by beings scarcely less awful to the imagination of the audience; the heroes namely of their old traditional history, to whom they attributed an immediate descent from their deities, a frame of body and mind surpassing humanity, and after death an exaltation into the rank of demigods.

It must be added, that, even when the action was laid among a less dignified set of personages, still the altar was present on the stage; incense frequently smoked; and frequent prayers and obtestations of the deity reminded the audience that the sports of the ancient theatre had their origin in religious observances. It is scarcely necessary to state how widely the classical drama, in this respect, differs in principle from that of the modern, which pretends to be nothing more than an elegant branch of the fine arts, whose end is attained when it supplies an evening's amusement, whose lessons are only of a moral description, and which is so far from possessing a religious character, that it has with difficulty escaped condemnation as a profane, dissolute, and antichristian pastime. From this difference of principle there flows a difference of practical results, serving to account for many circumstances which might otherwise seem embarrassing.

The ancients, we have seen, endeavoured by every means in their power, including the use of masks and of buskins, to disguise the person of the actor; and, at the expense of sacrificing the expression of his countenance, and the grace, or at least the ease, of his form, they removed from the observation of the audience every association which could betray the person of an individual player, under the garb of the deity or hero he was designed to represent. To have done otherwise would have been held indecorous, if not profane. It follows, that as the object of the Athenian and of the modern auditor in attending the theatre was perfectly different, the pleasure which each derived from the representation had a distinct source. Thus, for example, the Englishman's desire to see a particular character is intimately connected with the idea of the actor by whom it is performed. He does not wish to see Hamlet in the abstract, so much as to see how Kemble performs that character,[1] and to compare him perhaps with his own recollections of Garrick in the same part. He comes prepared to study each variation of the actor's countenance, each change in his accentuation and deportment; to note with critical accuracy the points which discriminate his mode of acting from that of others; and to compare the whole with his own abstract of the character. The pleasure arising from this species of critical investigation and contrast is so intimately allied with our ideas of theatrical amusement, that we can scarce admit the possibility of deriving much satisfaction from a representation sustained by an actor whose personal appearance and peculiar expression of features should be concealed from us, however splendid his declamation, or however appropriate his gesture and action. But this mode of considering the drama, and the delight which we derive from it, would have appeared to the Greeks a foolish and profane refinement, not very different in point of taste from the expedient of Snug the joiner, who intimated his identity by letting his natural visage be seen under the mask of the lion which he represented. It was with the direct purpose of concealing the features of the individual actor, as tending to destroy the effect of his theatrical disguise, that the mask and buskin were first invented, and afterwards retained in use. The figure was otherwise so dressed as to represent the deity or demigod, according to the statue best known, and adored with most devotion, by the Grecian public. The mask was, by artists who were eminent in the plastic art, so formed as to perfect the resemblance. Theseus or Hercules stood before the audience in the very form with which painters and statuaries had taught them to invest the hero, and there was certainly thus gained a more complete scenic deception than could have been obtained in our present mode. It was aided by the distance interposed betwixt the audience and the stage; but, above all, by the influence of enthusiasm acting upon the congregated thousands, whose imaginations, equally lively and susceptible, were prompt to receive the impressions which the noble verse of their authors conveyed to their ears, and the living personification of their gods and demigods placed before their eyes.

It is scarcely necessary to add, that, while these observations plead their apology for the mask and the buskin of the ancients, they leave, where it stood before, every objection to those awkward and unseemly disguises, considered in themselves, and without reference to the peculiar purpose and tendency of the ancient theatre. In fact, the exquisite pleasure derived from watching the eloquence of feature and eye, which we admire in an accomplished actor, was not, as some have supposed, sacrificed by the ancients for the assumption of these disguises. They never did, and, according to the plan of their theatres, never could, possess that source of enjoyment. The circuit of the theatre was immense, and the eyes of the thousands whom it contained were so far removed from the stage, that, far from being able to enjoy the minute play of the actor's features, the mask and buskin were necessary to give distinction to his figure, and to convey all which the ancients expected to see, his general resemblance, namely, to the character he represented.

The style of acting, so far as it has been described to us, corresponded to the other circumstances of the representation. It affected gravity and sublimity of movement and of declamation. Rapidity of motion and vivacity of action seem to have been reserved for occasions of particular emotion; and that delicacy of bye-play, as well as all the aid which look and slight jesture bring so happily to the aid of an impassioned dialogue, were foreign to their system. The actors, therefore, had an easier task than on the modern stage, since it is much more easy to preserve a tone of high and dignified declamation, than to follow out the whirlwind and tempest of passion, in which it is demanded of the performer to be energetic without bombast, and natural without vulgarity.

The Grecian actors held a high rank in the republic,

---

[1] It is proper to state here, once for all, that, contrary to our usual practice, this article is reprinted as it originally appeared in the Supplement to the fourth, fifth, and sixth editions of this work, without any of those adaptations which the course of time and change of circumstances render necessary in ordinary cases. We have deemed this homage due to the genius and fame of the illustrious author (Sir Walter Scott), whose splendid view of the origin and progress of the dramatic art we have accordingly presented to the reader exactly as it proceeded from his own hand, leaving every contemporaneous allusion and illustration untouched.

Drama.

and those esteemed in the profession were richly recompensed. Their art was the more dignified, because the poets themselves usually represented the principal character in their own pieces; a circumstance which corroborates what we have already stated concerning the comparative inferiority of talents required in a Grecian actor, who was only expected to move with grace and declaim with truth and justice. His disguise hid all personal imperfections; and thus a Grecian poet might aspire to become an actor without that extraordinary and unlikely union of moral and physical powers which would be necessary to qualify a modern dramatist to mount the stage in person, and excel at once as a poet and as an actor.

Principal tragic writers in Athens.

It is no part of our present object to enter into any minute examination of the comparative merits of the three great tragedians of Athens, Æschylus, Sophocles, and Euripides. Never, perhaps, did there arise, within so short a space, such a succession of brilliant talents. Sophocles might, indeed, be said to be the contemporary of both his rivals, for his youthful emulation was excited by the success of Æschylus, and the eminence of his latter years was disturbed by the rivalry of Euripides, whom, however, he survived. To Æschylus, who led the van in the dramatic enterprise, as he did in the field of Marathon, the sanction of antiquity has ascribed unrivalled powers over the realms of astonishment and terror. At his summons, the mysterious and tremendous volume of destiny, in which are inscribed the doom of gods and men, seemed to display its leaves of iron before the appalled spectators; the more than mortal voices of Deities, Titans, and departed Heroes, were heard in awful conference; heaven bowed, and its divinities descended; earth yawned, and gave up the pale spectres of the dead, and the yet more undefined and grisly forms of those infernal deities who struck horror into the gods themselves. All this could only be dared and done by a poet of the highest order, confident, during that early age of enthusiasm, that he addressed an audience prompt to kindle at the heroic scene which he placed before them. It followed almost naturally, from his character, that the dramas of Æschylus, though full of terrible interest, should be deficient in grace and softness; that his sublime conciseness should deviate sometimes into harshness and obscurity; that, finding it impossible to sustain himself at the height to which he had ascended, he should sometimes drop, "fluttering his pinions vain," into great inequalities of composition; and, finally, that his plots should appear rude and inartificial, contrasted with those of his successors in the dramatic art. Still, however, Æschylus led not only the way in the noble career of the Grecian drama, but outstripped, in point of sublimity at least, those by whom he was followed.

Sophocles, who obtained from his countrymen the title of the *Bee* of Attica, rivalled Æschylus when in the possession of the stage, and obtained the first prize. His success occasioned the veteran's retreat to Sicily, where he died, commanding that his epitaph should make mention of his share in the victory of Marathon, but should contain no allusion to his dramatic excellencies. His more fortunate rival judiciously avoided the dizzy and terrific path which Æschylus had trode with so firm and daring a step. It was the object of Sophocles to move sorrow and compassion, rather than to excite indignation and terror. He studied the progress of action with more attention than Æschylus, and excelled in that modulation of the story by which interest is excited at the beginning of a drama, maintained in its progress, and gratified at its conclusion. His subjects are also of a nature more melancholy and less sublime than those of his predecessor. He loved to paint heroes rather in their forlorn than in their triumphant fortunes, aware that the contrast offered new sources of the pathetic to the author. Sophocles was the most fortunate of the Greek tragedians. He attained the age of ninety-one years; and, in his eightieth, to vindicate himself from a charge of mental imbecility, he read to the judges his *Œdipus Coloneus*, the most beautiful, at least the most perfect, of his tragedies. He survived Euripides, his most formidable rival, of whom also we must say a few words.

Drama.

It is observed by Schlegel, that the tone of the tragedies of Euripides approaches more nearly to modern taste than to the stern simplicity of his predecessors. The passion of love predominates in his pieces, and he is the first tragedian who paid tribute to the passion which has been too exclusively made the moving cause of interest on the modern stage,—the first who sacrificed to

Cupid, king of gods and men.

The dramatic use of this passion has been purified in modern times, by the introduction of that tone of sentiment which, since the age of chivalry, has been a principal ingredient in heroic affection. This was unknown to the ancients, in whose society females, generally speaking, held a low and degraded place, from which few individuals emerged, unless those who aspired to the talents and virtues proper to the masculine sex. Women were not forbidden to become competitors for the laurel or oaken crown offered to genius and to patriotism; but antiquity held out no myrtle wreath as a prize for the domestic virtues peculiar to the female character. Love, therefore, in Euripides, does not always breathe purity of sentiment, but is stained with the mixture of violent and degrading passions. This, however, was the fault of the age rather than of the poet, although he is generally represented as an enemy of the female sex; and his death was ascribed to a judgment of Venus.

When blood-hounds met him by the way,
And monsters made the bard their prey.

This great dramatist was less happy than Sophocles in the construction of his plots; and, instead of the happy expedients by which his predecessor introduces us to the business of the drama, he had too often recourse to the mediation of a prologue, which came forth to explain in detail the previous history necessary to understand the piece.

Euripides is also accused of having degraded the character of his personages, by admitting more alloy of human weakness, folly, and vice, than was consistent with the high qualities of the heroic age. Æschylus, it was said, transported his audience into a new and more sublime race of beings; Sophocles painted mankind as they ought to be, and Euripides as they actually are. Yet the variety of character introduced by the latter tragedian, and the interest of his tragedies, must always attract the modern reader, coloured as they are by a tone of sentiment, and by his knowledge of the actual business, rules, and habits of actual life, to which his predecessors, living, as they did, in an imaginary and heroical world of their own, appear to have been strangers. And although the judgment of the ancients assigned the pre-eminence in tragedy to Æschylus or Sophocles, yet Euripides has been found more popular with posterity than either of his two great predecessors.

Grecian comedy.

The division betwixt tragedy and comedy, for both sprung from the same common origin, the feasts, namely, in honour of Bacchus, and the disguises adopted by his worshippers, seems to have taken place gradually, until the jests and frolics, which made a principal part of these revels, were found misplaced when introduced with graver mat-

ter, and were made by Susarion, perhaps, the subject of a separate province of the drama. The Grecian comedy was divided into the ancient, the middle, and the modern style of composition.

Ancient comedy.

The ancient and original comedy was of a kind which may, at first sight, appear to derogate from the religious purposes which we have pointed out as the foundation of the drama. They frequently turn upon parodies, in which the persons and adventures of those gods and heroes who were the sublime subjects of the tragic drama, are introduced for the purpose of buffoon-sport and ridicule, as in Carey's modern farces of *Midas* and the *Golden Pippin*. Hercules appears in one of those pieces astonishing his host by an extravagant appetite, which the cook in vain attempts to satiate, by placing before him, in succession, all the various dishes which the ancient kitchen afforded. In another comedy, Bacchus, in whose honour the solemnity was instituted, is brought in only in order to ridicule his extreme cowardice.

At other times, allowing a grotesque fancy its wildest range, the early comic authors introduced upon the stage animals, and even inanimate things, as part of their *dramatis personæ*, and embodied forth on the stage the fantastic imaginations of Lucian in his *True History*. The golden age was represented in the same ridiculous and bizarre mode of description as the *Pays de la Cocagne* of the French minstrels, or the popular ideas of *Lubber-land* in England; and the poets furnished kingdoms of birds, and worlds, in the moon.

Had the only charm of these entertainments consisted in the fantastic display with which the eyes of the spectators were regaled at the expense of the over-excited imagination of the poet, they would soon have fallen into disuse; for the Athenians were too acute and judicious critics to have been long gratified with mere extravagance. But these grotesque scenes were made the medium for throwing the most bold and daring ridicule upon the measures of the state, upon the opinions of individuals, and upon the religion of the country.

This propensity to turn into ridicule that which is most serious and sacred, had probably its origin in the rude gambols of the sylvan deities who accompanied Bacchus, and to whose petulant and lively demeanour rude jest was a natural accompaniment. The audience, at least the more ignorant part of them, saw these parodies with pleasure, which equalled the awe they felt at the performance of the tragedies, whose most solemn subjects were thus burlesqued; nor do they appear to have been checked by any sense that their mirth was profane. In fact, when the religion of a nation comes to consist chiefly in the practice of a few unmeaning ceremonies, it is often found that the populace, with whatever inconsistence, assume the liberty of profaning them by grotesque parodies, without losing their reverence for the superstitions which they thus vilify. Customs of a like tendency were common in the middle ages. The festival of the Ass in France, of the Boy-Bishop in England, of the Abbot of Unreason in Scotland, and many other popular practices of the same kind, exhibited, in countries yet Catholic, daring parodies of the most sacred services and ceremonies of the Roman church. And as these were practised openly, and under authority, without being supposed to shake the people's attachment to the rites which they thus ridiculed, we cannot wonder that similar profanities were well received among the Pagans, whose religion sat very loosely upon them, and who professed no fixed or necessary articles of faith.

It is probable that, had the old Grecian comedy continued to direct its shafts of ridicule only against the inhabitants of Olympus, it would not have attracted the coercion of the magistracy. But its province was far more extensive, the poets claiming the privilege of laying their opinions on public affairs before the people in this shape. Cratinus, Eupolis, and particularly Aristophanes, a daring, powerful, and apparently unprincipled writer, converted comedy into an engine for assailing the credit and character of private individuals, as well as the persons and political measures of those who administered the state. The doctrines of philosophy, the power of the magistrate, the genius of the poet, the rites proper to the deity, were alternately made the subject of the most uncompromising and severe satire. It was soon discovered that the more directly personal the assault could be made, and the more revered or exalted the personage, the greater was the malignant satisfaction of the audience, who loved to see wisdom, authority, and religious reverence brought down to their own level, and made subjects of ridicule by the powers of the merciless satirist. The use of the mask enabled Aristophanes to render his satire yet more pointedly personal; for, by forming it so as to imitate, probably with some absurd exaggeration, the features of the object of his ridicule, and by imitating the dress and manner of the original, the player stepped upon the stage a walking and speaking caricature of the hero of the night, and was usually placed in some ludicrous position, amidst the fanciful and whimsical chimeras with which the scene was peopled.

In this manner Aristophanes ridiculed with equal freedom Socrates, the wisest of the Athenians, and Cleon, the demagogue, when at the height of his power. As no one durst perform the latter part, for fear of giving offence to one so powerful, the author acted Cleon himself, with his face smeared with the lees of wine. Like the satire of Rabelais, the political and personal invective of Aristophanes was mingled with a plentiful allowance of scurril and indecent jests, which were calculated to insure a favourable reception from the bulk of the people. He resembles Rabelais also in the wild and fanciful fictions which he assumes as the vehicle of his satire; and his comedy of the Birds may even have given hints to Swift, when, in order to contrast the order of existing institutions with those of an Utopian and fantastic fairy land, he carries Gulliver among giants and pigmies. Yet though his indecency, and the offensive and indiscriminate scurrility of his satire, deserve censure;—though he merits the blame of the wise for his attack upon Socrates, and of the learned for his repeated and envenomed assaults on Euripides,—Aristophanes has nevertheless added one deathless name to the deathless period in which he flourished; and, from the richness of his fancy, and gaiety of his tone, has deserved the title of the Father of Comedy. When the style of his sarcasm possessed the rareness of novelty, it was considered of so much importance to the state, that a crown of olive was voted to the poet, as one who had taught Athens the defects of her public men. But unless angels were to write satires, ridicule cannot be considered as the test of truth. The temptation to be witty is just so much the more resistless, that the author knows he will get no thanks for suppressing the jest which rises to his pen. As the public becomes used to this new and piquant fare, fresh characters must be sacrificed for its gratification. Recrimination adds commonly to the contest, and those who were at first ridiculed out of mere wantonness of wit, are soon persecuted for resenting the ill usage; until literature resembles an actual personal conflict, where the victory is borne away by the strongest and most savage, who deals the most desperate wounds with the least sympathy for the feeling of his adversary.

The ancient comedy was of a character too licentious to be long tolerated. Two or three decrees having been

in vain passed, in order to protect the citizens against libels of this poignant description, the ancient comedy was finally proscribed by that oligarchy which assumed the government of Athens upon the downfall of the popular government towards the end of the Peloponnesian war. By order of these rulers, Anaxander, an actor, was punished capitally for parodying a line of Euripides, so as to infer a slight of the government. He was starved to death, to which, as an appropriate punishment, the public has since his time often indirectly condemned both actors and dramatists. Aristophanes, who was still alive, bowed to the storm, and relinquished the critical and satirical scourge which he had hitherto exercised in the combined capacity of satirist, reformer, and reviewer; and the use of the chorus was prohibited to comic actors, as it seems to have been in their stanzas chiefly that the offensive satire was invested. To this edict Horace alludes in the well known lines:

> Successit vetus his comœdia, non sine multa
> Laude: sed in vitium libertas excidit, et vim
> Dignam lege regi. lex est accepta, chorusque
> Turpiter obticuit, sublato jure nocendi.[1]

Middle comedy.

In the middle comedy, Thalia and her votaries seemed to have retraced their steps, and, avoiding personal satire, resorted once more to general subjects of burlesque raillery. We learn from history, real or fabulous, or from the works of the elder poets, that these plays had the fanciful wildness without the personal satire of the ancient comedy; for the authors were obliged to take care that there was no "offence" in their pleasantry. At most, they only ventured to touch on matters of instant interest in the way of inuendo, under feigned titles and oblique hints, and had no longer the audacity to join men's vices or follies to their names. Aristophanes re-cast several of his pieces in this manner. But the same food, without the poignant seasoning to which the audience had been accustomed, palled on their taste, and this cast of pieces soon gave place to that which the ancients called the New Comedy, so successfully cultivated by Menander and others.

New comedy.

Notwithstanding what modern critics have said to the contrary, and particularly the ingenious Schlegel, the new tone which comedy thus assumed seems more congenial to true taste as well as to public decorum, and even to the peace and security of the community, than that of Aristophanes, whose satiric wit, like a furious bull, charged upon his countrymen without respect or distinction, and tossed and gored whatever he met with in his way.

The new comedy had for its object the ludicrous incidents of private life (*celebrare domestica facta*, says Horace); to detail those foibles, follies, and whimsical accidents, which are circumstances material and serious to the agents themselves, but, as very usually happens on the stage of the world, matters only of ludicrous interest to the on-lookers. The new comedy admitted also many incidents of a character not purely ludicrous, and some which, calling forth pathetic emotion, approached more nearly to the character of tragedy than had been admitted in the ancient comedies of Aristophanes, and in this rather resembled what the French have called *Tragédie Bourgeoise.* It is scarce necessary to remark, that the line cannot be always distinctly drawn betwixt the subjects which excite mirth and those which call forth sympathy. It often happens that the same incident is at once affecting and ludicrous, or admits of being presented alternately in either point of view. In a drama, also, which treats of the faults and lighter vices, as well as of the follies of mankind, it is natural that the author should sometimes assume the high tone of the moralist. In these cases, to use the language of Horace, comedy exalts her voice, and the offended father, the pantaloon of the piece, swells into sublimity of language. A pleasant species of composition was thus attained, in which wit and humour were relieved by touches both of sentiment and moral instruction. The new comedy, taken in this enlarged point of view, formed the introduction to the modern drama; but it was neither so comprehensive in its plan, nor so various in character and interest.

General character of the new comedy.

The form which the Greeks, and in imitation of them the Romans, adopted, for embodying their comic effusions, was neither extended nor artificial. To avoid the charge of assaulting, or perhaps the temptation to attack private persons, the actors in their drama were rather painted as personifications of particular classes of society, than living individual characters. The list of these personages was sufficiently meagre. The principal character, upon whose devices and ingenuity the whole plot usually turns, is the *Geta* of the piece, a witty, roguish, insinuating, and malignant slave, the confident of a wild and extravagant son, whom he aids in his pious endeavours to cheat a suspicious, severe, and griping father. When to these three are added a wily courtezan, a procuress, a stolen virgin, who is generally a mute or nearly such, we have all the stock-characters which are proper to the classic comedy. Upon this limited scale of notes the ancients rung their changes, relieving them occasionally, however, by the introduction of a boastful soldier, a boorish clown, or a mild and good-natured old man, to contrast with the irascible Chremes of the piece, the more ordinary representative of old age.

The plot is in general as simple as the cast of the characters. A father loses his child, who falls into the hands of a procuress or slave merchant. The efforts of the youth, who falls in love with this captive, to ransom her from her captivity, are seconded by the slave, who aids him in the various devices necessary to extort from his father the funds necessary for the purchase, and their tricks form the principal part of the intrigue. When it is necessary that the play shall close, the discovery of the girl's birth takes place, and the young couple are married. The plots are indeed sometimes extended or enlarged by additional circumstances, but very seldom by any novelty of character or variety of general form.

It is a necessary consequence, that the ancient comic authors were confined within a very narrow compass. The vast and inexhaustible variety of knavery, folly, affectation, humour, &c. as mingled with each other, or as modified by difference of age, sex, temper, education, profession, and habit of body, are all within the royalty of the modern comic dramatist, and he may summon them up, under what limitations and in what circumstances he pleases, to play their parts in his piece. The ancients were much more limited in their circle of materials, and, perhaps, we must look for the ruling cause once more in the great size of their theatres, and to the use of the mask, which, though it easily presented the general or generic character of the personage introduced, was inca-

[1] The ancient comedy next play'd its part,
Well-famed, at first, for spirit and for art:
But Liberty o'erleaping decent awe,
Satiric rage required restraint from law;
The edict spoke, dishonour'd silence bound
The chorus, and forbade their ancient right to wound.

pable of the endless variety which can be given to ridicule of a more minute, refined, and personal kind, by the flexible organs of a modern actor.

But besides this powerful reason for refraining from any attempt to draw characters distinguished by peculiar habits, there is much reason to think that the mode of life pursued by the ancient Athenians was unfavourable to the formation of whimsical, original, or eccentric characters. Citizens of the same state, they lived much together, and the differences of ranks did not make the same distinction in taste and manners as in modern Europe Their occupation, also, was the same. They were all public men, and had a common interest in the management of the state; and it probably followed that, in men whose pursuits were all bent the same way, the same general similarity of manners might be found to exist, which is remarked in those who follow the same profession. The differences of youth and age, of riches and poverty, of good or bad temper, &c. must have been much modified in Attica, where all free citizens were, to a certain degree, on a level—discussed the same topics of state, and gave the same vote to forward them—enjoyed, without restriction, the same public amusements; and where the same general cast of manners might descend to the lowest of the citizens, for the very reason that even a poor herb-woman understood the delicacy of the Attic dialect so perfectly, as to distinguish a stranger by the first words he addressed to her.

The chorus, silenced, as we have seen, owing to the license of the old comedy, made no appendage to that which was substituted in its place. The exhibition of the Grecian comedy did not, in other respects, in so far as we know, materially differ from that of the tragedy. Instead of the choral interludes, the representation was now divided, by intervals of cessation, into acts, as upon the modern stage. And the number five seems to have been fixed upon as the most convenient and best adapted for the purposes of representation. The plot, as we have seen, and the distinct and discriminated specification of character, were, in either case, subordinate considerations to the force of style and composition. It follows, of consequence, that we can better understand and enjoy the tragedies than the comedies of the ancients. The circumstances which excite sublime or terrific sensations are the same, notwithstanding the difference of age, country, and language. But comic humour is of a character much more evanescent. The force of wit depends almost entirely upon time, circumstance, and manners, insomuch that a jest which raises inextinguishable laughter in a particular class of society, appears flat or disgusting if uttered in another. It is, therefore, no wonder that the ancient comedy, turning upon manners so far removed from our own time, should appear to us rather dull and inartificial. The nature of the intercourse between the sexes in classic times was also unfavourable for comedy. The coquette, the fine lady, the romp, all those various shades of the female character which occupy so many pleasant scenes on the modern stage, were totally unknown to ancient manners. The wife of the ancient comedy was a mere household drudge, the vassal, not the companion, of an imperious husband. The young woman whose beauty is the acting motive of the intrigue, never evinces the slightest intellectual property of any kind. And the only female character admitting of some vivacity is that of the courtezan, whose wit as well as her charms appeared to have been professional.

After subtracting the large field afforded by female art or caprice, female wit, or folly, or affection, the realm of the ancient comedy will appear much circumscribed; and we have yet to estimate a large deduction to be made on account of the rust of antiquity, and the total change of religion and manners. It is no wonder, therefore, that the wit of Plautus and Terence should come forth diminished in weight and substance, after having been subjected to the alembic of modern criticism. That which survives the investigation, however, is of a solid and valuable character. If these dramas do not entertain us with a display of the specific varieties of character, they often convey maxims evincing a deep knowledge of human passion and feeling; and are so admirably adapted to express, in few and pithy words, truths which it is important to remember, that even the Apostle Paul himself has not disdained to quote a passage from a Grecian dramatist. The situation, also, of their personages is often truly comic; and the modern writers who have borrowed their ideas, and arranged them according to the taste of their own age, have often been indebted to the ancients for the principal cause of their success.

Roman drama.

Having dwelt thus long upon the Grecian drama, we are entitled to treat with conciseness that of Rome, which, like the other fine arts, that people, rather martial than literary, copied from their more ingenious neighbours.

The Romans were not, indeed, without a sort of rude dramatic representation of their own, of the same nature with that which, as we have already noticed, usually arises in an early period of society. These were called *Fabulæ Atellanæ;* farces, for such they were, which took their name from *Atella*, a town belonging to the *Osci*, in Italy. They were performed by the Roman youth, who used to attack each other with satirical couplets during the intervals of some rude game, in which they seem to have represented the characters of fabulous antiquity. But, 361 years before the Christian era, the Romans, in the time of a great pestilence, as we learn from Livy, introduced a more regular species of theatrical entertainment, in order to propitiate the deities by a solemn exhibition of public games; after which, what had hitherto been matter of mere frolic and amusement, assumed, according to the historian, the appearance of a professional art; and the Roman youth, who had hitherto appeared as amateur performers, gave up the stage to regular performers.

These plays continued, however, to be of a very rude structure, until the Grecian stage was transplanted to Rome. Livius Andronicus, by birth a Grecian, led the way in this improvement, and is accounted her first dramatist.

Seneca the philosopher is the only Roman tragedian whose works have reached our time. But his tragedies afford no very favourable specimen of Roman art. They are in the false taste which succeeded the age of Augustus, and debased the style of composition in that of Nero; bombastic, tedious, and pedantic; treating, indeed, of Grecian subjects, but not with Grecian art.

By a singular contrast, although we have lost the more valuable tragedies of Rome, we have been compelled to judge of the new Greek comedy through the medium of the Latin translations. Of Menander we have but a few fragments, and our examples of his drama are derived exclusively from Plautus and Terence. Of these, the former appears the more original, the latter the more elegant author. The comedies of Plautus are much more connected with manners, much more full of what may be termed drollery and comic situation, and are believed to possess a greater portion of Roman character. The Romans, indeed, had two species of comedy, the *Palliata,* where the scene and dress were Grecian; the *Togata,* where both were Roman. But besides this distinction, even the *Mantled,* or Grecian comedy, might be more or less of a Roman cast; and Plautus is supposed to have

infused a much stronger national tone into his plays than can be traced in those of Terence. They are also of a ruder cast, and more extravagant, retaining, perhaps, a larger portion of the rough horse-play peculiar to the *Fabulæ Atellanæ*. Terence, on the contrary, is elegant, refined, and sententious; decorous and regular in the construction of his plots; exhibiting more of wit in his dialogue, than of comic force in his situations; grave often and moral, sometimes even pathetic; and furnishing, upon the whole, the most perfect specimens of the Grecian comedy, both in action and character.

The alterations which the Romans made in the practice of the theatrical art do not seem to have been of great consequence. One circumstance, however, deserves notice. The orchestra, or, as we should say, the pit of the theatre, was no longer left vacant for the occasional occupation of the chorus, but was filled with the senators, knights, and other more respectable citizens. The stage was thus brought more near to the eye of the higher class of the audience. It would also seem that the theatres were smaller; for we read of two so constructed that each turned upon a pivot, so that, when placed back to back, they were separate theatres, yet were capable of being wheeled round, with all the audience, so as to bring their oblong ends together, then forming a single amphitheatre, in which the games of the circus succeeded to dramatic representation. It is not easy to conceive the existence of such machinery; but the story, at any rate, seems to show that their theatres must have been greatly smaller than those of Greece, to admit the supposition of such an evolution as being in any degree practicable. This diminution in the size of the house, and the occupation of the orchestra by the most dignified part of the audience, may have afforded a reason why masks were, at least occasionally, disused on the Roman stage. That they were sometimes disused is certain; for Cicero mentions Roscius Gallus as using a mask to conceal a deformity arising from the inequality of his eyes, which implies plainly that other comedians played with their faces disclosed. It is therefore probable that the imperfections of the mask were felt so soon as the distance was diminished between the performer and the spectators; and we may hazard a conjecture that this disguise was first laid aside in the smaller theatres.

Degradation of the theatrical profession.

But the principal change introduced by the Romans into the drama, and which continues to affect it in every country of Europe, respected the *status* or rank of the actors in society. We have seen that Athens, enthusiastic in her attachment to the fine arts, held no circumstances degrading which were connected with them. Æschylus and Sophocles were soldiers and statesmen, yet lost nothing in the opinion of their countrymen by appearing on the public stage. Euripides, who was also a person of consequence, proved that "love esteems no office mean;" for he danced in a female disguise in his own drama, and that not as the Princess Nauticlea, but as one of her handmaidens, or, in modern phrase, as a *figurante*. The Grecians, therefore, attached no dishonour to the person of the actor, nor esteemed that he who contributed to giving the amusement of the theatre was at all degraded beneath those who received it. It was otherwise in Rome. The contempt which the Romans entertained for players might be founded partly upon their confounding this elegant amusement with the games of the circus and amphitheatre, performed by gladiators and slaves, the meanest, in short, of mankind. Hence, to use the words of St Augustine, "the ancient Romans, accounting the art of stage-playing and the whole scene infamous, ordained that this sort of men should not only want the honour of other citizens, but also be disfranchised and thrust out of their tribe, by a legal and disgraceful censure, which the censors were to execute; because they would not suffer their vulgar sort of people, much less their senators, to be defamed, disgraced, or defiled with stage-players;" which act of theirs he styles "an excellent true Roman prudence, to be enumerated among the Romans' praises."

Accordingly, an edict of the prætor stigmatized as infamous all who appeared on the stage, either to speak or act; but it is remarkable that from this general proscription the Roman youth were excepted; and they continued to enact the *Fabulæ Atellanæ*, namely, the farces or drolleries of ancient Italian origin, without incurring any stigma. This exception seems to indicate that the edict originated in the national pride of the Romans, and their contempt for Grecian literature, and for foreigners of every description. Under any other view it is impossible they should have preferred the actors in these coarse farces, who, by the bye, are supposed to have been the originals of no less persons that Harlequin and Punchinello, to those who possessed taste and talents sufficient to execute the masterly scenes borrowed from the Grecian drama.

Injustice, however, and we call that law unjust which devotes to general infamy any profession of which it nevertheless tolerates the practice, is usually inconsistent. Several individual play-actors in Rome rose to high public esteem, and to the enjoyment of great wealth. Roscius was the friend and companion of Piso and of Sylla, and, what was still more to his credit, of Cicero himself, who thus eulogises the scenic art, while commemorating the merit of his deceased friend: *Quis nostrûm tam animo agresti ac duro fuit, ut Roscii morte nuper non commoveretur? qui quum esset senex mortuus, tamen, propter excellentem artem ac venustatem, videbatur omnino mori non debuisse.*

Paris, another Roman actor, reached a height of celebrity as distinguished as Roscius, and exercised, as many of his profession have since done, an arbitrary authority over the unfortunate dramatic authors. It is recorded by the satirist that Statius the epic poet might have starved had he not given up to this favourite of the public, upon his own terms doubtless, the manuscript of an unacted performance. Paris was put to death by Domitian out of jealousy.

If the actors rose to be persons of importance in Rome, the dramatic critics were no less so. They had formed a code of laws for the regulation of dramatic authors, to which the great names of Aristotle and Horace both contributed their authority. But these will be more properly treated of when we come to mention their adoption by the French stage.

Decay and disrepute of the ancient stage.

Having thus hastily given some account of the ancient stage, from its rise in Greece to its transportation to Rome, we have only to notice the circumstances under which it expired.

Christianity from its first origin was inimical to the institution of the theatre. The fathers of the church inveigh against the profaneness and immodesty of the theatre. In the treatise of Tertullian, *De Spectaculis*, he has written expressly upon the subject. The various authorities on this head have been collected and quoted by the enemies of the stage, from Prynne down to Collier. It ought, however, to be noticed, that their exprobation of the theatre is founded, first, upon its origin, as connected with heathen superstition; and secondly, on the beastly and abominable license practised in the pantomimes, which, although they made no part of the regular drama, were presented nevertheless in the same place, and before the same audience. "We avoid your shows and games," says Tertullian, "be-

cause we doubt the warrant of their origin. They savour of superstition and idolatry, and we dislike the entertainment, as abhorring the heathen religion on which it is founded." In another place he observes, the temples were united to theatres, in order that superstition might patronize debauchery; and that they were dedicated to Bacchus and to Venus, the confederate deities of lust and intemperance.

It was not only the connection of the theatre with heathen superstition that offended the primitive church, but also the profligacy of some of the entertainments which were exhibited. There cannot be much objected to the regular Roman dramas in this particular, since even Mr Collier allows them to be more decorous than the British stage of his own time; but, as we have already hinted, in the *Ludi Scenici*, the intrigues of the gods and the heroes were represented upon the stage with the utmost grossness. These obscene and scandalous performances thus far coincided with the drama, that they were acted in the same theatres, and in honour of the same deities, and both were subjected to the same sweeping condemnation. They were not, however, absolutely or formally abolished, even when Christianity became the religion of the state. Tertullian and St Augustin both speak of the scenic representations of their own day, under the distinct characters of tragedy and comedy; and although condemned by the church, and abhorred by the more strict Christians, there is little doubt that the ancient theatre continued to exist until it was buried under the ruins of the Roman empire.

Modern Drama.

Dramatic representations of the middle ages.

The same proneness to fictitious personification, which we have remarked as a propensity common to all countries, introduced, during the dark ages, a rude species of drama into most of the nations of Europe. Like the first efforts of the ancients in that art, it had its foundation in religion; with this great difference, that as the rites of Bacchus before, and even after the improvements introduced by Thespis, were well enough suited to the worship of such a deity, the religious dramas, mysteries, or whatever other name they assumed, were often so unworthy of the Christian religion, on which they were founded, that their being tolerated can be attributed only to the gross ignorance of the laity, and the cunning of the Catholic priesthood, who used them, with other idle and sometimes indecorous solemnities, as one means of amusing the people's minds, and detaining them in contented bondage to their spiritual superiors.

In the empire of the East, religious exhibitions of a theatrical character appear to have been instituted about the year 990, by Theophylact, patriarch of Constantinople, with the intention, as Warton surmises, of weaning the minds of the people from the Pagan revels, by substituting Christian spectacles, partaking of the same spirit of license. His contemporaries give him little credit for his good intentions. "Theophylact," says Cedrenus, as translated by Warton, "introduced the practice, which prevails to this day, of scandalizing God and the memory of his saints, on the most splendid and popular festivals, by indecent and ridiculous songs, and enormous shoutings, even in the midst of those sacred hymns which we ought to offer to divine grace for the salvation of our souls. But he having collected a company of base fellows, and placing over them one Euthynicus, surnamed Casnes, whom he also appointed the superintendent of his church, admitted into the sacred service diabolical dances, exclamations of ribaldry, and ballads borrowed from the streets and brothels." The irregularities of the Greek clergy, who, on certain holidays, personated feigned characters, and entered even the choir in masquerade, are elsewhere mentioned. (Warton's *History of English Poetry*, vol. ii. p. 370.) These passages do not prove that actual mysteries or sacred dramas were enacted on such occasions; but probably the indecent revels alluded to bore the same relation to such representations, as the original rites of Bacchus to the more refined exhibitions of Thespis and Susarion.

There has been some dispute among theatrical antiquaries, in which country of Europe dramatic representations of a religious kind first appeared. The liberal and ingenious editor of the *Chester Mysteries* has well remarked, in his introduction to that curious and beautiful volume, that a difficulty must always attend the inquiry, from the doubts that exist, whether the earliest recorded performances of each country were merely pantomimes, or were accompanied with dialogue.

The practice of processions and pageants with music, in which characters, chiefly of sacred writ, were presented before the public, is so immediately connected with that of speaking exhibitions, that it is difficult to discriminate the one from the other.

We are tempted to look first to Italy; as it is natural that the tragic art should have revived in that country in which it was last exercised, and where traditions, and perhaps some faint traces, of its existence were still preserved.

"The first speaking sacred drama," says Mr Walker, "was *Della Passione di nostro Signor Giesù Christo*, by Giuliano Dati, bishop of San Leo, who flourished about the year 1445." (Walker's *Essay on the Revival of the Drama in Italy*, p. 6.) This elegant author does, indeed, show that Italian scholars, and particularly Mussato, the Paduan historian, had composed two Latin dramas upon something like the classical model about the year 1300. Yet, although his play upon the tyranny and death of Ezzlino obtained him both reputation and honour, it does not appear to have been composed for the stage, but rather to have been a dramatic poem, since the progress of the piece is often interrupted by the poet speaking in his own person.

The French drama is traced by M. Legrand as high as the thirteenth century; and he has produced one curious example of a pastoral entitled *Un Jeu*. He mentions also a farce, two devotional pieces, and two moralities, to each of which he ascribes the same title. It may be suspected that these are only dialogues recited by the travelling minstrels and troubadours, such as Petrarch acknowledges having sometimes composed for the benefit of the strolling musicians. Such were probably the spectacles exhibited by Philip the Fair in 1313, on account of the honour of knighthood conferred on his children. Riccoboni, anxious for the honour of Italy, denies to these amusements the character of a legitimate drama; with what justice we have no information that can enable us to decide.

Amidst this uncertainty, it is not unpleasant to record the fair claim which Britain possesses to be one of the earliest, if not the very first nation in which dramatic representation seems to have been revived. The *Chester Mysteries*, called the *Whitsun Plays*, appear to have been performed during the mayoralty of John Arneway, who filled that office in Chester from 1268 to 1276. The very curious specimen of these mysteries, which has been of late printed for private distribution by Mr Markland of the Temple, furnishes us with the banes or proclamation, containing the history and character of the pageants which it announces.

Reverende lordes and ladyes all,
That at this tyme here assembled bee,
By this messauge understande you shall,
That sometymes there was mayor of this citie,

Sir John Arnway, Knyghte, who most worthilye
Contented hymselfe to sett out an playe
The devise of one Done Rondali, moonke of Chester Abbey.

This moonke, moonke-like in scriptures well seene,
In storyes travelled with the best sorte;
In pagentes set fourth, apparently to all eyne,
The Olde and Newe Testament with livelye comforte;
Intermynglinge therewith, onely to make sporte,
Some things not warranted by any writt,
Which to gladd the hearers he woulde men to take yt.

This matter he abrevited into playes twenty-foure,
And every playe of the matter gave but a taste,
Leavinge for better learninge scircumstances to accomplishe,
For his proceedinges maye appeare to be in haste:
Yet all together unprofitable his labour he did not waste,
For at this daye, and ever, he deserveth the fame
Which all monkes deserves professinge that name.

This worthy Knihte Arnway, then mayor of this citie,
This order toke, as declare to you I shall,
That by twentye-fower occupations, artes, craftes, or misteries,
These pagentes shoulde be played after breeffe rehearsall;
For every pagente a cariage to be provyded withall,
In which sorte we purpose this Whitsontyde,
Our pageants into three partes to devyde.

I. Now you worshippfull TANNERS that of custome olde
The fall of Lucifer did set out,
Some writers awarrante your matter, therefore be boulde
Lustelye to playe the same to all the rowtte:
And yf any thereof stand in any doubte.
Your author his author hath, your shewe let bee,
Good speech, fyne players, with apparill comelye.

Chester Mysteries.

Such were the celebrated Mysteries of Chester. To Mr Markland's extracts from them is prefixed a curious dissertation upon their age and author. They were so highly popular, as to be ranked, in the estimation of the vulgar, with the ballads of Robin Hood; for a character in one of the old moralities is introduced as boasting,

I can rhimes of Robin Hood, and Randal of Chester,
But of our Lord and our Lady I can nought at all.

The poetical value of these mysteries is never considerable, though they are to be found among the dramatic antiquities of all parts of Europe. It was, however, soon discovered that the purity of the Christian religion was inconsistent with these rude games, in which passages from scripture were profanely and indecently mingled with human inventions of a very rude, and sometimes an indecorous character. To the Mysteries, therefore, succeeded the Moralities, a species of dramatic exercise, which involved more art and ingenuity, and was besides much more proper for a public amusement, than the imitations or rather parodies of sacred history, which had hitherto entertained the public.

Moralities. These Moralities bear some analogy to the old or original comedy of the ancients. They were often founded upon allegorical subjects, and almost always bore a close and poignant allusion to the incidents of the day. Public reformation was their avowed object, and, of course, satire was frequently the implement which they employed. Dr Percy, however, remarks that they were of two characters, serious and ludicrous; the one approaching to the tragedy, the other to the comedy of classical times; so that they brought taste as it were to the threshold of the real drama. The difference between the Catholic and reformed religion was fiercely disputed in some of these dramas; and in Scotland, in particular, a mortal blow was aimed at the superstitions of the Roman church, by the celebrated Sir David Lindsay, in a play or morality acted in 1539, and entitled *The Satire of the Three Estates.* The objects of this drama were entirely political, although it is mixed with some comic scenes, and introduced by an interlude, in coarseness altogether unmatched. The spirit of Aristophanes, in all its good and evil, seems to have actuated the Scottish king-at-arms. It is a singular proof of the liberty allowed to such representations at the period, that James V. and his queen repeatedly witnessed a piece, in which the corruptions of the existing government and religion were treated with such satirical severity. The play, as acted, seems to have differed in some respects from the state in which it exists in manuscript.

In a letter to the Lord Privy Seal of England, dated 26th January 1540, Sir William Eure (envoy from Henry VIII.) gives the following account of the play, as it had then been performed "in the feast of Ephipanie at Lightgowe, before the king, queene, and the whole counsaile, spirituall and temporall. In the firste entres come in SOLACE (whose parte was but to make mery, sing ballets with his fellowes, and drinke at the interluydes of the play), whoe showed firste to all the audience the play to be played. Next come in a king, who passed to his throne, having nae speche to thende of the play, and then to ratify and approve, as in parliament, all things done by the rest of the players, which represented THE THREE ESTATES. With hym came his cortiers, PLACEBO, PICTHANK, and FLATTERYE, and sic alike gard; one swering he was the lustiest, starkeste, best proportionit, and most valyeant man that ever was; ane other swere he was the beste with long-bowe, crosse-bowe, and culverin, and so fourth. Thairafter there come a man armed in harness, with a swerde drawn in his hande, a BUSHOP, a BURGESMAN, and EXPERIENCE, clede like a DOCTOR; who set them all down on the deis under the KING. After them come a POOR MAN, who did go up and down the scaffolde, making a hevie complainte that he was hereyet, throw the courtiers taking his fewe in one place, and his tackes in another; wherthrough he had sceyled his house, his wyfe and childrene beggyng thair brede, and so of many thousands in Scotland; saying thair was no remedy to be gotten, as he was neither acquainted with controller nor treasurer. And then he looked to the king, and said he was not king in Scotland, for there was ane other king in Scotland that hanged JOHNE ARMSTRANG, with his fellowes, SYM THE LAIRD, and mony other mae; but he had lefte ane thing undone. Then he made a long narracione of the oppression of the poor, by the taking of the corsepresaunte beists, and of the herrying of poor men by the consistorye lawe, and of many other abusions of the SPIRITUALITIE and Church. Then the BUSHOP raise and rebuked him. Then the MAN OF ARMES alledged the contraire, and commanded the poor man to go on. The poor man proceeds with a long list of the bishop's evil practices, the vices of cloisters, &c. This is proved by EXPERIENCE, who, from a New Testament, shows the office of a bushop. The MAN OF ARMES and the BURGES approve of all that was said against the clergy, and alledge the expediency of a reform, with the consent of parliament. The BUSHOP dissents. The MAN OF ARMES and the BURGES said they were two, and he but one, wherefore their voice should have most effect. Thereafter the king, in the play, ratified, approved, and confirmed all that was rehersed."

The other nations of Europe, as well as England, had their mysteries and moralities. In France, Boileau, following Menestrier, imputes the introduction of these spectacles to travelling bands of pilgrims.

Chez nos dévots ayeux, le théâtre abhorré
Fut long-temps dans la France un plaisir ignoré;
Des pélerins dit-on, une troupe grossière
En public à Paris y monta la première;
Et sottement zélée en sa simplicité
Joüa les saints, la Vierge, et Dieu par piété.

L'Art Poetique, chant. iii.

Drama.

In Spain the *Autos Sacramentales*, which are analogous to the mysteries of the middle ages, are still presented without shocking a nation whose zeal is stronger than their taste; and, it is believed, such rude and wild plays, founded on scripture, are also occasionally acted in Flanders. In the *History of the Council of Constance*, we find that mysteries were introduced into Germany by the English, about 1417, and were first performed to welcome the Emperor Sigismund, on his return from England; and, from the choice of the subjects, we should almost suppose that they had transferred to that country the *Chester Mysteries* themselves. "Les Anglois," says the historian, "se signalè ent entre les autres par un spectacle nouveau, ou au moins inusité jusques alors en Allemagne. Ce fut une comédie sacrée, que les evêques Anglois firent représenter devant l'empéreur, le Dimanche 31 de Janvier, sur la Naissance du Sauveur, sur l'Arrivée des Mages, et sur la Massacre des Innocens." (*Hist. du Concile de Constance*, par L'Enfant, lib. v.) The character of these rude dramatic essays renders them rather subjects for the antiquary than a part of a history of the regular dramatic art.

Latin plays.

We may also pass over, with brief notice, the Latin plays which, upon the revival of letters, many of the learned composed in express imitation of the ancient Grecian and Latin productions. We have mentioned those of Mussato, who was followed by the more celebrated Cararo, in the path which he had opened to fame. In other countries the same example was followed. These learned prolusions, however, were only addressed to persons of letters, then a very circumscribed circle, and, when acted at all, were presented at universities or courts on solemn public occasions. They form no step in the history of the drama, unless that, by familiarizing the learned with the form and rules of the ancient classical drama, they gradually paved the way for the adoption of the same regulations into the revived vernacular drama, and formed a division amongst the theatres of modern Europe, which has never yet been reconciled.

Historical plays.

While the learned laboured to revive the classical drama in all its purity, the public at large, to which the treasures of the learned languages were as a fountain sealed, became addicted to a species of representation which properly neither fell under the denomination of comedy or tragedy, but was named History or Historical Drama. Charles Verardo, who, about 1492, composed a drama of this sort, in Latin, upon the expulsion of the Moors from Granada, claims, for this production, a total emancipation from the rules of dramatic criticism.

> Requirat autem nullus hic comœdiæ,
> Leges ut observantur, aut tragediæ;
> Agenda nempe est *historia* non fabula.

"Let none expect that in this piece the rules of comedy or of tragedy should be observed; we mean to act a history, not a fable." From this expression it would seem that, in a historical drama, the author did not think himself entitled to compress or alter the incidents as when the plot was fabulous, but was bound, to a certain extent, to conform to the actual course of events. In these histories, the poet embraced often the life and death of a monarch, or some other period of history, containing several years of actual time, which, nevertheless, were made to pass before the eyes of the audience during the two or three hours usually allotted for the action of a play. It is not to be supposed that, with so fair a field open before them, and the applause of the audience for their reward, the authors of these histories should long have confined themselves to the matter of fact contained in records. They speedily innovated or added to their dramatic chronicles without regard to the real history. To those who plead for stage plays, that they elucidate and explain many dark and obscure histories, and fix the facts firmly in the minds of the audience, of which they had otherwise but an imperfect apprehension, the stern Prynne replies with great scorn, "that play-poets do not explain, but sophisticate and deform, good histories, with many false varnishes and playhouse fooleries;" and that "the histories are more accurately to be learned in the original authors who record them, than in derivative playhouse pamphlets, which corrupt them." (Prynne's *Histrio-Mastix*, p. 940.)

The dramatic chronicles, therefore, were a field in which the genius of the poet laboured to supply, by character, sentiment, and incident, the meagre detail of the historian. They became so popular in England, that, during the short interval betwixt the revival of the stage and the appearance of Shakspeare, the most part of the English monarchs had lived and died upon the stage; and it is well known that almost all his historical plays were new written by him, upon the plan of old dramatic chronicles which already existed.

But the miscellaneous audience which crowded to the vernacular theatre at its revival in Europe, were of that rank and intellect which is apt to become tired of a serious subject, and to demand that a lamentable tragedy should be intermingled with very pleasant mirth. The poets, obliged to cater for all tastes, seldom failed to insert the humours of some comic character, that the low or grotesque scenes in which he was engaged might serve as a relief to the graver passages of the drama, and gratify the taste of those spectators who, like Christofero Sly, tired until the fool came on the stage again. Hence Sir Philip Sidney's censure on these dramatists, "how all their plays be neither right tragedies nor right comedies, mingling kings with clowns; not because the matter so carrieth it, but to thrust in the clown, by head and shoulders, to play a part in magestical matters, with neither decency nor discretion, so that neither the admiration and commiseration, nor the right sportfulness, is by their mongrel tragi-comedy attained." (*Defence of Poesie.* Sidney's *Arcadia*, edit. 1627, p. 563.) "If we mark them well," he concludes, "funerals and hornpipes seldom match daintily together."

Romantic drama.

The historical plays led naturally into another class, which may be called Romantic Dramas, founded upon popular poems or fictitious narratives, as the former were on real history. Some of these were borrowed from foreign nations, ready dramatized to the hand of the borrower; others were founded on the plots which occurred in the almost innumerable novels and romances which we had made our own by translation. "I may boldly say it," says Gosson, a recreant play-wright, who attacked his former profession, "because I have seen it, that the *Palace of Pleasure*, the *Golden Asse*, the *Ethiopian History*, *Amadis of Fraunce*, the *Round Table*, *Bawdie Comedies in Latin, French, Italian, and Spanish*, have been thoroughly ransacked to furnish the playhouse in London." But it was not to be supposed that the authors would confine themselves to stricter rules in pieces founded upon Italian and Spanish novels, or upon romances of chivalry, than they had acted upon in the histories. Every circumstance which tended to loosen the reins of theatrical discipline in the one case, existed in the other; and, accordingly, comedies of intrigue, and tragedies of action and show, everywhere superseded, at least in popular estimation, the severe and simple model of the classical drama.

It happened that in England and Spain, in particular, the species of composition which was most independent of critical regulation was supported by the most bril-

liant display of genius. Lopez de Vega and Calderon rushed on the stage with their hasty and high-coloured, but glowing productions, fresh from the mint of imagination, and scorning that the cold art of criticism should weigh them in her balance. The taste of the Spaniards has been proverbially inclined to the wild, the romantic, and the chivalrous; and the audience of their bards would not have parted with one striking scene, however inartificially introduced, to have gained for their favourites the praise of Aristotle and all his commentators. Lopez de Vega himself was not ignorant of critical rules; but he pleads the taste of his countrymen as an apology for neglecting those restrictions which he had observed in his earlier studies.

> Yet true it is I too have written plays,
> The wiser few, who judge with skill, might praise;
> But when I see how show and nonsense draws
> The crowds, and, more than all, the fair's applause;
> Who still are forward with indulgent rage
> To sanction every monster of the stage;
> I, doom'd to write the public taste to hit,
> Resume the barbarous dress 'twas vain to quit;
> I lock up every rule before I write,
> Plautus and Terence banish from my sight,
> Lest rage should teach these injured wits to join,
> And their dumb books cry shame on works like mine.
> To vulgar standards, then, I frame my play,
> Writing at ease, for, since the public pay,
> 'Tis just, methinks, we by their compass steer,
> And write the nonsense that they love to hear.
>
> Lord Holland's *Life of Lope de Vega*, p. 103.

The Spanish comedies of intrigue also went astray, as far as their romantic tragedies, from the classical path. In fact, these new representations were infinitely more captivating from their vivacity, novelty, and, above all, from their reflecting the actual spirit of the time, and holding the mirror up to nature, than the cold imitations which the learned wrote in emulation of the classic drama. The one class are existing and living pictures of the times in which the authors lived; the others, the cold resurrection of the lifeless corpses which had long slumbered in the tomb of antiquity. The spirit of chivalry, which so long lingered in Spain, breathes through the wild and often extravagant genius of her poets. The hero is brave and loyal, and true to his mistress:

> A knight of love who never broke a vow.

Lovers of this description, in whose minds the sexual passion is sublimated into high and romantic feeling, make a noble contrast with the coarse and licentious Greek or Roman, whose passion turns only on the difficulty of purchasing his mistress's person, but who never conceives the slightest apprehension concerning the state of her affections.

That the crowd might have their loud laugh, a *grazioso* or clown, usually a servant of the hero, is in the Spanish drama uniformly introduced to make sport. Like Kemp or Tarletun, famous in the clown's part before the time of Shakspeare, this personage was permitted to fill up his part with extemporary jesting, not only on the performers, but with the audience. This irregularity, with others, seems to have been borrowed by the English stage from that of Spain, and is the license which Hamlet condemns in his instructions to the players: " And let those that be your clowns speak no more than is set down for them; for there be of them that will themselves laugh, to set on some quantity of barren spectators to laugh too, though, in the mean time, some necessary question of the play be then to be considered; that's villainous, and shows a most pitiful ambition in the fool that uses it."

The bald simplicity of the ancient plots was, in like manner, contrasted to disadvantage with the intricacies, involutions, suspense, and bustle of Spanish intrigue upon the stage. Hence the boast of one of their poets, thus translated by Lord Holland:

> Invention, interest, sprightly turns in plays,
> Say what they will, are Spain's peculiar praise;
> Her's are the plots which strict attention seize,
> Full of intrigue, and yet disclosed with ease.
> Hence acts and scenes her fertile stage affords,
> Unknown, unrivall'd, on the foreign boards.
>
> *Life of Lope de Vega*, p. 106.

While we admire the richness of fancy displayed in the Spanish pieces, it is impossible, in an age of refinement, to avoid being shocked by their wilful and extravagant neglect of every thing which can add probability to the action of their drama. But the apology for this license is well pleaded by Lord Holland.

" Without dwelling on the expulsion of the chorus (a most unnatural and inconvenient machine), the moderns, by admitting a complication of plot, have introduced a greater variety of incidents and character. The province of invention is enlarged; new passions, or at least new forms of the same passions, are brought within the scope of dramatic poetry. Fresh sources of interest are opened, and additional powers of imagination called into activity. Can we then deny what extends its jurisdiction, and enhances its interest, to be an improvement in an art whose professed object is to stir the passions by the imitation of human actions? In saying this I do not mean to justify the breach of decorum, the neglect of probability, the anachronisms, and other extravagancies of the founders of the modern theatre. Because the first disciples of the school were not models of perfection, it does not follow that the fundamental maxims were defective. The rudeness of their workmanship is no proof of the inferiority of the material; nor does the want of skill deprive them of the merit of having discovered the mine. The faults objected to them form no necessary part of the system they introduced. Their followers in every country have either completely corrected or gradually reformed such abuses. Those who bow not implicitly to the authority of Aristotle, yet avoid such violent outrages as are common in our early plays. And those who pique themselves on the strict observance of his laws, betray, in the conduct, the sentiments, the characters, and the dialogue of their pieces (especially of their comedies), more resemblance to the modern than the ancient theatre; their code may be Grecian, but their manners, in spite of themselves, are Spanish, English, or French. They may renounce their pedigree, and even change their dress, but they cannot divest their features of a certain family-likeness to their poetical progenitors."

In France the irregularities of the revived drama were of a lower complexion; for, until her stage was refined by Corneille, and brought under its present strict *regime*, it was adorned by but little talent; a circumstance which, amongst others, may account for the ease with which she subjected herself to critical rules, and assumed the yoke of Aristotle. Until she assumed the Grecian forms and restrictions, there is but little interesting in the history of her stage.

England adopted the historical and romantic drama with ardour, and in a state scarce more limited by rules than that of Spain herself. Her writers seem early to have ransacked Spanish literature; for the union of the countries during the short reign of Mary, nay even their wars under Elizabeth and Philip, made them acquainted with each other. The Spaniards had the start in the revival of the drama. *Ferrex and Perrex*, our earliest tragedy, was first presented in 1561; and *Gammer Gurton's*

Needle, our first comedy, in 1575; whereas Lopez de Vega, who was not by any means the earliest Spanish dramatist, died in 1562, leaving the stage stocked with his innumerable productions, to which his contemporaries had not failed to add their share. Thus, as soon as the stage of Britain was so far advanced as to be in a capacity of borrowing, that of Spain offered a fund to which her authors could have recourse; and, in fact, the Spanish drama continued to be a mine in which the British poets collected materials, often without acknowledgment, during all the earlier part of her dramatic history. From this source, as well as from the partialities of the audience, arose that early attempt at show and spectacle, at combats and marvellous incidents, which, though with very poor means of representation, our early dramatic poets loved to produce at the Bull or the Fortune playhouses. The extravagance of their plots, and the poor efforts by which our early dramatists endeavoured to represent show and procession, did not escape the censure of Sir Philip Sidney, who, leaning to the critical reformation which was already taking place in Italy, would gladly have seen our stage reduced to a more classical model.

"It is faultie," says that gallant knight, "both in place and time, the two necessarie companions of all corporall actions. For the stage should alway present but one place; and the uttermost time presupposed in it should bee, both by *Aristotle's* precept and common reason, but one day; there are both many dayes and many places inartificially imagined. But if it be so in *Gorboduke*, how much more in all the rest? where you shall have *Asia* of the one side, and *Affricke* of the other, and so many other under kingdomes, that the plair, when he comes in, must ever begin with telling where hee is, or else the tale will not be conceived. Now shall you have three ladies walke to gather flowers, and then wee must beleeve the stage to be a garden. By and by wee heare newes of shipwracke in the same place, then wee are to blame if we accept it not for a rocke. Upon the backe of that comes out a hideous monster with fire and smoke, and then the miserable beholders are bound to take it for a cave; while, in the mean time, two armies flie in, represented with some swordes and bucklers, and then what hard heart will not receive it for a pitched field? Now of time they are much more liberall; for ordinarie it is, that two young princes fall in love. After many traverses shee is got with childe, delivered of a faire boy; he is lost, groweth a man, falleth in love, and is readie to get another childe, and all this in two houres space; which how absurd it is in sense, even sense may imagine, and art hath taught, and all ancient examples justified, and at this day the ordinary players in *Italy* will not err in."

Italian tragedy.

Italy, referred to by Sir Philip Sidney as the cradle of the reformed drama, had had her own age of liberty and confusion; her mysteries, her moralities, her historical and her romantic dramas. But the taste for the ancient and classical stage was still rooted in the country where it had flourished, and Trissino is acknowledged as the father of the regular drama. The *Sophonisba* of this learned prelate is praised by Voltaire as the first regular tragedy which Europe had seen after so many ages of barbarism. Pope has added his tribute.

> When learning, after the long Gothic night,
> Fair o'er the western world renewed its light,
> With arts arising, Sophonisba rose,
> The tragic muse returning wept her woes;
> With her the Italian scene first learned to glow,
> And the first tears for her were taught to flow.

This tragedy was represented at Rome in the year 1515. The Greek model is severely observed, and the author has encumbered his scene with a chorus. It has some poetic beauties, and is well calculated to recommend the new or rather revived system on which it was written. *La Rosmonda* of Rucelleri was written about the same time with *Sophonisba;* and, after these pieces, tragi-comedies, histories, and romantic dramas, were discarded, and succeeded by tragedies upon a regular classical model; written in verse, having five acts, and generally a chorus.

Notwithstanding their rigorous attention to the ancient model, the modern tragic poets of Italy have not been very successful in arresting the attention of their countrymen. They are praised rather than followed; and the stern, unbending composition of Alfieri, while it has given a tone of rude and stoical dignity to his dramas, has failed in rendering them attractive. They frequently please in the closet; but the audience of modern days requires to be kept awake by something more active, more bustling, more deeply interesting, than the lessons of the schools; and a poet of high fancy has written in some measure in vain, because he has mistaken the spirit of his age. The tragic actors, also, whatever excellence they may attain to in their art, do not attract the same consideration, attention, and respect, as in France or England; and they who are the direct authors of a pleasure so nearly connected with our noblest and best feelings, occupy a rank subordinate to the performers at the opera.

Opera.

It is only as a modification of the drama that we here propose to touch upon that entertainment of Italian growth, but known by importation in every civilized kingdom of Europe. These kingdoms have often rivalled each other in the rewards held forth to musical performers, and encouraged their merit by a degree of profusion, which has had the effect of rendering the professors petulant, capricious, and unmanageable. Their high emoluments are not granted, or their caprices submitted to, without a degree of pleasure in some degree corresponding to the expense and the sufferance; and it is in vain for the admirers of the legitimate drama to pretend that such is not obtained. Voltaire has with more justice confessed, that probably the best imitation of the ancient stage was to be found in the Italian tragic opera. The recitative resembled the musical declamation of the Athenians, and the choruses, which are frequently introduced, when properly combined with the subject, approach to those of the Greeks, as forming a contrast, by the airs which they execute, to the recitative, or modulated dialogue of the scene. Voltaire instances the tragic operas of Metastasio in particular, as approaching in beauty of diction, and truth of sentiment, near to the ancient simplicity; and finds an apology even for the detached airs, so fatal to probability, in the beauty of the poetry and the perfection of the music. And although, as a critic and man of cultivated taste, this author prefers the regular, noble, and severe beauties of the classic stage, to the effeminate and meretricious charms of the opera, still he concludes that, with all its defects, the sort of enchantment which results from the brilliant intermixture of scenery, chorus, dancing, music, dress, and decoration, subjects even the genius of criticism; and that the most sublime tragedy, and most artful comedy, will not be so frequently revisited by the same individual as an indifferent opera. We may add the experience of London to the testimony of this great critic; and, indeed, were it possible that actors could frequently be procured, possessed of the powers of action and of voice which were united in Grassini, it would be impossible to deny to the opera the praise of being an amusement as exquisite in point of taste as fascinating from show and music. But as the musical parts of the entertainment are predominant, every thing else has been too often sacrificed to the caprice of a composer, wholly igno-

Drama.

rant in every art save his own; and the mean and paltry dialogue, which is used as a vehicle for the music, is become proverbial to express nonsense and inanity.

Italian comedy.

The Italian comedy, as well as their tragedy, boasts its regular descent from classical times. Like the comedy of Menander, it introduces *dramatis personæ* whose characters are never varied, and some of whom are supposed to be directly descended from the ancient *Mimi* of the Atellan Fables. Such an origin is claimed for the celebrated Harlequin, and for the no less renowned Puncinello, our English Punch, both of whom retain the character of jesters, cowards, wags, and buffoons, proper to the *Sannio* of the Romans. It is believed of these worthies that they existed before the time of Plautus, and continued to play their frolics during the middle ages, when the legitimate drama was unknown. For the former fact, sculpture, as well as tradition, is appealed to by Italian antiquaries, who have discovered the representation of these grotesque characters upon the Etruscan vases. In support of the latter averment, the grave authority of Saint Thomas Aquinas is appealed to, who, we rejoice to find, thought Harlequin and Punch no unlawful company in fitting time and place. "*Ludus*," says that eminent person, with more consideration for human infirmity than some saints of our own day, "*est necessarius ad conversationem vitæ humanæ: ad omnia autem quæ sunt utilia conversationi humanæ, deputari possunt aliqua officia licita: et ideo etiam officium histrionum quod ordinatur ad solatium hominibus exhibendum, non est secundum se illicitum, nec sunt histriones in statu peccati, dummodo moderate ludo utantur; id est, non utendo aliquibus illicitis verbis vel factis, ad ludum, et non adhibendo ludum negotiis et temporibus indebitis, unde illi qui moderate eis subveniunt, non peccant, sed juste faciunt mercedem ministerii eorum eis tribuendo. Et licet D. August.* super Joan. *dicit quod donare res suas histrionibus, vitium est immane, hoc intelligi debet de illis qui dant histrionibus qui in ludo utuntur illicitis, vel de illis qui superflue sua in tales consumunt, non de illis histrionibus qui moderate ludo utuntur.*"

Saint Anthony gives his sanction to Saint Thomas on this point: "*Histrionatus ars quia deservit humanæ recreationi quæ necessaria est vitæ hominis secundum D. Thomam, de se non est illicita et de illa arte vivere non est prohibitum.*" (S. Antonius in 3 part. *Suæ Summæ*, tit. iii. cap. 4.) Saint Anthony, indeed, adds the reasonable restriction, that no clergyman should play Harlequin, and that Punch should not exhibit in the church.

Under this venerable authority these *Mimi* went on and flourished. Other characters enlarged their little drama. The personages appeared in masks. "Each of these," says Mr Walker, "was originally intended as a kind of characteristic representation of some particular Italian district or town. Thus *Pantalone* was a Venetian merchant; *Dottore*, a Bolognese physician; *Spaviento*, a Neapolitan braggadocio; *Pullicinella*, a wag of Apulia; *Giangurgolo* and *Coviello*, two clowns of Calabria; *Gelsomino*, a Roman beau; *Beltrame*, a Milanese simpleton; *Brighella*, a Ferarese pimp; and *Arlecchino*, a blundering servant of Bergamo. Each of these personages was clad in a peculiar dress, each had his peculiar mask, and each spoke the dialect of the place he represented. Besides these, and a few other such personages, of which at least four were introduced in each play, there were the *Amorosos* or *Innamoratos;* that is, some men and women who acted serious parts, with Smeraldina, Colombina, Spilletta, and other females, who played the parts of servettas or waiting-maids. All these spoke Tuscan or Roman, and wore no masks." (*Essay on the Revival of the Drama in Italy*, p. 249.)

The pieces acted by this class of actors were called *Commedia dell' arte*, and were congenial to the taste of the Italians, with whom gesticulation and buffoonery are natural attributes. Their drama was of the most simple kind. Each of the actors was already possessed of his dramatic character, which was as inalienable as his dress, and was master of the dialect he was to use, and had his imagination and memory stored with all the characteristic jests, or *lazzi* as they were termed, peculiar to the personage he represented. All that the author had to do was to invent the skeleton of a plot which should bring his characters into dramatic situation with respect to each other. The dialogue suited to the occasion was invented by the players, just as ours invest their parts with the proper gestures and actions. This skeleton had the name of *scenario*, and was filled up by the performers, either impromptu or in consequence of previous arrangement and premeditation. This species of comedy was extremely popular, especially among the lower class of spectators. It was often adopted as an amusement in good society, and by men of genius; and Flamineo de la Scala has left about fifty such *scenarios* adapted for representation. The fashion even found its way into England, and probably the part of Master Punch, who first appeared in the character of the *Vice* of the English morality, was trusted to the improvisatory talents of the actor. Mr d'Israeli, a curious as well as elegant investigator of ancient literature, has shown that at least one scheme of a *Commedia dell' arte* has been preserved to us. It is published in the *Variorum* edition of Shakspeare, but remains unexplained by the commentators. Such comedies, it is evident, could require no higher merit in the composer than the imagining and sketching a few comic situations; the dialogue and diction was all entrusted to the players.

The Italians, however, became early possessed of a regular comedy, which engrossed the admiration of the more cultivated classes of society. Bibbiena's comedy, entitled *La Calandra*, is composed in imitation of Terence and Plautus. It was first acted in 1490. *La Calandra* is remarkable, not only for being the first Italian comedy, but also for the perfection of scenic decoration with which it was accompanied in the representation. It was followed by the productions of Ariosto and Trissino, and other authors in the same line. But it appears, from the efforts used to support this style of drama, that it did not take kindly root in the soil, and lacked that popularity which alone can nurse it freely. Various societies were formed under the whimsical titles of *Gli Intronati*, *Gli Insensati*, and so forth, for the express purpose of bringing forward the regular drama; exertions which would certainly have been unnecessary had it received that support and encouragement which arises from general popularity.

Goldoni, in a later age, at once indulged his own fanciful genius and his natural indolence, by renouncing the classical rules, and endeavouring to throw into the old and native Italian *Mascherata* the variety and attributes of the proper comedy. He adopted Harlequin and the rest of his merry troop in the characters which they held, and endeavoured to enlist them in the more regular service of the drama, just as free corps and partizans are sometimes new-modelled into battalions of the line. This ingenious and lively writer retained all the license of the *Commedia dell' arte*, and all the immunities which it claimed from regular and classical rules; but instead of trusting to the extempore jests and grotesque wit of the persons whom he introduced, he engaged them in dialogues, as well as plots, of his own invention, which often display much humour and even pathos. It required, however, the richness of a fancy like Goldoni's to extract novelty and interest from a dramatic system in which so many of the actors held a fixed and prescriptive character, hardly

Drama.

admitting of being varied. Accordingly, we do not find that the Italian stage is at present in a more flourishing condition than that of other modern nations.

French drama.

The revival of the regular drama in France was attended with important consequences, owing to the nature of her government, the general use of her language throughout Europe, and the influence which, from her situation, she must necessarily hold over other nations. It is the boast of Paris that the regular classical drama, banished from every other stage, found a safe and honourable refuge on her own. Yet France has reluctantly confessed that she also had her hour of barbarism. Her earlier drama was borrowed, like that of other countries, from Spain, who, during the whole of the sixteenth and great part of the seventeenth century, held such a formidable predominance in the European republic. While the classical stage was reviving in Italy, and the historical and romantic drama was flourishing in Spain, France was torn to pieces by civil discord. The first French tragedy composed upon a regular plan was that of *Mairet*, imitated from the *Sophonisba* of Trissino; and Riccoboni boasts with justice, that whoever shall compare the Italian tragedy of the sixteenth century with that of the French of the same period, will find the latter extravagant and irregular, and the former already possessed of gravity, dignity, and regularity. The French, like the English, date the excellence of their stage from one great author; and the illustrious name of Pierre Corneille affords to their dramatic history the mighty landmark which Shakspeare gives to our own.

Cardinal Richelieu, who had succeeded in establishing upon a broad basis the absolute power of the French monarch, was not insensible to the graces and ornaments which the throne derived from being surrounded by the muses. He was himself fond of poetry, and even a competitor for the honours of the buskin. He placed himself at the head of five dramatic writers, to whom on that account the public gave the title of *Les Cinq Auteurs*. All these are deservedly forgotten excepting Corneille, of whose successful talent the cardinal had the meanness to evince no ordinary degree of jealousy. The malevolence of that minister was carried so far that he employed the French Academy, whose complaisance must be recorded to their shame, to criticise severely the *Cid*, the first, and perhaps the finest, of Corneille's tragedies. Scudery, a favourite of the cardinal, buoyed by Richelieu's favour, was able for some time to balance Corneille in the opinion of the public; but his name is now scarcely known by any other circumstance than his imprudent and audacious rivalry. This great man was not only surrounded by the worst possible models, but unfortunately the authors of these models were also favourites of the public and of the all-powerful cardinal; yet Corneille vanquished the taste of his age, the competition of his rivals, and the envy of Richelieu.

Corneille, like his predecessors, and like Routrou in particular, borrowed liberally from the Spanish theatre; but his own taste, regulated probably upon his situation, dictated an adherence to the classical model. The French stage arose, it must be remembered, under the protection of an absolute monarch, for whose amusement the poet laboured, and in whose presence the drama was performed. It followed, as a natural consequence, that a more strict etiquette was exacted upon the scene than had hitherto been supposed applicable to a merely popular amusement. A departure from regularity in tragedy was no longer a bold flight. A violation of decorum in comedy was no longer a broad jest. When the audience was dignified by the presence of the monarch, the former became an impertinence, and the latter a gross and indecent insult. The muse of comedy was therefore bound over for her good behaviour; and even her grave sister was laid under such rules and restrictions as should insure the decorum and dignity of her scene.

French writers enforce the unities.

It was at this period that those classical fetters which are framed on the three unities were fashioned into form, and imposed on the French drama. These are acknowledged by Corneille, in his *Essay upon Dramatic Poetry*, in the following short but emphatic sentence: "*Il faut observer les unités d'action, de lieu, et de jour; personne n'en doute.*" The rule, as thus emphatically admitted by the fiery Corneille, was equally binding upon the elegant Racine, and has fettered the French stage until the present day. "La Motte," says Voltaire, "a man of wit and talent, but attached to paradoxes, has written in our time against the doctrine of the unities; but that literary heresy had no success."

Upon these rules, adopted by the very first writer of eminence for the French stage, and subscribed to by all succeeding dramatists, depends the principal and long-disputed difference betwixt the drama of France and those countries in which her laws of taste have been received, and the stages of Spain, England, and modern Germany, where those critical maxims have been controverted. In other words, the unities proper to the classical drama have been found inapplicable to plays of a historical or romantic plan. It is therefore necessary to examine with accuracy the essence and effect of those laws so often disputed with more obstinacy than liberality.

Examination of this doctrine.

The arbitrary forms to which the French thus subjected their theatre are, in their general purport, founded on good and sound rules of the critical art. But, considered judaically and literally, the interpretation put upon those unities by the French critics must necessarily lay the dramatic author under restraints equally severe and unnecessary, without affording any corresponding addition to the value of his work. The pedantry by which they are enforced reminds one of the extreme, minute, rigorous, and punctilious discipline to which some regiments have been subjected by a pedantic commanding officer, which seldom fails to lower the spirit and destroy the temper of the soldier, without being of the slightest service to him in the moment of danger or the day of battle.

The first dramatic unity is that of action, and, rightly understood, it is by far the most important. A whole, says Aristotle, is that which has a beginning, middle, and end. In short, one strong concentrated interest, upon which all subordinate incidents depend, and to which they contribute, must pervade the piece. It must open with the commencement of the play, evolve itself, and be progressive with its progress—must be perpetually in sight, and never stationary, until at length it arrives at a catastrophe, by which it is ended and extinguished. In this rule, abstractedly considered, there is nothing but what is consistent with good sense and sound criticism. The period allowed for dramatic representation is not long, and will not admit of the episodical ornaments which may be happily introduced into epic poetry. And as the restlessness or impatience of a theatrical audience is always one of its marked characteristics, it has been observed, that neither the most animated description, nor the most beautiful poetry, can ever reconcile the spectators to those inartificial scenes in which the plot or action of the piece stands still that the performers may say fine things. The introduction of an interest, separate and distinct from the main action of the play, has a still worse effect; it diminishes the effect of the whole, and divides the attention of the audience; as a pack of hounds, when in full pursuit, are impeded and puzzled by starting a fresh object of chase.

Yet even this rule must be liberally considered if we would allow dramatic authors that fair room and exercise for their genius, which gives rise to the noblest displays of genius in the art. Modern dramatists are no longer, it must be remembered, limited to the simple and surer uniformity of the ancient drama, which fixed on one single event as its object, made it the subject of the moral reflections of the chorus, managed it by the intervention of three or at most five persons, and consequently presented a picture so limited in size and subject that there was no difficulty in avoiding the intermixture of a foreign interest. The modern taste has opened the stage to a wider range of topics, which are at the same time more complicated in detail, depending on the agency of a variety of performers, and on the result of a succession of events. Such dramas have indeed an unity of action peculiar to themselves, which should predominate over and absorb every other. But although, like the oak, it should predominate over all the neighbouring underwood, its dignity is not injured by the presence and vicinity of that which it overshadows. On the contrary, a succession of events tending to the same end, if they do not divert the attention from the principal interest, cannot fail, by their variety and succession, to keep it fixed upon the business of the scene.

To take an example. In the tragedy of Macbeth a chain of varied and important events are introduced, any one link of which might be hammered out into a drama on the severe and simple model of the drama of ancient Greece. There is the murder of Duncan, that of Banquo, and the dethronement and death of the tyrant; all which are events complete of themselves, independent of each other, and yet included within one tragedy of five acts. But, nevertheless, this is never felt as a deficiency in the performance. It is to the character of Macbeth, to his ambition, guilt, remorse, and final punishment, that the mind attaches itself during the whole play; and thus the succession of various incidents, unconnected excepting by the relation they bear to the principal personage, far from distracting the attention of the audience, continues to sharpen and irritate curiosity till the curtain drops over the fallen tyrant. This is not, indeed, an unity of action according to the rule of Aristotle, or the observance of the French theatre. But, in a lighter point of view, it has all the advantage which could possibly be derived from the severest adherence to the precept of Aristotle, with this additional merit, that the interest never stagnates in declamation, or is suspended by unnecessary dialogue.

It would in fact be easy to show that the unity of action, in its strict sense, may frequently be an unnatural as well as a cumbrous restraint on the genius of the poet. In the course of nature, an insulated action seldom exists of a nature proper to transfer to the stage. If, indeed, the play is founded on some single mythological fable, or if the scene is laid in some early stage of society, when man as yet remained separated from his kind, and connected only with his petty tribe or family, the subject of a plot may be chosen where the agency of a very few persons, and these naturally connected together, may, without foreign or extraneous assistance, afford matter for a tragedy. But in the actual course of the peopled world, men are so crowded together, and their movements depend so much upon impulses foreign to themselves, that the action must often appear multiplied and complicated, and all that the author can do is to preserve the interest uniform and undivided. Its progress may be likened to that of a brook through beautiful scenery. A judicious improver of the landscape would be certainly desirous to make its course visible, but not to cut off its beautiful undulations, or to compel it into a straight channel. He would follow the course of nature, and neither affect to conceal the smaller rills by which the stream was fed, nor bring them so much in view as to deprive the principal object of its consequence. We admit the difficulty inseparable from the dramatic art, and must grant that the author runs some risk of losing sight of the main interest of the piece, by dwelling upon the subordinate accessories; but we contend that the attention of the audience is still more likely to be fatigued by a bald and simple plot, to which, during the course of five acts, there must belong much speaking and little progress. And, in point of common sense and common feeling, that piece must always present unity of action which has unity of interest and feeling; which fixes the mind of the audience upon one train of thought and passion, to which every occurrence in the drama verges; and which is consummated and wound up by the final catastrophe.

The second dramatic unity is that of time, about which the critics of various nations have disagreed. If taken in its strict and proper sense, it means that the time supposed to be consumed in the action represented, should not exceed that which is occupied by the actual representation. But even Aristotle extends the duration of the action to one revolution of the sun, and Corneille extends it to thirty hours, which is to the actual period of representation as ten to one. Boileau, a supereminent authority, thus lays down the rule for the unities of time and place:

> Que le lieu de la scène y soit fixé & marqué.
> Un Rimeur, sans péril, delà les Pirenées,
> Sur la scène en un jour renferme des années.
> Là souvent le Héros d'un spectacle grossier,
> Enfant au premier acte, est Barbon au dernier,
> Mais nous, que la Raison à se règles engage,
> Nous voulons qu'avec art l'action se ménage:
> Qu'en un lieu, qu'en un jour, un seul fait accompli
> Tienne jusqu'à la fin le Théâtre rempli.

It has been triumphantly remarked, that in thus yielding up the strict letter of the precept, in allowing the three hours employed in acting a play to be multiplied into twenty-four or thirty, the critics have retained nearly all the inconvenience of this famous rule, while they sacrificed its principle, and any advantage attached to its observance. The only benefit supposed to be attached to this unity is that of probability. We shall not at present inquire whether this is worth preserving at the cost of imposing heavy restrictions on dramatic genius. But granting the affirmative, probability is as much violated by squeezing the events of twenty-four hours into a period of only three, as if the author had exercised the still greater license of the English and Spanish theatres. There is no charm in the revolution of the sun, which circumscribes within that particular period the events of a drama. When the magic circle drawn around the author by the actual date of representation is once obliterated, the argument grounded upon probability falls; and he may extend his narrative unconfined by any rule, except what may be considered as resolving itself into the unity of action. A week, a month, a year, years may be included in the course of the drama, provided always the poet has power so to rivet the attention of the audience on the passing scene, that the lapse of time shall pass unregarded. There must be none of those marked pauses which force upon the spectators' attention the breach of this unity. Still less ought the judicious dramatist to permit his piece to embrace such a space of time as shall necessarily produce the change on the persons of the characters ridiculed by Boileau. The extravagant conduct of the plot in the *Winter's Tale* has gone far to depreciate that dra-

ma, which, in passages of detached beauty, is inferior to none of Shakspeare's, in the opinion of the best judges. It might perhaps be improved in acting, by performing the three first acts as a play, and the fourth and fifth as an afterpiece. Yet, even as it is now acted, who is it that, notwithstanding the cold objection arising out of the breach of unity, witnesses without delight the exquisite contrast betwixt the court and the hamlet, the fascinating and simple elegance of Perdita, or the witty rogueries of Autolycus? The poet is too powerful for the critic, and we lose the exercise of our judgment in the warmth of our admiration.

The faults of Shakspeare or of his age we do not, however, recommend to the modern dramatist, whose modesty will certainly place him in his own estimation far beneath that powerful magician whose art could fascinate us even by means of deformity itself. But if for his own sake the author ought to avoid such gross violations of dramatic rule, the public, for theirs, ought not to tie him down to such severe limitations as must cramp, at least, if they do not destroy, his power of affording them pleasure. If the whole five acts are to be compressed within the space of twenty-four hours, the events must, in the general case, be either so much crowded upon each other as to destroy the very probability which it is the purpose of this law to preserve; or many of them being supposed to have happened before the commencement of the piece, must be detailed in narrative, which never fails to have a bad effect on the stage.

The same objections apply to the rigid enforcement of the third unity, that of place; and indeed the French authors have used respecting it the license of relaxing, in practice, the severity of their theory. They have frequently infringed the rule which they affirm to be inviolable; and their flexible creed permits the place to be changed, provided the audience are not transported out of the city where the scene is laid. This mitigation of doctrine, like that granted in the unity of time, is a virtual resignation of the principle contended for. Let us examine, however, upon what that principle is founded.

The rule which prohibits the shifting the scene during the period of performance, was borrowed by the French from the ancients, without considering the peculiar circumstances in which it arose. First, we have seen already, that during the ancient drama, there was no division into acts, and that the action was only suspended during the songs of the chorus, who themselves represented a certain class of personages connected with the scene. The stage, therefore, was always filled; and a supposed change of place would have implied the violent improbability that the whole chorus were transported, while in the sight of the spectators, and employed in the discharge of their parts, to the new scene of action. Secondly, there is evidence that in the *Eumenides* of Æschylus, and the *Ajax* of Sophocles, the scene is actually changed, in defiance of the presence of the chorus; and a much greater violation of probability is incurred than could have taken place in a modern theatre, where, before every change of scene, the stage is emptied of the performers. Thirdly, the ancients were less hardly pressed by this rule than the modern writers. From the extent of their theatres and the size of their stages, the place of action was considerably larger, and might be held to include a wider extent, than ours. The climate of Greece admitted of many things being transacted with propriety in the open air; and, finally, they had a contrivance for displaying the interior of a house or temple to the audience, which, if not an actual change of scene, was adapted to the same purpose.

If this long litigated question, therefore, is to be disposed of by precedent, we have shown that the rule of the ancients was neither absolute, nor did the circumstances of their stage correspond with those of ours; to which it may be added, that the simple and inartificial structure of their plots seldom required a change of scene. But surely it is of less consequence to examine the practice of the ancients, than to consider how far it is founded upon truth, good taste, and general effect. Granting, therefore, that the supposed illusion, which transports the spectator to the actual scene of action, really exists, let us inquire whether, in sacrificing the privilege of an occasional change of scene, we do not run the risk of shocking the spectator, and disturbing his delightful dreams, by other absurdities and improbabilities, attendant necessarily on a scrupulous adherence to this restriction.

If the action is always to pass in the scene, some place of general resort must be adopted, a hall, anti-room, or the like. It can seldom be so fortunately selected but that much must be necessarily discussed there, which, in order to preserve any appearance of probability, should be transacted elsewhere; that many persons must be introduced whose presence must appear unnatural; and that much must be done there which the very circumstances of the piece render totally absurd. Dennis has applied these observations with great force, and at the same time with great bitterness, in his critique upon *Cato*, which Johnson has quoted at length in his *Life of Addison*. The scene, it must be remembered, is laid, during the whole drama, with scrupulous attention to the classical rule, in the great hall of Cato's palace at Utica. Here the conspirators lay their plots, the lovers carry on their intrigues; and yet Sempronius, with great inconsistency, disguises himself as Juba to obtain entrance into this vestibule, which was common to all. Here Cato retires to moralize, and chides his son for interrupting him; and although he retires to stab himself, it is to this place that he is brought back to die. All this affords a striking proof how genius and taste can be fettered and embarrassed by a too pedantic observance of rules. Let no one suppose that the inconveniences arising from the rigid observance of the unity of place, occur in the tragedy of *Cato* alone; they might in that case be attributed to the inexperience or want of skill in the author. The tragedies of Corneille and Racine afford examples enough that the authors found themselves compelled to violate the rules of probability and common sense, in order to adhere to those of Aristotle. In the tragedy of *Cinna*, for example, the scene is laid in the emperor's cabinet; and in that very cabinet, compelled, doubtless, by the laws of unity, Amelia shouts forth aloud her resolution to assassinate the emperor. It is there too that Maximus and Cinna confide to each other all the secrets of their conspiracy; and it is there where, to render the impropriety more glaring, Cinna suddenly reflects upon the rashness of his own conduct:

> Amis, dans ce palais on peut nous écouter;
> Et nous parlons peut-être avec trop d'imprudence,
> Dans un lieu si mal propre à notre confidence.

It would be an invidious, but no difficult task, to show that several of the *chefs d'œuvres* of the French drama are liable to similar objections; and that the awkward dilemmas in which the unity of place involves them, is far more likely to destroy the illusion of the performance, than the mere change of scene would have done. But we refer the reader to the *Dramaturgie* of Lessing upon this curious topic.

The main question yet remains behind, namely, whether such an illusion is actually produced in the minds of the audience by the best-acted play, as induces them to

suppose themselves witnessing a reality;—an illusion, in short, so complete, as to suffer from the occasional extension of time or change of place in the course of the piece? We do not hesitate to say that no such impression was ever produced on a sane understanding; and that the Parisian critic, in whose presence the unities are never violated, no more mistakes Talma for Nero, than a London citizen identifies Kemble with Coriolanus, or Kean with Richard III.[1] The ancients, from the distance of the stage, and their mode of dressing and disguising their characters, might certainly approach a step nearer to reality; and producing on their stage the very images of the deities they worshipped, speaking the language which they accounted proper to them, it is highly probable that, to minds capable of high excitation, there might be a shade of this illusion in their representations. The solemn distance of the stage, the continuous and uninterrupted action, kept the attention of the Greeks at once more closely riveted, and more abstracted from surrounding circumstances. But in the modern theatre, the rapid succession of intervals for reflection, the well-known features of the actors, the language which they speak differing frequently from that which belongs to the age and country where the scene is laid, interrupt at every turn every approximation to the fantastic vision of reality into which those writers who insist upon the strict observance of the unities suppose the audience to be lulled. To use the nervous words of Johnson, "It is false that any representation is mistaken for reality; that any dramatic fable in its materiality was ever credible, or for a single moment was ever credited." There is a conventional treaty between the author and the audience, that upon certain suppositions being granted by the latter, his powers of imagination shall be exerted for the amusement of the spectators. The postulates which are demanded, even upon the French theatre, and under the strictest model, are of no ordinary magnitude. Although the stage is lighted with lamps, the spectator must say with the subjugated Catherine,

I grant it is the sun that shines so bright.

The painted canvass must pass for a landscape; the well-known faces of the performers for those of ancient Greeks, or Romans, or Saracens; and the present time for many ages distant. He that submits to such a convention ought not scrupulously to limit his own enjoyment; that which is supposed Rome in one act, may in the next be fancied Paris; and as for time, it is, to use the words of Dr Johnson, "of all modes of existence, most obsequious to imagination; a lapse of years is as easily conceived as a passage of hours. In contemplation we easily contract the time of real actions, and therefore willingly permit it to be contracted when we only see their imitation."

If dramatic representation does not produce the impression of reality, in what, it may be asked, consists its power? We reply, that its effects are produced by the powerful emotions which it excites in the minds of the spectators. The professors of every fine art operate their impressions in the same manner, though they address themselves to different organs. The painter exhibits his scene to the eye, the orator pours his thunder upon the ear, the poet awakens the imagination of his reader by written description; but each has the same motive, the hope, namely, of exciting in the reader, hearer, or spectator, a tone of feeling similar to that which existed in his own bosom, ere it was bodied forth by his pencil, tongue, or pen. It is the artist's object, in short, to tune the reader's imagination to the same pitch with his own; and to communicate, as well as colours and words can do, the same sublime sensations which had dictated his own compositions. The tragedian attempts to attain this object still more forcibly, because his art combines those of the poet, orator, and artist, by storming as it were the imagination at once through the eye and the ear. Undoubtedly a drama with such advantages, and with those of dresses and costume, approaches more nearly to actual reality, and therefore has a better chance of attaining its object, especially when addressing the sluggish and inert fancies of the multitude; although it may remain a doubtful question whether, with all these means and appliances, minds of a high poetic temperature may not receive a more lively impression from the solitary perusal than from the representation of one of Shakspeare's plays. But, to the most ignorant spectator, however unaccustomed to the trick of the scene, the excitement which his fancy receives falls materially short of actual mental delusion. Even the sapient Partridge himself never thought of being startled at the apparition of the king of Denmark, which he knew to be only a man in a strange dress; it was the terror so admirably expressed by Garrick, which communicated itself to his feelings, and made him reverse the case of the fiends, and tremble without believing. In truth, the effects produced upon this imaginary character, as described by an excellent judge of human nature, exhibit, probably, the highest point of illusion to which theatrical exhibition can conduct a rational being. In an agony of terror which made his knees knock against each other, he never forgets that he is only witnessing a play The presence of Mrs Millar and his master assures him against the reality of the apparition; yet he is no more able to subdue his terrors by this comfortable reflection, than we have been to check our tears, although well aware that the Belvidera with whose sorrows we sympathized was no other than our own inimitable Mrs Siddons. With all our passions and all our sympathies, we are still conscious of the ideal character of that which excites them; and it is probably this very consciousness of the unreality of scene that refines our sorrows into a melancholy yet delicious emotion, and extracts from it that bitterness necessarily connected with a display of similar misery in actual life.

If, therefore, no illusion subsists of a character to be affected by a change of scene, or by the prolongation of the time beyond the rules of Aristotle, the very foundation of these unities is undermined; but, at the same time, every judicious author will use liberty with prudence.

If we are inclined to ascend to the origin of these celebrated rules, we ought not to be satisfied with the *ipse dixit* of a Grecian critic, who wrote so many centuries ago, and whose works have reference to a state of dramatic composition which has now no existence. Upon the revival of letters, indeed, the authority of Aristotle was considered as omnipotent; but even Boileau remonstrated against his authority, when weighed with that of reason and common sense.

Un pedant envieux de sa vaine science,
Tout herissé de Grec, tout bouffi d'arrogance,
Et qui de mille auteurs retenus mot pour mot,
Dans la teste entassez, n'a souvent fait qu'un sot,
Croit qu'un livre fait tout, et que sans Aristote
La raison ne voit goutte, et le bon sens radote.

The opinions of Aristotle must be judged of according to the opportunities and authorities which lay open before him; and from the high critical judgment he has displayed, we can scarce err in supposing he would have drawn

[1] See note to page 147.

Drama.

different results in different circumstances. Dr Drake, whose industry and taste have concentrated so much curious information respecting Shakspeare and his age, has quoted upon this topic a striking passage from Mr Morgan's *Essay on the Character of Falstaff*.

Speaking, says Dr Drake, of the magic influence which our poet almost invariably exerts over his auditors, Mr Morgan remarks, that "on such an occasion, a fellow like *Rymer*,[1] waking from his trance, shall lift up his constable's staff, and charge this great magician, this daring *practiser of arts inhibited*, in the name of Aristotle to surrender; whilst Aristotle himself, disowning his wretched officer, would fall prostrate at his feet and acknowledge his supremacy.—O supreme of dramatic excellence! might he say, not to me be imputed the insolence of fools. The bards of *Greece* were confined within the narrow circle of the chorus, and hence they found themselves constrained to practise, for the most part, the precision, and copy the details, of nature. I followed them, and knew not that a larger circle might be drawn, and the drama extended to the whole reach of human genius. Convinced, I see that a more compendious *nature* may be obtained; a nature of *effects* only, to which neither the relation of places, or continuity of time, are always essential. Nature, condescending to the faculties and apprehensions of man, has drawn through human life a regular chain of visible causes and effects. But poetry delights in surprise, conceals her steps, seizes at once upon the heart, and obtains the sublime of things without betraying the rounds of her ascent. True poetry is *magic*, not *nature;* an effect from causes hidden or unknown. To the magician I prescribed no laws; his law and his power are one; his power is his law. If his end is obtained, who shall question his course? Means, whether apparent or hidden, are justified in poesy by success; but then most perfect and most admirable when most concealed.

"Yes, continues Mr Morgan, whatever may be the neglect of some, or the censure of others, there are those who firmly believe that this wild, this uncultivated *barbarian*, as he has been called, has not yet obtained one half of his fame; and who trust that some new Stagyrite will arise, who, instead of pecking at the surface of things, will enter into the inward soul of his compositions, and expel, by the force of congenial feelings, those foreign impurities which have stained and disgraced his page. And as to those *spots* which still remain, they may perhaps become invisible to those who shall seek them through the medium of his beauties, instead of looking for those beauties, as is too frequently done, through the smoke of some real or imputed obscurity. When the hand of time shall have brushed off his present editors and commentators, and when the very name of Voltaire, and even the memory of the language in which he has written, shall be no more, the Appalachian Mountains, the banks of the Ohio, and the plains of Sciola, shall resound with the accents of this *barbarian*. In his native tongue he shall roll the genuine passions of nature; nor shall the griefs of *Lear* be alleviated, or the charms and wit of *Rosalind* be abated, by *time*."[2]

In adopting the views of those authors who have pleaded for the liberty of the poet, it is not our intention to deny that great advantages may be obtained by the observance of the unities; not considering them as in themselves essential to the play, but only as points upon which the credibility and intelligibility of the action in some sort depends. We acknowledge, for example, that the author would be deficient in dramatic art, who should divide the interest of his piece into two or more separate plots, instead of combining it in one progressive action. We confess, moreover, that the author, who more violently extends the time, or more frequently changes the place of representation, than can be justified by the necessity of the story, and vindicated by his exertion of dramatic force, acts unwisely, in so far as he is likely to embarrass a great part of the audience, who, from imperfect hearing or slowness of comprehension, may find it difficult to apprehend the plot of his play. The latitude which we are disposed to grant is regulated by the circumstances of the case, the interest of the plot, and, above all, the talents of the author. He that despises the praise of regularity which is attainable by study, cannot reckon on the indulgence of the audience, unless on the condition of indemnifying them by force of genius. If a definitive rule were to be adopted, we should say that it would certainly be judicious to place any change of place or extension of time at the beginning of a new act; as the falling of the curtain and cessation of the action has prepared the audience to set off, as it were, upon a new score. But we consider the whole of these points of propriety as secondary to the real purposes of the drama, and not as limitary of that gifted genius who can, in the whirlwind of his scene, bear the imagination of his audience along with him over the boundaries of place,

While panting time toils after them in vain.

French notions of tragi-comedy.

It is not upon the observance of the unities alone that the French found their pretensions to a classical theatre. They boast also to have discarded that intermixture of tragic and comic scenes, which was anciently universal upon the Spanish and English stages.

If it had been only understood by this reformation, that the French condemned and renounced that species of tragi-comedy which comprehended two distinct plots, the one of a serious, the other of a humorous character, and these two totally unconnected, we give them full credit for their restriction. Dryden, in the *Spanish Friar*, and other pieces; and Southern, both in *Oronoko* and *Isabella*, as well as many other authors of their age, have in this particular transgressed unpardonably the unity of action. For, in the cases we have quoted, the combination of the two plots is so slight, that the serious and comic scenes separated, might each furnish forth a separate drama; so that the audience appear to be listening, not to one play only, but to two dramatic actions independent of each other, although contained in the same piece. So far, therefore, we heartily agree in the rule which excludes such an unhappy interchange of inconsistent scenes, moving upon opposite principles and interests.

When, however, the French critics carry this rule farther, and proscribe the appearance of comic or inferior characters, however intimately connected with the tragic plot, we would observe, in the first place, that they run the risk of diminishing the reality of the scene; and secondly, that they exclude a class of circumstances essential to its beauty.

On the first point it must be observed, that the rule which imposes upon valets and subordinate personages the necessity of talking as harmonious verse and as elegant poetry as their masters, entirely ruins the probability of the action. Where all is elegant, nothing can be sublime; where all is ornamented, nothing can be impressive; where all is tuned to the same smooth *falsetto* of sentiment, nothing can be natural or real. By such an assimilation of manners and language, we stamp fiction on the very front

[1] Rymer was a calumniator of Shakspeare.
[2] *Shakspeare and his Times*, by Nathan Drake, M.D. p. 553, 554, vol. ii.

of our dramatic representation. The touches of nature which Shakspeare has exhibited in his lower and gayer characters, like the chastened back-ground of a landscape, increase the effect of the principal group. The light and fanciful humour of Mercutio serves, for example, to enhance and illustrate the romantic and passionate character of Romeo. Even the doating fondness and silly peevishness of the nurse tends to relieve the soft and affectionate character of Juliet, and to place her before the audience in a point of view which those who have seen Miss O'Neil perform Juliet know how to appreciate. A contrast is effected which a French author dared not attempt, but of which every bosom at once acknowledges the power and the truth. Let us suppose that the gay and gallant Mercutio had as little character as the walking confident of a French hero, who echoes the hexameters of his friend in hexameters of a lower level; or let us suppose the nurse of Juliet to be a gentle Nora, as sublime in white linen as her principal in white satin; and let the reader judge whether the piece would gain in dignity any thing proportioned to what it must lose in truth and interest. The audience at once sympathizes with the friendship of Romeo and Mercutio, rendered more natural and more interesting by the very contrast of their characters; and each spectator feels as a passion, not as a matter of reflection, that desire of vengeance which impels Romeo against Tibalt; for we acknowledge as an amiable and interesting individual the friend whom he has lost by the sword of Capulet. Even the anilities of the nurse give a reality to the piece, which, whatever French critics may pretend, is much more seriously disturbed by inconsistency of manners, than by breach of their dramatic unities. "God forbid," says Mr Puff, in the *Critic*, "that, in a free country, all the fine words in the language should be engrossed by the higher characters of the piece." The French critics did not carry their ideas of equality quite so far, but they tuned the notes of their subalterns just one pitch lower than those of their principal characters, so that their language, similar in style, but lower in sentiment and diction, presents still that subordinate resemblance and correspondence to that of their superiors, which the worsted lace upon the livery of a servant bears to the embroidery upon the coat of his master.

It is not to mere expression that these remarks are confined; for if we consult the course of human life, we shall find that mirth and sorrow, and events which cause both, are more nearly allied than perhaps it is altogether pleasing to allow. Considered relatively to a spectator, an incident may often excite a mingled emotion, partaking at once of that which is moving and that which is ludicrous; and there is no reader who has not, at some period of his life, met with events at which he hesitated whether to laugh or to cry. It remains to be proved why scenes of this dubious yet interesting description should be excluded from the legitimate drama, while their force is acknowledged in that of human life. We acknowledge the difficulty of bringing them upon the scene with their full and corresponding effect. It was perhaps under this persuasion that the fool, whose wild jests were too much the result of habit and practice to be subdued even by the terrors of the storm, has been banished from the terrific scene of King Lear. But, in yielding to this difficulty, the terrible contrast has been thus destroyed, in which Shakspeare exhibited the half perceptions of the natural fool, as contrasted with the assumed insanity of Edgar, and the real madness of the old king. They who prefer to this living variety of emotion the cold uniformity of a French scene of passion, must be numbered among those who read for the pleasure of criticism, and without hope of partaking the enthusiasm of the poet.

While we differ from French criticism respecting the right to demand an accurate compliance with the unities, and decline to censure that casual intermixture of comic character which gives at once reality and variety to the drama, we are no less disposed to condemn the impertinent love scenes which these authors have, as a matter of etiquette, introduced into all their tragedies, however alien from the passion on which they are grounded. The French drama assumed its present form under the auspices of Louis XIV. who aimed at combining all the characters of a hero of romance. The same spirit which inspired the dull monotony of the endless *folios* of Scudery and Calprenede, seemed to dictate to Corneille, and even to Racine, those scenes of frigid metaphysical passion which encumber their best plays. We do not dispute the deep interest which attaches to the passion of love, so congenial to the human breast, when it forms the groundwork of the play; but it is intolerably nauseous to find a dull love tale mingled as a indispensable ingredient in every dramatic plot, however inconsistent with the rest of the piece. The *Amoureux* and *Amoureuse* of the piece come regularly forth to recite their common-places of gallantry, in language as cold as it is exaggerated, and as inconsistent with passion and feeling as with propriety and common sense. Even the horrid tale of Œdipus has the misplaced garnishment of a love intrigue between Theseus, brought there for no other purpose, and a certain Dirce, whom, in the midst of the pestilence, he thus gallantly compliments:

> Quelque ravage affreux qu'étale ici la peste,
> L'absence aux vrais amans est encore plus funeste.

The predominance of a passion which expresses itself so absurdly is all that the French have condescended to adopt from the age of chivalry, so rich in more dramatic stores; and they have borrowed it in all its pedantry, and without its tenderness and fire. Riccoboni has probably alleged the true reason for the introduction of these heavy scenes of love intrigue, which is, that at little expense of labour to the author, they fill up three quarters of the action of his play. We quote from the French version, as that immediately before us, and most generally intelligible: "*Par exemple, ôtons de* NICOMEDE *les dix scènes de* LAODICE, *de l'*ŒDIPE *les dix scènes de* DIRCE, *de* POLIEUCTE *les scènes d'amour de* SEVERE, *de la* PHEDRE *de Monsieur Racine les six scènes d'*ARICIE, *et nous verrons que non seulement l'action ne sera point interrompuë, mais qu'elle en sera plus vive; en sorte que l'on verra manifestement, que ces scènes de tendresses n'ont servi qu'à ralentir l'action de la pièce, à la refroidir, et à rendre le héros moins grand. Si après ces deux meilleurs tragédies de la France, on examine tous les autres, on connoitra bien mieux cette vérité. Lorsque l'amour fait le sujet de la tragédie, ce sentiment, si intéressant par lui-même, occupe le scène avec raison; j'aime l'amour de* PHEDRE, *mais de* PHEDRE *seule*." Under this thraldom the fetters of the French stage long laboured, notwithstanding the noble example of *Athalie*, the chef d'œuvre of Racine. By the example of Voltaire, in one or two of his best pieces, they have of late ventured occasionally to discard their uninteresting Cupid, whose appearance on the stage as a matter of course and of ceremony, produced as little effect as when his altar and godhead are depicted on the semicircle of a fan.

We have already observed, that the refined, artificial, and affected character of the French tragedy, arose from its immediate connection with the pleasures and with the presence of an absolute sovereign. From the same circumstance, however, the French stage derived several advantages. A degree of discipline, unknown in other theatres, was early introduced among the French actors; and those of a subordinate rank, who, on the English stage,

Drama. sometimes exhibit intolerable, contemptuous, and wilful negligence, become compelled, on that of France, to pay the same attention to their parts as their superiors, and to exert what limited talents they possess in the subordinate parts to which they are adapted. The effect of this common diligence upon the scene, is a general harmony and correspondence in its parts, which never fails to strike a stranger with admiration.

The royal protection, also, early produced on the Parisian stage an improved and splendid style of scenery, decoration, and accompaniments. The scenes and machinery which they borrowed from Italy, they improved with their usual alert ingenuity. They were still further improved under the auspices of Voltaire, who had the sole merit of introducing natural and correct costume. Before his time the actors, whether Romans or Scythians, appeared in the full dress of the French court; and Augustus himself was represented in a huge full-bottomed wig, surmounted by a crown of laurel. The strict national costume introduced by Voltaire is now observed. That author has also the merit of excluding the idle crowd of courtiers and men of fashion who thronged the stage during the time of representation, and formed a sort of semicircle round the actors, leaving them thus but a few yards of an area free for performance, and disconcerting at once the performers and the audience, by the whimsical intermixture of players and spectators. The nerves of those pedants who contended most strenuously for the illusion of the scene, and who objected against its being interrupted by an occasional breach of the dramatic unities, do not appear to have suffered from the presence of this singular chorus.

Corneille. It was not decoration and splendour alone which the French stage owed to Louis XIV. Its principal obligation was for that patronage which called forth in its service the talents of Corneille and Racine, the Homer and the Virgil of the French drama. However constrained by pedantic rules; however held back from using that infinite variety of materials which national and individual character presented to them; however frequently compelled by system to adopt a pompous, solemn, and declamatory style of dialogue; these distinguished authors still remain the proudest boast of the classical age of France, and a high honour to the European republic of letters. It seems probable that Corneille, if left to the exercise of his own judgment, would have approximated more to the romantic drama. The *Cid* possesses many of the charms of that species of composition. In the character of Don Gourmaz, he has drawn a national portrait of the Spanish nobility, for which very excellence he was subjected to the censure of the academy, his national court of criticism. In a general point of view, he seems to have been ambitious of overawing his audience by a display of the proud, the severe, the ambitious, and the terrible. Tyrants and conquerors have never sat to a painter of greater skill; and the romantic tone of feeling which he adopts in his more perfect characters is allied to that of chivalry. But Corneille was deficient in tenderness, in dramatic art, and in the power of moving the passions. His fame, too, was injured by the multiplicity of his efforts to extend it. Critics of his own nation have numbered about twenty of his dramas which have little to recommend them; and no foreign reader is very likely to verify or refute the censure, since he must previously read them to an end.

Racine, who began to write when the classical fetters were clenched and riveted upon the French drama, did not make that effort of struggling with his chains which we observe in the elder dramatist; he was strong where Corneille evinced weakness, and weak in the points where his predecessor showed vigour. Racine delineated the passion of love with truth, softness, and fidelity; and his Drama. scenes of this sort form the strongest possible contrast with those in which he, as well as Corneille, sacrificed to the dull Cupid of metaphysical romance. In refinement and harmony of versification, Racine has hitherto been unequalled; and his *Athalie* is, perhaps, likely to be generally acknowledged as the most finished production of the French drama.

Voltaire. Subsequent dramatists, down to the time of Voltaire, were contented with imitating the works of these two great models, until the active and ingenious spirit of that celebrated author seems tacitly to have meditated further experimental alterations than he thought it prudent to defend or to avow. His extreme vivacity and acute intellect were mingled, as is not unfrequent in such temperaments, with a certain nervous timidity, which prevented him from attempting open and bold innovation, even where he felt compliance with existing rules most inconvenient and dispiriting. He borrowed, therefore, liberally from Shakspeare, whose irregularities were the frequent object of his ridicule; and he did not hesitate tacitly to infringe the dramatic unities in his plays, while in his criticism he holds them up as altogether inviolable. While he altered the costume of the stage, and brought it nearer to that of national truth, he made one or two irresolute steps towards the introduction of national character. If we were, indeed, to believe the admirers of Corneille, little remained to be done in this department; he had already, it is said, taught his Romans to speak as Romans, and his Greeks as Greeks; but of such national discrimination foreigners are unable to perceive a trace. His heroes, one and all, talk like men of no peculiar character or distinct age and nation, but, like the other heroes of the French dramatic school, are "all honourable men," who speak in high, grave, buskined rhimes, where an artificial brilliancy of language, richness of metaphor, and grandeur of sentiment, are substituted for that concise and energetic tone of dialogue, which shows at once the national and individual character of the personage who uses it. In *Mahomet*, *Alzire*, and one or two other pieces, Voltaire has attempted some discrimination of national character; the groundwork, however, is still French; and, under every disguise, whether of the turban of the Ottoman, the feathery crown of the savage, or the silk tunic of the Chinese, the character of that singular people can be easily recognized. Voltaire probably saw the deficiency of the national drama with his usual acuteness; but, like the ancient philosophers, he contentedly joined in the idolatry which he despised.

It seems, indeed, extremely doubtful whether the French tragedy can ever be brought many steps nearer to nature. That nation is so unfortunate as to have no poetical language; so that some degree of unnatural exaltation of sentiment is almost necessary to sustain the tone of tragedy at a pitch higher than that of ordinary life. The people are passionately fond of ridicule; their authors are equally afraid of incurring it: they are aware, like their late ruler, that there is but one step betwixt the sublime and the ridiculous; and they are afraid to aim at the former, lest their attempt, falling short, should expose them to derision. They cannot reckon on the mercy or enthusiasm of their audience; and while they banish combats and deaths, and even violent action of any kind, from the stage, this seems chiefly on account of the manifest risk that a people, more alive to the ludicrous than the lofty, might laugh when they should applaud. The drunken and dizzy fury with which Richard, as personated by Kean, continues to make the motion of striking after he has lost his weapon, would be caviare to the Parisian parterre. Men must compound with their poets and actors,

and pardon something like extravagance, on the score of enthusiasm. But if they are nationally dead to that enthusiasm, they resemble a deaf man listening to eloquence, who is more likely to be moved to laughter by the gestures of the orator, than to catch fire at his passionate declamation.

Above all, the French people are wedded to their own opinions. Each Parisian is, or supposes himself, master of the rules of the critical art; and whatever limitations it imposes on the author, the spectators receive some indemnification from the pleasure of sitting in judgment upon him. To require from a dancer to exhibit his agility without touching any of the lines of a diagram chalked on the floor, would deprive the performance of much ease, strength, and grace; but still the spectator would feel a certain interest in watching the dexterity with which the artist avoided treading on the interdicted limits, and a certain pride in detecting occasional infringements. In the same manner, the French critic obtains a triumph from watching the transgressions of the dramatic poet against the laws of Aristotle; equal, perhaps, to the more legitimate pleasure he might have derived from the unfettered exercise of his talents. Upon the whole, the French tragedy, though its regulations seem to us founded in pedantry, and its sentiments to belong to a state of false and artificial refinement, contains, nevertheless, passages of such perfect poetry and exquisite moral beauty, that to hear them declaimed with the art of Talma, cannot but afford a very high pitch of intellectual gratification.

French comedy.

The French comedy assumed a regular shape about the same period with the tragedy; and Molière was in his department what Corneille and Racine were in theirs; an original author, approached in excellence by none of those that succeeded him. The form which he assumed for a model was that of the comedy of Menander, and he has copied pretty closely some pieces from the Latin stage. Molière was endowed by nature with a rich fund of comic humour, which is nowhere more apparent than in those light pieces which are written upon the plan of the Italian masked comedy. In these he has introduced the jealous old pantaloon, the knavish and mischievous servant, and some of its other characters. In his regular comedy he soared to a higher pitch. Before his time the art had sought its resources in the multiplicity and bustle of intrigue, escape, and disguise,—of, at best, in a comic dialogue, approaching to mere buffoonery. Molière's satire aimed at a nobler prey; he studied mankind for the purpose of attacking those follies of social life which are best exposed by ridicule. The aim of few satirists has been so legitimate, or pursued with such success. Female vanity, learned pedantry, unreasonable jealousy, the doating and disgraceful passions of old men, avarice, coquetry, slander, the quacks who disgrace medicine, and the knaves who prostitute the profession of the law, were the marks at which his shafts were directed.

Molière's more regular comedies are limited by the law of unities, and finished with great diligence. It is true, the author found it sometimes necessary tacitly to elude the unity of place, which he durst not openly violate; but, in general, he sacrifices probability to system. In the *Ecole des Femmes*, Arnolph brings his wife into the street, out of the room in which his jealousy has imprisoned her, in order to lecture her upon the circumspection due to her character; which absurdity he is guilty of, that the scene may not be shifted from the open space before his door to her apartment. In general, however, it may be noticed, that the critical unities impose much less hardship upon the comic than upon the tragic poet. It is much more easy to reconcile the incidents of private life to the unities of time and place, than to compress within their limits the extensive and prolonged transactions which comprehend the revolution of kingdoms and fate of monarchs. What influence, however, these rules do possess, must operate to cramp and embarrass the comic as well as the tragic writer; to violate and disunite those very probabilities which they affect to maintain; and to occasion a thousand real absurdities rather than grant a conventional license, which seems essential to the freedom of the drama.

The later comic authors of France seem to have abandoned the track pointed out by Molière, as if in despair of approaching his excellence. Their comedy, compared with that of other nations, and of their great predecessor, is cramped, and tame, and limited. In this department, as in tragedy, the stage experienced the inconvenience arising from the influence of the court. The varied and unbounded field of comic humour which the passions and peculiarities of the lower orders present, was prohibited, as containing subjects of exhibition too low and vulgar for a monarch and his courtiers; and thus the natural, fresh, and varied character of comedy was flung aside, while the heartless vices and polished follies of the great world were substituted in its place. Schlegel has well observed, that the object of French comedy "is no longer life, but society; that perpetual negotiation between conflicting vanities which never ends in a sincere treaty of peace; the embroidered dress, the hat under the arm, and the sword by the side, essentially belong to them; and the whole of the characterization is limited to the folly of the men and the coquetry of the women."

It is scarcely in nature that a laughter-loving people should have remained satisfied with an amusement so dull and insipid as their regular comedy. A few years preceding the revolution, and while the causes of that event were in full fermentation, the *Marriage of Figaro* appeared on the stage. It is a comedy of intrigue; and the dialogue is blended with traits of general and political satire, as well as with a tone of licentiousness, which was till then a stranger to the French stage. It was received with a degree of enthusiastic and frantic popularity which nothing but its novelty could have occasioned, for there is little real merit in the composition. Frederick of Prussia, and other admirers of the old theatrical school, were greatly scandalized at so daring an innovation on the regular French comedy. The circumstances which followed have prevented Beaumarchais' example from being imitated; and the laughers have consoled themselves with inferior departments of the drama. Accordingly, we find the blank supplied by farces, comic operas, and dramatic varieties, in which plots of a light, flimsy, and grotesque character are borne out by the comic humour of the author and comic skill of the actor. Brunet, a comedian of extraordinary powers in this cast of interludes, has at times presumed so far upon his popularity as to season his farce with political allusions. It will scarce be believed that he aimed several shafts at Napoleon when in the height of his power. The boldness as well as the wit of the actor secured him the applause of the audience; and such a hold had Brunet of their affections, that an imprisonment of a few hours was the greatest punishment which Bonaparte ventured to inflict upon him. But whatever be the attachment shown to the art in general, the French, like ourselves, rest the character of their theatre chiefly upon the ancient specimens of art; and the regular tragedy, as well as comedy, seems declining in that kingdom.

English drama.

As the drama of France was formed under the patronage of the monarch, and bears the strongest proofs of its courtly origin, that of England, which was encouraged by the people at large, retains equally unequivocal marks of its popular descent. Its history must naturally draw to

some length, as being that part of our article likely to be most interesting to the reader. In part, however, we have paved the way for it by the details common to the rise of dramatic art in the other nations of Europe. We shall distinguish the English drama as divided into four periods, premising that this is merely a general, and not a precise division. The taste which governed each period, and the examples on which it is grounded, will usually be found to have dawned in the period preceding that in which it was received and established.

I. From the revival of the theatre until the great civil war.

II. From the Restoration to the reign of Queen Anne.

III. From the earlier part of the last century down to the present reign.

IV. The present state of the British drama.

First period of the English drama.

I. The drama of England commenced, as we have already observed, upon the Spanish model. *Ferrex and Perrex* was the first composition approaching to a regular tragedy, and it was acted before Queen Elizabeth, upon the 18th day of January 1561, by the gentlemen of the Inner Temple. It partakes rather of the character of a historical than of a classical drama, although more nearly allied to the latter class than the chronicle plays which afterwards took possession of the stage. We have already recorded Sir Philip Sidney's commendation of this play, which he calls by the name of *Gorboduc*, from one of the principal characters. Acted by a learned body, and written in great part by Lord Sackville, the principal author of the *Mirror for Magistrates*, the first of English tragedies assumed in some degree the honours of the learned buskin; but although a chorus was presented according to the classical model, the play was free from the observance of the unities, and contains many irregularities severely condemned by the regular critics.

English comedy, considered as a regular composition, is said to have commenced with *Gammer Gurton's Needle*. This " right pithy, pleasant, and merry comedy," was the supposed composition of John Still, Master of Arts, and afterwards Bishop of Bath and Wells. It was acted in Christ-Church College, Cambridge, in 1575. It is a piece of low humour, the whole jest turning upon the loss and recovery of the needle with which Gammer Gurton was to repair the breeches of her man Hodge; but, in point of manners, it is a great curiosity, as the *curta suppellex* of our ancestors is scarcely anywhere so well described. The popular characters also, the Sturdy Beggar, the Clown, the Country Vicar, and the Shrew of the sixteenth century, are drawn in colours taken from the life. The unity of time, place, and action, are observed through the play with an accuracy of which France might be jealous. The time is a few hours; the place, the open square of the village before Gammer Gurton's door; the action, the loss of the needle; and this, followed by the search for and final recovery of that necessary implement, is intermixed with no other thwarting or subordinate interest, but is progressive from the commencement to the conclusion.

It is remarkable that the earliest English tragedy and comedy are both works of considerable merit; that each partakes of the distinctive character of its class; that the tragedy is without intermixture of comedy, the comedy without any intermixture of tragedy.

These models were followed by a variety of others, in which no such distinctions were observed. Numerous theatres sprung up in different parts of the metropolis, opened upon speculation by distinct troops of performers. Their number shows how much they interested public curiosity; for men never struggle for a share in a losing profession. They acted under licenses, which appear to have been granted for the purpose of police alone, not of exclusive privilege or monopoly; since London contained, in the latter part of the sixteenth century, no fewer than fourteen distinct companies of players, with very considerable privileges and remunerations. (See Drake's *Shakspeare and his Times*, vol. ii. p. 205.)

The public, therefore, in the widest sense of the word, was at once arbiter and patron of the drama. The companies of players who traversed the country might indeed assume the name of some peer or baron, for the sake of introduction or protection; but those of the metropolis do not, at this early period of our dramatic history, appear to have rested in any considerable degree upon learned or aristocratic privilege. Their license was obtained from the crown, but their success depended upon the voice of the people; and the pieces which they brought forward were, of course, adapted to popular taste. It followed necessarily that histories and romantic dramas were the favourites of the age. A general audience in an unlearned age requires rather amusement than conformity to rules, and is more displeased with a tiresome uniformity than shocked with the breach of all the unities. The players and dramatists, before the rise of Shakspeare, followed, of consequence, the taste of the public, and dealt in the surprising, elevating, and often bombastic incidents of tragedy, as well as in the low humour and grotesque incident of the comic scene. Where these singly were found to lack attraction, they mingled them together, and dashed their tragic plot with an under-intrigue of the lowest buffoonery, without any respect to taste or congruity.

The clown was no stranger to the stage; he interfered, without ceremony, in the most heart-rending scenes, to the scandal of the more learned spectators.

> Now lest such frightful shows of fortune's fall,
> And bloody tyrant's rage, should chance appall
> The death-struck audience, 'midst the silent rout
> Comes leaping in a self-misformed lout,
> And laughs and grins, and frames his mimic face,
> And jostles straight into the prince's place;
> Then doth the theatre echo all aloud
> With gladsome noise of that applauding crowd,
> A goodly hotchpotch, where vile russettings
> Are matched with monarchs and with mighty kings.

An ancient stage-trick, illustrative of the mixture of tragic and comic action in Shakspeare's time, was long preserved in the theatre. Henry IV. holding council before the battle of Shrewsbury, was always represented as seated on a drum; and when he rose and came forward, the place was occupied by Falstaff, which seldom failed to produce a laugh from the galleries. The taste and judgment of the author himself was very different. During the whole scene Falstaff gives only once, and under irresistible temptation, the rein to his petulant wit, and it is instantly checked by the prince, to whom, by the way, and not to the king, his words ought to be addressed.

Shakspeare.

The English stage might be considered as equally without rule and without model when Shakspeare arose. The effect of the genius of an individual upon the taste of a nation is mighty; but that genius, in its turn, is formed according to the opinions prevalent at the period when it comes into existence. Such was the case with Shakspeare. With an education more extensive, and a taste refined by the classical models, it is probable that he also, in admiration of the ancient drama, might have mistaken the form for the essence, and subscribed to those rules which had produced such masterpieces of art. Fortunately for the full exertion of a genius as comprehensive and versatile as intense and powerful, Shakspeare had no access to any models of which the commanding merit might have controlled and limited his own exertions. He followed the

path which a nameless crowd of obscure writers had trodden before him; but he moved in it with the grace and majestic step of a being of a superior order, and vindicated for ever the British theatre from a pedantic restriction to classical rule. Nothing went before Shakspeare which in any respect was fit to fix and stamp the character of a national drama; and certainly no one will succeed him capable of establishing by mere authority a form more restricted than that which Shakspeare used.

Such is the action of existing circumstances upon genius, and the re-action of genius upon future circumstances. Shakspeare and Corneille were each the leading spirit of his age; and the difference between them is well marked by the editor of the latter. "*Corneille est inégal comme Shakspeare, et plein de génie comme lui; mais le génie de Corneille étoit à celui de Shakspeare ce qu'un seigneur est à l'égard d'un* homme de peuple *né avec le même esprit que lui.*" This distinction is strictly accurate, and contains a compliment to the English author which, assuredly, the critic did not intend to make. Corneille wrote as a courtier, circumscribed within the imaginary rules and ceremonies of a court, as a chicken is by a circle of chalk drawn round it. Shakspeare, composing for the amusement of the public alone, had within his province, not only the inexhaustible field of actual life, but the whole ideal world of fancy and superstition; more favourable to the display of poetical genius than even existing realities. Under the circumstances of Corneille, Shakspeare must have been restricted to the same dull, regular, and unvaried system. He must have written, not according to the dictates of his own genius, but in conformity to the mandate of some *intendant des menus plaisirs;* or of some minister of state, who, like Cardinal Richelieu, thought he could write a tragedy because he could govern a kingdom. It is not equally clear to what height Corneille might have ascended had he enjoyed the national immunities of Shakspeare. Each pitched down a land-mark in his art. The circle of Shakspeare was so extended, that it is with advantage liable to many restrictions; that of Corneille included a narrow limit, which his successors have deemed it unlawful to extend.

It is not our intention, within the narrow space to which our essay is necessarily limited, to enlarge upon the character and writings of Shakspeare. We can only notice his performances as events in the history of the theatre—of a gigantic character indeed, so far as its dignity, elevation, and importance are considered; but, in respect of the mere practice of the drama, rather fixing and sanctioning, than altering or reforming those rules and forms which he found already established. This we know for certain, that those historical plays or chronicles, in which Shakspeare's muse has thrown a never-fading light upon the history of his country, did, almost every one of them, exist before him in the rude shape of dry dialogue and pitiful buffoonery, stitched into scenes by the elder playwrights of the stage. His romantic dramas exhibit the same contempt of regularity which was manifested by Marlow and other writers; for where there was abuse or extreme license upon the stage, the example of Shakspeare may be often quoted as its sanction, never as tending to reform it. In these particulars the practice of our immortal bard was contrasted with that of Ben Jonson, a severe and somewhat pedantic scholar; a man whose mind was coarse, though capable both of strength and elevation, and whose strong perception of comic humour was tinctured with vulgarity.

Jonson.

Jonson's tragic strength consists in a sublime, and sometimes harsh, expression of moral sentiment; but displays little of tumultuous and ardent passion, still less of tenderness or delicacy; although there are passages in which he seems adequate to expressing them. He laboured in the mine of the classics, but overloaded himself with the ore, which he could not or would not refine. His *Cataline* and *Sejanus* are laboured translations from Cicero, Sallust, and Tacitus, which his own age did not endure, and which no succeeding generation will probably be much tempted to revive. With the stern superiority of learning over ignorance, he asserted himself a better judge of his own productions than the public which condemned him, and haughtily claimed the laurel which the public suffrage often withheld; but the world has as yet shown no disposition to reverse the opinion of their predecessors.

In comedy Jonson made some efforts partaking of the character of the older comedy of the Grecians. In his *Tale of a Tub* he follows the path of Aristophanes, and lets his wit run into low buffoonery, that he might bring upon the stage Inigo Jones, his personal enemy. In *Cynthia's Revels* and the *Staple of News,* we find him introducing the dull personification of abstract passions and qualities, and turning legitimate comedy into an allegorical mask. What interest can the reader have in such characters as the three Penny boys, and their transactions with the Lady Pecunia? Some of Jonson's more legitimate comedies may be also taxed here with filthiness of language, of which disgusting attribute his works exhibit more instances than any English writer of eminence excepting Swift. Let us, however, be just to a master-spirit of his age. The comic force of Jonson was strong, marked, and peculiar; and he excelled even Shakspeare himself in drawing that class of truly English characters, remarkable for peculiarity of *humour;* that is, for some mode of thought, speech, and behaviour, superinduced upon the natural disposition by profession, education, or fantastical affectation of singularity. In blazoning these forth with their natural attributes and appropriate language, Ben Jonson has never been excelled, and his works everywhere exhibit a consistent and manly moral, resulting naturally from the events of the scene.

It must also be remembered, that although it was Jonson's fate to be eclipsed by the superior genius, energy, and taste of Shakspeare, yet those advantages which enabled him to maintain an honourable though an unsuccessful struggle, were of high advantage to the drama. Jonson was the first who showed by example the infinite superiority of a well-conceived plot, all the parts of which bore upon each other, and forwarded an interesting conclusion over a tissue of detached scenes, following without necessary connection or increase of interest. The plot of the *Fox* is admirably conceived; and that of the *Alchymist,* though faulty in the conclusion, is nearly equal to it. In the two comedies of *Every Man in his Humour* and *Every Man out of his Humour,* the plot deserves much less praise, and is deficient at once in interest and unity of action; but in that of the *Silent Woman* nothing can exceed the art with which the circumstance upon which the conclusion turns is, until the very last scene, concealed from the knowledge of the reader, while he is tempted to suppose it constantly within his reach. In a word, Jonson is distinguished by his strength and stature, even in those days when there were giants in the land, and affords a model of a close, animated, and characteristic style of comedy, abounding in moral satire, and distinguished at once by force and art, which was afterwards more cultivated by English dramatists, than the lighter, more wild, and more fanciful department in which Shakspeare moved, beyond the reach of emulation.

The general opinion of critics has assigned genius as the characteristic of Shakspeare, and art as the appropriate excellence of Jonson; not surely that Jonson was deficient in genius, but that art was the principal character-

istic of his laborious scenes. We learn from his own confession, and from the panegyrics of his friends, as well as the taunts of his enemies, that he was a slow composer. The natural result of laborious care is jealousy of fame; for that which we do with labour, we value highly when achieved. Shakspeare, on the other hand, appears to have composed rapidly and carelessly, and sometimes even without considering, while writing the earlier acts, how the catastrophe was to be huddled up, in that which was to conclude the piece. We may fairly conclude him to have been indifferent about fame, who would take so little pains to win it. Much perhaps might have been achieved by the union of these opposed qualities, and by blending the art of Jonson with the fiery invention and fluent expression of his great contemporary. But such an union of opposite excellencies in the same author was hardly to be expected; nor perhaps would the result have proved altogether so favourable as might at first view be conceived. We should have had more perfect specimens of the art, but they must have been much fewer in number; and posterity would certainly have been deprived of that wild luxuriance of dramatic excellencies and poetic beauties, which, like wild flowers upon a common field, lie scattered profusely among the unacted plays of Shakspeare.

Massinger. Although incalculably superior to his contemporaries, Shakspeare had successful imitators, and the art of Jonson was not unrivalled. Massinger appears to have studied the works of both with the intention of uniting their excellencies. He knew the strength of plot; and although his plays are altogether irregular, yet he well understood the advantage of a strong and defined interest; and in unravelling the intricacy of his intrigues, he often displays the management of a master. Art, therefore, not perhaps in its technical, but in its most valuable sense, was Massinger's as well as Jonson's; and, in point of composition, many passages of his plays are not unworthy of Shakspeare. Were we to distinguish Massinger's peculiar excellence, we should name that first of dramatic attributes, a full conception of character, a strength in bringing out, and consistency in adhering to it. He does not, indeed, always introduce his personages to the audience in their own proper character; it dawns forth gradually in the progress of the piece, as in the hypocritical Luke, or in the heroic Marullo. But, upon looking back, we are always surprised and delighted to trace from the very beginning, intimations of what the personage is to prove as the play advances. There is often a harshness of outline, however, in the character of this dramatist, which prevents their approaching to the natural and easy portraits bequeathed us by Shakspeare.

Beaumont and Fletcher. Beaumont and Fletcher, men of remarkable talent, seemed to have followed Shakspeare's mode of composition rather than Jonson's, and thus to have altogether neglected that art which Jonson taught, and which Massinger in some sort practised. They may, indeed, be rather said to have taken for their model the boundless license of the Spanish stage, from which many of their pieces are expressly and avowedly derived. The acts of their plays are so detached from each other, in substance and consistence, that the plot scarce can be said to hang together at all, or to have, in any sense of the word, a beginning, progress, and conclusion. It seems as if the play began because the curtain rose, and ended because it fell, the author, in the mean time, exerting his genius for the amusement of the spectators, pretty much in the same manner as in the *Scenario* of the Italians, by the actors filling up, with their extempore wit, the scenes chalked out for them. To compensate for this excess of irregularity, the plays of Beaumont and Fletcher have still a high poetical value. If character be sometimes violated, probability discarded, and the interest of the plot neglected, the reader is, on the other hand, often gratified by the most beautiful description, the most tender and passionate dialogue, a display of brilliant wit and gaiety, or a feast of comic humour. These attributes had so much effect on the public, that, during the end of the seventeenth and the beginning of the eighteenth centuries, many of Beaumont and Fletcher's plays had possession of the stage, while those of Shakspeare were laid upon the shelf.

Shirley and others. Shirley, Ford, Webster, Decker, and others, added performances to the early treasures of the English drama, which abound with valuable passages. There never, probably, rushed into the lists of literary competition together a band more distinguished for talent. If the early drama be inartificial and unequal, no nation at least can show so many detached scenes, and even acts, of distinguished poetical merit. One powerful cause seems to have produced an effect so marked and distinguished, to wit, the universal favour of a theatrical public, which daily and nightly thronged the numerous theatres then open in the city of London.

Cause of the abundance of dramatic talent in this period. In considering this circumstance, it must above all be remembered that these numerous audiences crowded, not to feast their eyes upon show and scenery, but to see and hear the literary production of the evening. The scenes which the stage exhibited were probably of the most paltry description. Some rude helps to the imagination of the audience might be used by introducing the gate of a castle or town; the monument of the Capulets, by sinking a trap-door, or by thrusting in a bed. The good-natured audience readily received these hints, with that conventional allowance which Sir Philip Sidney had ridiculed, and which Shakspeare himself has alluded to when he appeals from the poverty of theatrical representation to the excited imagination of his audience.

> ....Can this cockpit hold
> The vasty fields of France? Or may we cram
> Within this wooden O, the very casques
> That did affright the air at Agincourt?
> O, pardon! since a crooked figure may
> Attest, in little space, a million;
> And let us, ciphers to this great account,
> On your imaginary forces work;
> Suppose, within the girdle of these walls,
> Are now confined two mighty monarchies,
> Whose high upreared and abutting fronts
> The perilous narrow ocean parts asunder;
> Printing their proud hoofs i' the receiving earth.
> For 'tis your thoughts that now must deck our kings,
> Carry them here and there; jumping o'er times;
> Turning the accomplishment of many years
> Into an hour-glass.........

Such were the allowances demanded by Shakspeare and his contemporaries from the public of their day, in consideration of the imperfect means and appliances of their theatrical machinery. Yet the deficiency of scenery and show, which, when existing in its utmost splendour, divides the interest of the piece in the mind of the ignorant, and rarely affords much pleasure to a spectator of taste, may have been rather an advantage to the infant drama. The spectators having nothing to withdraw their attention from the immediate business of the piece, gave it their full and uninterrupted attention. And here it may not be premature to inquire into the characteristical difference between the audiences of the present day, and those earlier theatrical ages, when the drama boasted not only the names of Shakspeare, of Massinger, of Jonson, of Beaumont and Fletcher, of Shirley, of Ford, and others of subordinate degree; the meanest of whom shows occasionally more fire than warms whole reams of modern plays. This will probably be found

to rest on the varied and contrasted feelings with which the audience of ancient and that of modern days attend the progress of the scene.

Nothing, indeed, is more certain than that the general cast of theatrical composition must receive its principal bent and colouring from the taste of the audience:

> The drama's laws, the drama's patrons give;
> For those who live to please, must please to live.

But though this be an undeniable, and in some respects a melancholy truth, it is not less certain that genius, labouring in behalf of the public, possesses the power of re-action, and of influencing in its turn that taste to which it is in some respects obliged to conform; while, on the other hand, the playwright, who aims only to catch the passing plaudit and the profit of a season, by addressing himself exclusively to the ruling predilections of the audience, degrades the public taste still farther by the gross food which he ministers to it, unless it shall be supposed that he may contribute involuntarily to rouse it from its degeneracy, by cramming it even to satiety and loathing. This action, therefore, and re-action of the taste of the age on dramatic writing, and *vice versa*, must be both kept in view when treating of the difference betwixt the days of Shakspeare and our own.

Perhaps it is the leading distinction betwixt the ancient and modern audiences, that the former came to listen and to admire; to fling the reins of their imaginations into the hands of the authors and actors, and to be pleased, like the reader to whom Sterne longed to do homage, " they knew not why, and cared not wherefore." The novelty of dramatic entertainments (for there elapsed only about twenty years betwixt the date of *Gammer Gurton's Needle*, accounted the earliest English play, and the rise of Shakspeare) must have had its natural effect upon the audience. The sun of Shakspeare arose almost without a single gleam of intervening dawn; and it was no wonder that the audience, introduced to this enchanting and seductive art at once, under such an effulgence of excellence, should have been more disposed to wonder than to criticise; to admire, or rather to adore, than to measure the height or ascertain the course of the luminary which diffused such glory around him. The great number of theatres in London, and the profusion of varied talent which was dedicated to this service, attest the eagerness of the public to enjoy the entertainments of the scene. The ruder amusements of the age lost their attractions; and the royal bear-ward of Queen Elizabeth lodged a formal complaint at the feet of her majesty, that the play-houses had seduced the audience from his periodical bear-baitings. This fact is worth a thousand conjectures; and we can hardly doubt that the converts, transported by their improving taste from the bear-garden to the theatre, must, generally speaking, have felt their rude minds subdued and led captive by the superior intelligence, which not only placed on the stage at pleasure all ranks, all ages, all tempers, all passions of mere humanity, but extended its powers beyond the bounds of time and space, and seemed to render visible to mortal eyes the secrets of the invisible world. We may, perhaps, form the best guess of the feelings of Shakspeare's contemporary audience, by recollecting the emotions of any rural friend, of rough but sound sense and ardent feelings, whom we have had the good fortune to conduct to a theatre for the first time in his life. It may be well imagined that such a spectator thinks little of the three dramatic unities, of which Aristotle says so little, and his commentators and followers talk so much; and that the poet and the performers have that enviable influence over his imagination, which transports him from place to place at pleasure, crowds years into the course of hours, and interests him in the business of each scene, however disconnected from the others. His eyes are riveted to the stage, his ears drink in the accents of the speakers, and he experiences in his mature age, what we have all felt in childhood, a sort of doubt whether the beings and business of the scene be real or fictitious. In this state of delightful fascination, Shakspeare and the gigantic dramatic champions of his age found the British public at large; and how they availed themselves of the advantages which so favourable a temper afforded them, their works will show so long as the language of Britain continues to be read. It is true that the enthusiastic glow of the public admiration, like the rays of a tropical sun darted upon a rich soil, called up in profusion weeds as well as flowers; and that, spoiled in some degree by the indulgent acceptation which attended their efforts, even our most admired writers of Elizabeth's age not unfrequently exceeded the bounds of critical nicety, and even of common taste and decorum. But these eccentricities were atoned for by a thousand beauties, to which, fettered by the laws of the classic drama, the authors would hardly have aspired, or, aspiring, would hardly have attained. All of us know and feel how much the exercise of our powers, especially those which rest on keen feeling and self-confidence, is dependent upon a favourable reception from those for whom they are put in action. Every one has observed how a cold brow can damp the brilliancy of wit and fetter the flow of eloquence; and how both are induced to send forth sallies corresponding in strength and fire, upon being received by the kindred enthusiasm of those whom they have addressed. And thus, if we owe to the indiscriminate admiration with which the drama was at first received, the irregularities of the authors by whom it was practised, we also stand indebted to it, in all probability, for many of its beauties, which became of rare occurrence, when, by a natural, and indeed a necessary change, satiated admiration began to give way to other feelings.

When a child is tired of playing with a new toy, its next delight is to examine how it is constructed; and, in like manner, so soon as the first burst of public admiration is over with respect to any new mode of composition, the next impulse prompts us to analyse and to criticise what was at first the subject of vague and indiscriminate wonder. In the first instance, the toy is generally broken to pieces; in the other, while the imagination of the authors is subjected to the rigid laws of criticism, the public generally lose in genius what they may gain in point of taste. The author who must calculate upon severe criticism turns his thoughts more to avoid faults than to attain excellence, as he who is afraid to stumble must avoid rapid motion. The same process takes place in all the fine arts; their first productions are distinguished by boldness and irregularity; those which succeed, by a better and more correct taste, but also by inferior and less original genius.

The original school founded by Shakspeare and Ben Jonson, continued by Massinger, Beaumont and Fletcher, Shirley, Ford, and others, whose compositions are distinguished by irregularity as well as genius, was closed by the breaking out of the great civil war in 1642. The stage had been the constant object of reprobation and abhorrence on the part of the puritans, and its professors had no favour to expect at their hands if victorious. We read, therefore, with interest, but without surprise, that almost all the actors took up arms in behalf of their old master King Charles, in whose service most of them perished. Robinson, a principal actor at the Blackfriars, was killed by Harrison in cold blood, and under the application of a text of scripture,—" Cursed is he that doeth the work of the Lord negligently." A few survivors endeavoured occasionally to practise their art in secrecy and obscurity,

Drama.

but were so frequently discovered, plundered and stripped by the soldiers, that "*Enter the red-coat, Exit hat and cloak,*" was too frequent a stage direction. Sir William Davenant endeavoured to evade the severe zealots of the time, by representing a sort of opera, said to have been the first drama in which moveable scenery was introduced upon the stage. Even the cavaliers of the more grave sort disapproved of the revival of these festive entertainments during the unstable and melancholy period of the interregnum. "I went," says the excellent Evelyn, in his *Diary*, 5th May 1658, "to see a new opera after the Italian way; in recitation, music, and scenes, much inferior to the Italian composure and magnificence; but it was prodigious that in such a time of public consternation, such a variety should be kept up or permitted, and being engaged with company, could not decently resist the going to see it, though my heart smote me for it." Davenant's theatrical enterprise, abhorred by the fanaticism of the one party, and ill adapted to the dejected circumstances of the other, was not probably very successful.

Second period of the English drama.

II. With royalty the stage revived in England. But the theatres in the capital were limited to two, a restriction which has never since been extended. This was probably by the advice of Clarendon, who endeavoured, though vainly, to stem at all points the flood of idle gaiety and dissipation which broke in after the Restoration. The example of France might reconcile Charles to this exertion of royal authority. With this restoration of the drama, as well as of the crown, commences the second part of English dramatic history.

Charles II. had been accustomed to enjoy the foreign stage during his exile, and had taste enough to relish its beauties. It is probable, however, that his judgment was formed upon the French model, for few of the historical or romantic dramas were revived at the restoration. So early as 26th of November 1662, the *Diary* of Evelyn contains this entry: "I saw Hamlet, Prince of Denmark, played; but now the old plays began to disgust this refined age, since his majesty has been so long abroad." Dryden, Howard, and others, who obtained possession of the stage, introduced what was for some time called Heroic Plays, written in couplets, and turning upon the passions of love and honour. In the dialogue, these pieces resembled that of the French stage, where the actors declaim alternately in the best language and in the finest thoughts which the poet can supply, but without much trace of natural passion or propriety of character. But though French in dialogue and sentiment, the heroic plays were English in noise and bustle, and the lack of truth and nature was supplied by trumpets and tempests, victories and processions. An entertainment of a character so forced and unnatural was obviously of foreign growth, and flowed from the court. Dryden himself has assured us "that the favour which heroic plays had acquired upon the stage was entirely owing to the countenance which they had received at court; and that the most eminent persons for wit and humour in the royal circle had so far honoured them, that they judged no way so fit as verse to entertain a noble audience, or express a noble passion." In these pieces the unities were not observed; but in place of the classical restrictions, there were introduced certain romantic whimsical limitations of the dramatic art, which, had they been adopted, must soon have destroyed all its powers of pleasing. The characters were avowedly formed upon the model of the French romance, where honour was a sort of insane gasconading extravagance, and who seem to have made a vow never to speak or think of any thing but love, and that in language sometimes ingeniously metaphysical, sometimes puerile to silliness, sometimes mad even to raving, but always absurd, unnatural, and extravagant. In point of system it was stated, that a heroic play should be an imitation of a heroic poem. The laws of such compositions did not, it was said, dispense with those of the elder drama, but exalted them, and obliged the poet to draw all things as far above the ordinary proportion of the stage, as the stage itself is beyond the common words and actions of human life. The effects which a heroic play, constructed upon such an overstrained model, produced, is well described by Mrs Evelyn, wife of the author of that name already quoted, in a letter to Mr Bohun, written in 1671. "Since my last to you I have seen the *Siege of Grenada*, a play so full of ideas, that the most refined romance I ever read is not to compare with it. Love is made so pure, and valour so nice, that one would imagine it designed for an Utopia rather than our stage. I do not quarrel with the poet, but admire one born in the decline of morality should be able to feign such exact virtue; and as poetic fiction has been instructive in former ages, I wish this the same event in ours. As to the strict law of comedy, I dare not pretend to judge. Some think the division of the story not so well as if it could all have been comprehended in the day of action. Truth of history, exactness of time, possibilities of adventures, are niceties which the ancient critics might require; but those who have outdone them in fine notions may be allowed the liberty to express them their own way, and the present world is so enlightened that the old dramatique must bear no sway. This account perhaps is not enough to do *Mr Driden* right, yet is as much as you can expect from the leisure of one who has the care of a nursery." (See Evelyn's *Works.*) This ingenious lady felt what, overawed by the fashion of the moment, she has intimated rather than expressed; namely, that the heroic drama, notwithstanding the fine poetry of which it may be made the vehicle, was overstrained, fantastical, and unnatural.

Introduction of the heroic plays.

In comedy, also, there was evinced, subsequent to the Restoration, a kindred desire of shining in dialogue rather than attempting the humorous delineation of character of which Shakspeare, Jonson, and the earlier schools, had set the example. The comic author no longer wrote to move the hearty laugh of a popular assembly, but to please a fashionable circle, "the men of wit and pleasure about town," with whom wit and raillery is always more prevailing than humour. As in tragedy, therefore, the authors exhausted trope and figure, and reduced to logic the language of heroic passion; so in comedy, a succession of smart jests, which neither serve to advance the action of the piece, nor display the character of the speaker, was bandied to and fro upon the stage.

Heroic plays superseded by dramas of a more natural structure.

Satire is the appropriate corrective of extravagance in composition; and the *Rehearsal* of the Duke of Buckingham, though it can scarcely be termed a work of uncommon power, had yet the effect of holding up to public ridicule the marked and obvious absurdities of the revived drama in both its branches. After the appearance of this satire, a taste too extravagant for long endurance was banished from the theatre; both tragedy and comedy retraced their steps, and approached more nearly to the field of human action, passion, and suffering; and, down to the revolution, a more natural style of drama occupied the stage. It was supported by men of the highest genius, who, but for one great leading error, might perhaps have succeeded in giving to the art its truest and most energetic character. The talents of Otway, in his scenes of passionate affection, rival at least, and sometimes excel, those of Shakspeare. More tears have been shed, probably, for the sorrows of Belvidera and Monimia than for those of Juliet and Desdemona. The introduction of actresses upon the stage was scarcely known before the Restoration, and it furnished the poets of the latter period

with appropriate representatives for their female characters. This more happy degree of personification, as it greatly increased the perfection of the scene, must have animated in proportion the genius of the author. A marked improvement, therefore, may be traced in love scenes, and, indeed, in all those wherein female characters are introduced; that which was to be spoken by a fitting representative was of course written with more care, as it was acted with greater effect. This was an advantage, and a great one, possessed by the theatre succeeding the Restoration. Great dramatic force and vigour marked the dramatic compositions of this age. It was not, indeed, equal to that of Shakspeare, either in point of the talent called forth, or the quantity of original poetry given to the public; but Otway, and even Lee, notwithstanding his bombastic rant, possessed considerable knowledge of dramatic art and stage-effect. Several plays of this period have kept possession of the stage; less perhaps on account of intrinsic merits, than because some of the broad errors of the earlier age had been removed, and a little more art had been introduced in the combination of the scenes, and disentanglement of the plot. The voice of criticism was frequently heard; the dramatic rules of the ancients were known and quoted; and though not recognized in their full extent, had nevertheless some influence in regulating the action of the drama.

Gross immorality of the drama.

In one heinous article, however, the poets of this age sinned at once against virtue, good taste, and decorum; and endangered, by the most profligate and shameless indecency, the cause of morality, which has been often considered as nearly allied with that of the legitimate drama. In the first period of the British stage, the actors were men of decent character, and often acquired considerable independence. The women's parts were acted by boys. Hence, although there were too many instances of low and licentious dialogue, there were few of that abominable species which addresses itself, not to the fancy, but to the passions, and is seductive, instead of being ludicrous. Had Charles II. borrowed from the French monarchs the severe etiquette of their court, when he introduced into England something resembling the style of their plays, he would have asserted what was due to his own dignity, and the cause of sound morals and good manners, by prohibiting this vulgar and degrading license, which in itself was insulting to the presence of a king. It was, however, this prince's lot, in the regulation of his amusements, as well as in his state government, to neglect self-respectability. In his exile he had been "merry, scandalous, and poor;" had been habituated to share familiarly coarse jests and loose pleasures with his dissolute companions; and unfortunately he saw no reason for disusing the license to which he had accustomed himself, when it was equally destructive to his own character and to decorum. What had been merely coarse was, under his influence, rendered vicious and systematic impurity. Scenes, both passionate and humorous, were written in such a style as if the authors had studied whether the grave seduction of the heroic, or the broad infamy of the comic scenes, should contain the grossest insult to public decency. The female performers were of a character proper to utter whatever ribaldry the poet chose to put into their mouths; and as they practised what they taught, the king himself, and the leading courtiers, formed connections which gave the actress a right to be saucy in their presence, and to reckon upon their countenance when practising in public the effrontery which marked their intercourse in private life. How much this shocked the real friends of Charles, is shown by its effects upon Evelyn, whose invaluable *Diary* we have already quoted: "This night was acted my Lord Broghill's tragedy called Mustapha, before their majesties at court, at which I was present; though very seldom now going to the public theatres, for many reasons, as they are now abused to an atheistical liberty. Foul and indecent women now, and never till now, are permitted to appear and act, who, inflaming several young noblemen and gallants, became their misses, and some their wives: witness the Earl of Oxford, Sir R. Howard, P. Rupert, the Earl of Dorset, and another greater person than any of them, who fell into their snares, to the reproach of their noble families, and ruin of both body and soul." He elsewhere repeatedly expresses his grief and disgust at the pollution and degeneracy of the stage. (Evelyn's *Works*, vol. i. p. 392.) In a letter to Lord Cornbury (son of the great Clarendon), he thus expresses himself: "In the town of London there are more wretched and indecent plays permitted than in all the world besides;" and adds shortly after, "If my Lord Chancellor would but be instrumental in reforming this one exorbitancy, it would gain both the king and his lordship multitudes of blessings. You know, my lord, that I (who have written plays, and am a scurvy poet too sometimes) am far from puritanisme; but I would have no reproach left our adversaries, in a theme which may so conveniently be reformed. Plays are now with us become a licentious exercise, and a vice, and neede severe censors, that should look as well to their morality as to their lines and numbers." And, at the hazard of multiplying quotations, we cannot suppress the following:—1st March 1671. "I walked with him (the king) through St James's Park to the garden, where I both heard and saw a very familiar discourse betwixt— (*i. e.* the king) and Mrs Nelly (Gwyn), as they called an impudent comedian, she looking out of her terrace at the top of the wall, and —— [the king] standing in the green walk under it. I was heartily sorry at this scene."

The foul stain, so justly censured by a judge so competent and so moderate as Evelyn, was like that of the leprosy in the Levitical law, which sunk into and pervaded the very walls of the mansion; it became the leading characteristic of the English theatre, of its authors, and of its players. It was, however, especially in comedy that this vice was most manifest; and, to say truth, were not the eyes of antiquaries, like the ears of confessors, free from being sullied by the impurities committed to them, the comedies of this period, as well as the comic scenes introduced to relieve the tragedies, are fitter for a brothel than for the library of a man of letters.

It is a pity that we are under the necessity of drawing the character of the drama at this age from a feature so coarse and disgusting. Unquestionably, as the art in other respects made progress, it might, but for this circumstance, have reached an uncommon pitch of perfection. The comedies of Congreve contain probably more wit than was ever before embodied upon the stage; each word was a jest, and yet so characteristic, that the repartee of the servant is distinguished from that of the master; the jest of the coxcomb from that of the humorist or fine gentleman of the piece. Had not Sheridan lived in our own time, we could not have conceived the possibility of rivalling the comedies of Congreve. This distinguished author understood the laws of composition, and combined his intrigue with an art unusual on the British stage. Nor was he without his rivals, even where his eminence was most acknowledged. Vanburgh and Farquhar, inferior to Congreve in real wit, and falling into the next period, were perhaps his equals in the composition of acting plays. Like other powerful stimulants, the use of wit has its bounds, which Congreve is supposed sometimes to have exceeded. His dialogue keeps the attention too much upon the stretch, and, however delightful in the closet, fatigues the mind during the action. When you are per-

petually conscious that you lose something by the slightest interruption of your attention, whether by accident or absence of mind, it is a state of excitement too vivid and too constant to be altogether pleasant; and we feel it possible that we might sometimes wish to exchange a companion of such brilliant powers, for one who would afford us more repose and relaxation.

The light, lively, but somewhat more meagre dialogue of the latter dramatists of the period, and of that which succeeded, was found sufficient to interest, yet was not so powerful as to fatigue the audience. Vanburgh and Farquhar seemed to have written more from the portraits of ordinary life; Congreve from the force of his own conception. The former, therefore, drew the characters of men and women as they found them; selected, united, and heightened for the purpose of effect, but without being enriched with any brilliancy foreign to their nature. But all the personages of Congreve have a glimpse of his own fire, and of his own acuteness. He could not entirely lay aside his quick powers of perception and reply, even when he painted a clown or a coxcomb; and all that can be objected, saving in a moral sense, to this great author, is his having been too prodigal of his wit; a faculty used by most of his successors with rigid economy.

That personification of fantasy or whim called characters of humour, which Ben Jonson introduced, was revived during this period. Shadwell, now an obscure name, endeavoured to found himself a reputation, by affecting to maintain the old school, and espousing the cause of Ben Jonson against Dryden and other innovators. But although there was considerable force of humour in some of his forgotten plays, it was Wycherly upon whom fell the burthen of upholding the standard of the Jonsonian school. The *Plain Dealer* is indeed imitated from Molière; but the principal character has more the force of a real portrait, and is better contrasted with the perverse, bustling, masculine, petty-fogging, and litigious character of Widow Blackacker, than Alceste is with any of the characters in the *Misanthrope*. The other plays of this author are marked by the same strong, masculine, and forcible painting, which approaches more to the satire of Jonson, than to the ease of Vanburgh, the gaiety of Farquhar, or the wit of Congreve. Joining, however, the various merits of these authors, as belonging to this period, they form a galaxy of comic talent scarce to be matched in any other age or country; and which is only obscured by those foul and impure mists which their pens, like the raven wings of Sycorax, had brushed from fern and bog.

Morals repeatedly insulted long demanded an avenger; and he arose in the person of Jeremy Collier. It is no disgrace to the memory of this virtuous and well-meaning man, that, to use the lawyer's phrase, he pleaded his cause too high; summoned unnecessarily to his aid the artillery with which the Christian fathers had fulminated against the heathen drama; and pushing his arguments to extremity, directed it as well against the use as against the abuse of the stage. Those who attempted to reply to him availed themselves, indeed, of the weak parts of his arguments; but, upon the main points of impeachment, the poets stood self-convicted. Dryden made a manly and liberal submission, though not without some reflections upon the rudeness of his antagonist's attacks. "I shall say the less of Mr Collier, because in many things he has taxed me justly; and I have pleaded guilty to all thoughts and expressions of mine which can be truly accused of obscenity, profaneness, or immorality, and retract them. If he be my enemy, let him triumph; if he be my friend, as I have given him no occasion to be otherwise, he will be glad of my repentance. It becomes me not to draw my pen in the defence of a bad cause, when I have so often drawn it for a good one. Yet it were not difficult to prove, that in many places he has perverted my meaning by his glosses, and interpreted my words into blasphemy and bawdry, of which they were not guilty; besides, that he is too much given to horse-play in his raillery, and comes from battle like a dictator from the plough. I will not say, 'the zeal of God's house has eaten him up;' but I am sure it has devoured some part of his good manners and civility." Congreve, less prudent, made an angry and petulant defence, yet tacitly admitted the charge brought against him, by retrenching in the future editions of his plays, passages of grossness and profaneness, which the restless antiquary still detects in the early copies. And, on the whole, Collier's satire was attended with such salutary effects, that men started at the mass of impudence and filth which had been gradually accumulated in the theatre during the last reigns; and if the Augean stable was not sufficiently cleansed, the stream of public opinion was fairly directed against its conglomerated impurities. Since that period, indecency, that easy substitute for wit and pleasantry, has been gradually banished from the drama, where the conversation is now (according to Sheridan) at least always moral, if not entertaining.

During the second period of the British drama, great improvement was made in point of art. The principles of dramatic composition were more completely understood, and the poets themselves had written so much upon the subject, that, as Dryden somewhere complains, they had taught their audience the art of criticising their performances. They did not, however, so far surrender the liberties and immunities of their predecessors, as to receive laws from the French critics. The rules of the unities were no further adopted by Otway, Congreve, and the writers of the time, than their immediate purpose admitted. It was allowed on all hands that unnecessary and gross irregularities were to be avoided, but no precise rule was adopted. Poets argued upon the subject according to caprice, and acted according to convenience. Gross and palpable extensions of time, and frequent changes of place, were avoided; and, unless in tragi-comedies, authors studied to combine the intrigue of their play into one distinct and progressive action. The genius by which this art was supported was neither so general nor so profuse as that which decorated the preceding period. It was enough, however, to support the honour of the drama; and if the second period has produced fewer masterpieces of talent, it has exhibited more plays capable of being acted.

Third period of the English drama.

III. In the third period of dramatic history, the critics began to obtain an authority for which they had long struggled, and which might have proved fatal to the liberties of the stage. It is the great danger of criticism, when laying down abstract rules without reference to any example, that these regulations can only apply to the form, and never to the essence, of the drama. They may assume that the plot must be formed on a certain model, but they cannot teach the spirit which is to animate its progress. They cannot show how a passion should be painted, but they can tell to a moment when the curtain should be dropped. The misfortune is, that, while treating of these subordinate considerations, critics exalt them to an undue importance in their own minds and that of their scholars. What they carve out for their pupils is a mere dissection of a lifeless form; the genius which animated it escapes, as the principle of life glided from the scalpel of those anatomists who sought to detect it in the earlier days of that art. Rymer had, as early as 1688, discovered that our poetry of the last age was as rude as its architecture. "One cause thereof," he continues.

"might be, that Aristotle's *Treatise of Poetry* has been so little studied amongst us; it was, perhaps, commented upon by all the great men in *Italy*, before we well knew (on this side of the Alps) that there was such a book in being." Accordingly, Rymer endeavours to establish what he calls the Rule of Reason over Fancy, in the contrivance and economy of a play. "Those who object to this subjugation," he observes, "are mere fanatics in poetry, and will never be saved by their good works." The species of reason, however, to which Rymer appeals, resembles, in its occult nature, that which lies hidden in the depths of municipal law, and which is better known to the common class of mankind under the name of Authority. Because Aristotle assigns Pity and Terror as the objects of tragedy, Rymer resumes the proposition, that no other source of passion can be legitimate. To this he adds some arbitrary rules, of which it would be difficult to discover the rationale. It was the opinion, we are told, of the ancients, "that comedy (whose province was humour and ridiculous matter only) was to represent worse than the truth, history to describe the truth, but tragedy was to invent things better than the truth. Like good painters, they must design their images like the life, but yet better and more beautiful than the life. The malefactor of tragedy must be a better sort of malefactor than those that live in the present age: For an obdurate, impudent, and impenitent malefactor, can neither move compassion nor terror, nor be of any imaginable use in tragedy." It would be difficult to account for these definitions upon any logical principle, and impossible for an admirer of the drama to assent to a rule which would exclude from the stage Iago and Richard III. It is equally difficult to account for the *rationale* of the following dogmas: "If I mistake not, in poetry no woman is to kill a man, except her quality gives her the advantage above him; nor is a servant to kill his master; nor a private man, much less a subject, to kill a king, nor on the contrary. Poetical decency will not suffer death to be dealt to each other by such persons, whom the laws of duel allow not to enter the lists together." (Rymer's *View of the Tragedies of the Last Age.*) Though for these and similar critical conceits it would be difficult to find any just principle, nevertheless, Rymer, Dennis, and other critics, who, mixing observations founded on sound judgment and taste, with others which rested merely upon dauntless assertion, or upon the opinions of Aristotle, began thereby to extend their authority, and produce a more than salutary influence upon the drama. It is true, that both of the aristarchs whom we have named were so ill advised as themselves to attempt to write plays, and thereby most effectually proved that it was possible for a drama to be extremely regular, and at the same time intolerably dull. Gradually, however, their precepts, in despite of their example, gained influence over the stage. They laid down rules in which the audience were taught to regard the trade of a connoisseur as easy and soon learned; and the same quantity of technical jargon which, in the present day, constitutes a judge of painting, was, in the beginning of the eighteenth century, sufficient to elevate a templar into a dramatic critic. The court of criticism, though self-constituted, was sufficiently formidable, since they possessed the power of executing their own decrees. Many authors made their submission; amongst others, Congreve humbled himself in the *Mourning Bride;* and Addison, with anxious and constitutional timidity, sacrificed to the unities in his celebrated tragedy of *Cato.* Being in form and essence rather a French than an English play, it is one of the few English tragedies which foreigners have admired. It was translated into Italian, and admired as a perfect model by Riccoboni, although his taste condemns the silly love intrigue. Its success was contagious. Southerne and Rowe may be considered as belonging to the same school; although the former admired Shakspeare, and the latter formed himself, in some degree, on the model of Otway. Translations of French tragedies became every day more frequent; and their diction and style of dialogue was imitated upon the British stage. The language of tragedy no longer expressed human passion, or intimated what the persons of the drama actually felt, but described and debated alternately what they ought to feel; and sounding sentences, and long similes, exhibiting an active fancy and a cold imagination, supplied at once the place of force and of pathos.

Unfavourable influence of dramatic criticism.

The line between comedy and tragedy was now strictly drawn. The latter was no longer permitted to show that strain of heroic humour which exhibits itself in the character of Falconbridge, Hotspur, and Henry V., as well as Mercutio. All was to be cold and solemn, and in the same key of dull, grave state. Neither was comedy relieved by the touches of pathetic tenderness, and even sublimity, which are to be found in the romantic plays of the earlier period. To compensate the audience for the want of this beautiful variety of passion and feeling, Southerne, as Otway had done before him, usually introduces a few scenes of an under-plot, containing the most wretched and indecent farce, which was so slightly and awkwardly dovetailed into the original tragedy, that they have since been cancelled as impertinent intrusions, without being so much as missed. Young, Thomson, and others who followed the same wordy and declamatory system of composition, contributed rather to sink than to exalt the character of the stage. The two first were both men of excellent genius, as their other writings have sufficiently testified; but, as dramatists, they wrought upon a false model, and their productions are of little value.

It is a remarkable instance of the decay of dramatic art at this period, that several of the principal authors of the time felt themselves at liberty to write imitations of old plays belonging to the original school, by way of adapting them to the taste of their own age. The *Fair Penitent* of Rowe is well known as a poor imitation of Massinger's *Fatal Dowry.* It does not greatly excel the original in the management and conduct of the piece; and, in every thing else, falls as far beneath it as the baldest translation can sink below the most spirited original.

It would appear that the players of this period had adopted a mode of acting correspondent to the poetical taste of the time. Declamation seems to have been more in fashion in the school of Booth and Betterton than that vivacity of action that exhibits at once with word, eye, and gesture, the immediate passion which it is the actor's part to express. "I cannot help," says Cibber, "in regard to truth, remembering the rude and riotous havock we made of all the late dramatic honours of the theatre: all became at once the spoil of ignorance and self-conceit. Shakespeare was defaced, and tortured in every signal character; *Hamlet* and *Othello* lost, in one hour, all their good sense, their dignity, and fame; *Brutus* and *Cassius* became noisy blusterers, with bold unmeaning eyes, mistaken sentiments, and turgid elocution." (Cibber's *Memoirs.*)

Lillo endeavours to enlarge the sphere of tragedy.

A singular attempt to deviate from the prevailing taste in tragedy was made by Lillo, with the highly laudable purpose of enlarging the sphere of dramatic utility. He conceived that plays founded upon incidents of private life might carry more immediate conviction to the mind of the hearers, and be the means of stifling more vices in the bud, than those founded on the more remote and grander events of history. Accordingly, he formed his plots from domestic crimes, and his characters never rose

Drama.

above the ranks of middle life. Lillo had many requisites for a tragedian; he understood, either from innate taste or critical study, the advantage to be derived from a consistent fable; and, in the tragedy of the *Fatal Curiosity*, he has left the model of a plot, in which, without the help of any exterior circumstances, a train of events operating upon the characters of the dramatic persons produce a conclusion at once the most dramatic and the most horrible that the imagination can conceive. Neither does it appear that, as a poet, Lillo was at all inferior to others of his age. He possessed a beautiful fancy; and much of his dialogue is as forcibly expressed as it is well conceived. On some occasions, however, he sinks below his subject; and on others, he appears to be dragged down to the nether sphere in which it is laid, and to become cold and creeping, as if depressed with the consciousness that he was writing upon a mean subject. *George Barnwell* never rises above an idle and profligate apprentice; Milwood's attractions are not beyond those of a very vulgar woman of the town; Thoroughgood, as his name expresses, is very worthy and very tiresome; and there is, positively, nothing to redeem the piece, excepting the interest arising from a tale of horror, and the supposed usefulness of the moral. The *Fatal Curiosity* is a play of a very different cast, and such as might have shaken the Grecian stage even during the reign of terror. But the powers of the poet prove unequal to the concluding horrors of his scene. Old Wilmot's character, as the needy man who had known better days, exhibits a mind naturally good, but prepared for acting evil, even by the evil which he has himself suffered, and opens in a manner which excites the highest interest and expectation. But Lillo was unable to sustain the character to the close. After discovering himself to be the murderer of his son, the old man falls into the common cant of the theatre; he talks about computing sands, increasing the noise of thunder, adding water to the sea, and fire to Ætna, by way of describing the excess of his horror and remorse; and becomes as dully desperate, or as desperately dull, as any other despairing hero in the last scene of a fifth act.

Genteel comedy.

During this third period of the drama, comedy underwent several changes. The department called genteel comedy, where the persons as well as the foibles ridiculed were derived chiefly from high life, assumed a separate and distinct existence from that which ransacked human nature at large for its subject. Like the tragedy of the period, this particular species of comedy was borrowed from the French. It was pleasing to the higher classes, because it lay within their own immediate circle, and turned upon the topics of gallantry, persiflage, affectation, and raillery. It was agreeable to the general audience, who imagined they were thereby admitted into the presence of their betters, and enjoyed their amusement at their expense. The *Careless Husband* of Cibber is, perhaps, the best English play on this model. The general fault to which they are all liable is their tendency to lower the tone of moral feeling; and to familiarize men, in the middling, with the cold, heartless, and selfish system of profligate gallantry practised among the higher ranks. We are inclined to believe that, in a moral point of view, genteel comedy, as it has been usually written, is more prejudicial to public morals, than plays the tendency of which seems at first more grossly vicious. It is not so probable that the *Beggar's Opera* has sent any one from the two-shilling gallery to the highway, as that a youth entering upon the world, and hesitating between good and evil, may be determined to the worse course by the gay and seductive example of *Lovemore* or *Sir Charles Easy*. At any rate, the tenderness with which vices are shaded off into foibles familiarizes them to the mind of the hearer, and gives a false colouring to those crimes which should be placed before the mind in their native deformity. But the heaviness of this class of plays, and the difficulty of finding adequate representatives for those characters which are really well drawn, are powerful antidotes to the evil which we complain of. That which is dully written, and awkwardly performed, will not find many imitators.

Comedy of intrigue.

The genteel comedy being a plant of foreign growth, never obtained exclusive possession of the English stage, any more than court dresses have been adopted in our private societies. The comedy of intrigue, borrowed, perhaps, originally from the Spaniards, continued to be written and acted with success. Many of Cibber's pieces, of Centlivre's, and others, still retain their place on the stage. This is a species of comedy easily written, and seen with pleasure, though consisting chiefly of bustle and complicated incident; and requiring much co-operation of the dress-maker, scene-painter, and carpenter. After all the bustle, however, of surprise, and disguise, and squabble; after every trick is exhausted, and every stratagem played off, the writer too often finds himself in a labyrinth from which a natural mode of extrication seems altogether impossible. Hence the intrigue is huddled up at random; and the persons of the drama seem, as if by common consent, to abandon their dramatic character before throwing off their stage-dresses. The miser becomes generous; the peevish cynic good humoured; the libertine virtuous; the coquette is reformed; the debauchee is reclaimed; all vices natural and habitual are abandoned by those most habitually addicted to them: a marvellous reformation, which is brought about entirely from the consideration that the play must now be concluded. It was when pressed by this difficulty that Fielding is said to have damned all fifth acts.

English opera.

The eighteenth century, besides genteel comedy, and comedy of intrigue, gave rise to a new species of dramatic amusement. The Italian opera had been introduced into this country at a great expense, and to the prejudice, as it was supposed, of the legitimate drama. Gay, in aiming at nothing beyond a parody of this fashionable entertainment, and making it the vehicle of some political satire against Sir Robert Walpole's administration, unwittingly laid the foundation of the English opera. The popularity of his piece was unequalled; partly owing to its peculiar humour, partly to its novelty, partly to the success of the popular airs, which every body heard with delight, and partly to political motives. The moral tendency of the *Beggar's Opera* has been much questioned; although, in all probability, the number of highwaymen is not more increased by the example of Macheath, than that of murderers is diminished by the catastrophe of George Barnwell. Many years ago, however, an unhappy person, rather from a perverted and most misplaced ambition, than from the usual motives of want and desperation, chose, though in easy circumstances, and most respectably connected, to place himself at the head of a band of thieves and housebreakers, whose depredations he directed and shared. On the night on which they committed the crime for which he suffered, and when they were equipped for the expedition, he sung to his accomplices the chorus of the *Beggar's Opera*, "Let us take the road." But his confederates, professional thieves, and who pursued, from habit and education, the desperate practices which Mr B—— adopted from an adventurous spirit of profligate quixotry, knew nothing at all of Gay or the *Beggar's Opera;* and, in their several confessions and testimonies, only remembered something of a *flash-song*, about "turning lead to gold." This curious circumstance, while it tends to show that the drama may affect the weak part of a mind, predisposed to evil by a diseased imagina-

tion, proves the general truth of what Johnson asserts in the *Life of Gay*, that "highwaymen and housebreakers seldom mingle in any elegant diversions; nor is it possible for any one to imagine that he may rob with safety because he sees Macheath reprieved on the stage."

This play is now chiefly remarkable as having given rise to the English opera. In this pleasing entertainment, it is understood that the plot may be light and the characters superficial, provided that the music be good and adapted to the situation, the scenes lively and possessed of comic force. Notwithstanding the subordinate nature of this species of composition, it approaches, perhaps, more closely to the ancient Grecian drama than any thing which retains possession of our stage. The subjects, indeed, are as totally different as the sublime from the light and the trivial. But, in the mixture of poetry and music, and in the frequent introduction of singing characters unconnected with the business of the piece, and therefore somewhat allied to the chorus, the English opera has some general points of resemblance with the Grecian tragedy. This species of dramatic writing was successfully practised by Bickerstaff, and has been honoured by the labours of Sheridan.

Fourth period of the English drama.

IV. With the fourth era of our dramatic history commenced a return to a better taste, introduced by the celebrated David Garrick. The imitations of French tragedy, and the tiresome uniformity of genteel comedy, were ill adapted to the display of his inimitable talent. And thus, if the last generation reaped many hours of high enjoyment from the performances of this great actor, the present is indebted to him for having led back the public taste to the dramas of Shakspeare.

Revival of the plays of Shakspeare.

The plays of this great author had been altogether forgotten, or so much marred and disguised by interpolations and alterations, that he seems to have arisen on the British stage with the dignity of an antique statue disencumbered from the rubbish in which it had been enveloped since the decay of the art. But, although Garrick showed the world how the characters of Shakspeare might be acted, and so far paved the way for a future regeneration of the stage, no kindred spirit arose to imitate his tone of composition. His supremacy was universally acknowledged; but it seemed as if he was regarded as an object of adoration, not of imitation; and that authors were as much interdicted the treading his tragic path, as the entering his magic circle. It was not sufficiently remembered that the faults of Shakspeare, or rather of his age, are those into which no modern dramatist is likely to fall; and that he learned his beauties in the school of nature, which is ever open to all who profess the fine arts. Shakspeare may, indeed, be inimitable, but there are inferior degress of excellence, which talent and study cannot fail to attain; and the statuary were much to blame who, in despair of modelling a Venus like that of Phidias, should set himself to imitate a Chinese doll. Yet such was the conduct of the dramatists of Britain long after the supremacy of Shakspeare had been acknowledged. He reigned a Grecian prince over Persian slaves; and they who adored him

Tragedy of this period

did not dare attempt to use his language. The tragic muse appeared to linger behind the taste of the age, and still used the constrained and mincing measure which she had been taught in the French school. Hughes, Cumberland, and other men of talent, appeared in her service; but their model remained as imperfect as ever; and it was not till our own time that any bold efforts were made to restore to tragedy that truth and passion, without which declamation is only rant and impertinence. Horace Walpole, however, showed what might be done by adopting a more manly and vigorous style of composition; and Home displayed the success of a more natural current of passion. The former, chusing a theme not only totally unfit for representation, but from which the mind shrinks in private study, treated it as a man of genius, free from the trammels of habit and of pedantry. His characters in the *Mysterious Mother* do not belong to general classes, but have bold, true, and individual features; and the language approaches that of the first age of the English drama. The *Douglas* of Home is not recommended by this species of merit. In diction and character it does not rise above other productions of the period. But the interest turns upon a passion which finds a response in every bosom; for those who are too old for love, and too young for ambition, are all alike awake to the warmth and purity of maternal and filial affection. The scene of the recognition of Douglas's birth possesses a power over the affections, which, when supported by adequate representation, is scarcely equalled in the circle of our drama. It is remarkable that the ingenious author was so partial to this theatrical situation, as to introduce it in several of his other tragedies.

Comedy of this period.

The comedy of the fourth period is chiefly remarkable for exhibiting *The Rivals* and the *School for Scandal*. Critics prefer the latter, whilst the general audience reap, perhaps, more pleasure from the former; the pleasantry being of a more general cast, the incident more complicated and varied, and the whole plot more interesting. In both these plays, the gentlemanlike ease of Farquhar is united with the wit of Congreve. Indeed, the wit of Sheridan, though equally brilliant with that of his celebrated predecessor, flows so easily, and is so happily elicited by the line of the dialogue, that, in admiring its sparkles, we never once observe the stroke of the flint which produces them. Wit and pleasantry seemed to be the natural atmosphere of this extraordinary man, whose history was at once so brilliant and so melancholy. Goldsmith was, perhaps, in relation to Sheridan what Vanburgh was to Congreve. His comedies turn on an extravagance of intrigue and disguise, and so far belong to the Spanish school. But the ease of his humorous dialogue, and the droll yet true conception of the characters, make sufficient amends for an occasional stretch in point of probability. If all who draw on the spectators for indulgence were equally prepared to compensate by a corresponding degree of pleasure, they would have little occasion to complain. The elder Colman's *Jealous Wife*, and some of his smaller pieces, are worthy, and it is no ordinary compliment, of being placed beside these masterpieces. We dare not rank Cumberland so high, although two or three of his numerous efforts retain possession of the stage. *The Wheel of Fortune* was certainly one of the best acting plays of its time, but it was perhaps chiefly on account of the admirable representative which the principal character found in Mr John Kemble.

The plays of Foote, the modern Aristophanes, who ventured, by his powers of mimicking the mind as well as the external habits, to bring living persons on the stage, belong to this period, and make a remarkable part of its dramatic history. But we need not dwell upon it. Foote was an unprincipled satirist; and while he affected to be the terror of vice and folly, was only anxious to extort forbearance-money from the timid, or to fill his theatre at the indiscriminate expense of friends and enemies, virtuous or vicious, who presented foibles capable of being turned into ridicule. It is a just punishment of this course of writing, that Foote's plays, though abounding in comic and humorous dialogue, have died with the parties whom he ridiculed. When they lost the zest of personality, their popularity, in spite of much intrinsic merit, fell into utter decay.

Meantime dramatic composition of the higher class seem-

ed declining. Garrick in our fathers' time, Mrs Siddons in ours, could neither of them extract from their literary admirers any spark of congenial fire. No part written for either of these astonishing performers has survived the transient popularity which their talents could give to almost any thing. The truth seems to be, that the French model had been wrought upon till it was altogether worn out; and a new impulse from some other quarter—a fresh turning up of the soil, and awakening of its latent energies by a new mode of culture—was become absolutely necessary to the renovation of our dramatic literature. England was destined to receive this impulse from Germany, where literature was in the first luxuriant glow of vegetation, with all its crop of flowers and weeds rushing up together. There was good and evil in the importation derived from this superabundant source. But the evil was of a nature so contrary to that which had long palsied our dramatic literature, that, like the hot poison mingling with the cold, it may in the issue bring us nearer to a state of health.

The drama receives a new impulse from Germany.

The affectation of Frederic II. of Prussia, and of other German princes, for a time suppressed the native literature, and borrowed their men of letters from France, as well as their hair-dressers,—their dramas as well as their dressed dishes. The continental courts, therefore, had no share in forming the national drama. To the highest circle in every nation that of France will be most acceptable, not only on account of its strict propriety and conformity to *les convenances*, but also as securing them against the risk of hearing bold and offensive truths uttered in the presence of the sovereign and the subject. But the bold, frank, cordial, and rough character of the German people at large did not relish the style of the French tragedies translated for their stage; and this cannot be wondered at, when the wide difference between the nations is considered.

The natural character of the Germans is diametrically opposite to that of the French. The latter are light almost to frivolity, quick in seeing points of ridicule, slowly awakened to those of feeling. The Germans are of an abstracted, grave, and somewhat heavy temper; less alive to the ridiculous, more easily moved by an appeal to the passions. That which moves a Frenchman to laughter, affects a German with sorrow or indignation; and in that which touches the German as a source of the sublime or pathetic, the quick-witted Frenchman sees only subject of laughter. In their theatres the Frenchman comes to judge, to exercise his critical faculties, and to apply the rules which he has learned, fundamentally or by rote, to the performance of the night. A German, on the contrary, expects to receive that violent excitation which is most pleasing to his imaginative and somewhat phlegmatic character. While the Frenchman judges of the form and shape of the play, the observance of the unities, and the denouement of the plot, the German demands the powerful contrast of character and passion—the sublime in tragedy and the grotesque in comedy. The former may be called the formalist of dramatic criticism, keeping his eye chiefly on its exterior shape and regular form; the latter is the fanatic, who, disregarding forms, requires a deep and powerful tone of passion and of sentiment, and is often content to surrender his feelings to inadequate motives.

General character of the German drama.

From the different temper of the nations, the merits and faults of their national theatres became diametrically opposed to each other. The French author is obliged to confine himself, as we have already observed, within the circle long since described by Aristotle. He must attend to all the decorum of the scene, and conform to every regulation, whether rational or arbitrary, which has been entailed on the stage since the days of Corneille. He must never so far yield to feeling as to lose sight of grace and dignity. He must never venture so far in quest of the sublime, as to run the risk of moving the risible faculties of an audience, so much alive to the ridiculous, that they will often find or make it in what is to others the source of the grand or the terrible. The Germans, on the contrary, have never subjected their poets to any arbitrary forms. The division of the empire into so many independent states has prevented the ascendency of any general system of criticism; and their national literature was not much cultivated, until the time when such authority had become generally unpopular. Lessing had attacked the whole French theatrical system in his *Dramaturgie* with the most bitter raillery. Schiller brought forward his splendid dramas of romance and of history. Goethe crowded the stage with the heroes of ancient German chivalry. No means of exciting emotion were condemned as irregular, providing emotion was actually excited. And there can be no doubt that the license thus given to the poet, the willingness with which the audience submitted to the most extravagant postulates on their part, left them at liberty to exert the full efforts of their genius.

Lessing, Schiller, and Goethe, became at once the fathers and the masters of the German theatre; and it must be objected to these great men, that, in the abundance of their dramatic talent, they sometimes forgot that their pieces, in order to be acted, must be adapted to the capabilities of a theatre; and thus wrote plays altogether incapable of being represented. Their writings, although affording many high examples of poetry and passion, are marked with faults which the exaggeration of their followers has often carried into total extravagance. The plays of chivalry and of history were followed by an inundation of imitations, in which, according to Schlegel, "there was nothing historical but the names and external circumstances; nothing chivalrous but the helmets, bucklers, and swords; and nothing of old German honesty but the supposed rudeness. The sentiments were as modern as they were vulgar; from chivalry pieces, they were converted into cavalry plays, which certainly deserve to be acted by horses rather than men." (Schlegel *on the Drama.*)

It is not the extravagance of the apparatus alone, but exaggeration of character and sentiment, which have been justly ascribed as faults to the German school. The authors appear to have introduced too harshly, brilliant lights and deep shadows; the tumid is too often substituted for the sublime; and faculties and dispositions the most opposed to each other are sometimes described as existing in the same person.

In German comedy the same faults predominate in a much greater degree. The pathetic comedy, which might be rather called domestic tragedy, became, unfortunately, very popular in Germany; and found a champion in Kotzebue, who carried its conquests over all the Continent. The most obvious fault of this species of composition is the demoralizing falsehood of the pictures which it offers to us. The vicious are frequently presented as objects less of censure than of sympathy; sometimes they are selected as objects of imitation and praise. There is an affectation of attributing noble and virtuous sentiments to the persons least qualified by habit or education to entertain them; and of describing the higher and better educated classes as uniformly deficient in those feelings of liberality, generosity, and honour, which may be considered as proper to their situation in life. This contrast may be true in particular instances, and being used sparingly, might afford a good moral lesson; but, in spite of truth and probability, it has been assumed, upon all occasions, by these authors, as the groundwork of a sort of intellectual jacobinism; consisting, as Mr Coleridge has well expres-

Drama.

ed it, "in the confusion and subversion of the natural order of things, their causes and their effects; in the excitement of surprise, by representing the qualities of liberality, refined feeling, and a nice sense of honour in persons and in classes of life where experience teaches us least to expect them; and in rewarding with all the sympathies that are the dues of virtue, those criminals whom law, reason, and religion, have excommunicated from our esteem."

The German taste was introduced upon the English theatre within these twenty years. But the better productions of her stage have never been made known to us; for, by some unfortunate chance, the wretched pieces of Kotzebue have found a readier acceptance or more willing translators, than the sublimity of Goethe, the romantic strength of Schiller, or the deep tragic pathos of Lessing. They have tended, however, wretched as the model is, to introduce on our stage a degree of sentiment, and awaken among the audience a strain of sensibility, to which we were previously strangers.

George Coleman's comedy of *John Bull* is by far the best effort of our late comic drama. The scenes of broad humour are executed in the best possible taste; and the whimsical, yet native characters, reflect the manners of real life. The sentimental parts, although one of them includes a finely wrought up scene of paternal distress, partake of the *falsetto* of German pathos. But the piece is both humorous and affecting; and we readily excuse its obvious imperfections, in consideration of its exciting our laughter and our tears.

Joanna Baillie.

Whilst the British stage received a new impulse from a country whose literature had hitherto scarce been known to exist, she was enriched by productions of the richest native genius. A retired female, thinking and writing in solitude, presented to her countrymen the means of regaining the true and manly tone of national tragedy. She has traced its foundation to that strong instinctive and sympathetic curiosity, which tempts men to look into the bosoms of their fellow-creatures, and to seek, in the distresses or emotions of others, the parallel of their own passions. She has built on the foundations which she laid bare, and illustrated her precepts by examples which will long be an honour to the age in which they were produced and admired, yet its disgrace, when it is considered that they have been barred their legitimate sphere of influence upon the public taste.

Maturin, Coleridge, and others.

Besides this gifted person, the names of Coleridge, of Maturin, and other men of talents, throng upon our recollection; and there is one who, to judge from the dramatic sketch he has given us in *Manfred*, must be considered as a match for Æschylus, even in his sublimest moods of horror. It is no part of our plan, however, to enter upon the criticism of our contemporaries.[1] Suffice it to say, that the age has no reason to apprehend any decay of dramatic talent.

Neither can our actors be supposed inadequate to the representation of such pieces of dramatic art as we judge our authors capable of producing. We have lost Mrs Siddons and John Kemble, but we still possess Kean, Young, and Miss O'Neil; and the stage has to boast other tragic performers of merit. In comedy perhaps it was never more strong. In point of scenery and decoration, our theatres are so amply provided, that they may rather seem to exceed than to fall short of what is required to form a classical exhibition.

Where then are we to look for that unfortunate counterbalance, which confessedly depresses the national drama, in despite of the advantages we have enumerated? We apprehend it will be found in the monopoly possessed by two large establishments, which, unhappily for the progress of national taste, and, it is said, without any equivalent advantage to the proprietors, now enjoy the exclusive privilege of dramatic representation. It must be distinctly understood, that we attribute these disadvantages to the *system* itself, and by no means charge them upon those who have the administration of either theatre. The proprietors have a right to enjoy what the law invests in them; and the managers have probably discharged their duty to the public as honourably as circumstances would admit of; but the system has led into errors which affect public taste, and even public morals. We shall briefly consider it as it influences, 1*st*, the mode of representation; 2*dly*, the theatrical authors and performers; and, 3*dly*, the quality and composition of the audience.

Drama.

Bad consequences of the monopoly possessed by the London theatres.

The *first* inconvenience arises from the great size of the theatres, which has rendered them unfit for the legitimate purposes of the drama. The persons of the performers are, in these huge circles, so much diminished, that nothing short of the mask and buskin could render them distinctly visible to the audience. Show and machinery have therefore usurped the place of tragic poetry; and the author is compelled to address himself to the eyes, not to the understanding or feelings, of the spectators. This is of itself a gross error. Every thing beyond correct costume and theatrical decorum is foreign to the legitimate purposes of the drama, as tending to divide the attention of the audience; and the rivalry of the scene-painter and the carpenter cannot be very flattering to any author or actor of genius. Besides, all attempts at decoration, beyond what the decorum of the piece requires, must end in paltry puppet-show exhibition. The talents of the scene-painter and mechanist cannot, owing to the very nature of the stage, make battles, sieges, &c. any thing but objects of ridicule. Thus we have enlarged our theatres, so as to destroy the effect of acting, without carrying to any perfection that of pantomime and dumb show.

Secondly, The monopoly of the two large theatres has operated unfavourably both upon theatrical writers and performers. The former have been in many instances, if not absolutely excluded from the scene, yet deterred from approaching it, in the same manner as men avoid attempting to pass through a narrow wicket, which is perpetually thronged by an importunate crowd. Allowing the managers of these two theatres, judging in the first and in the last resort, to be possessed of the full discrimination necessary to a task so difficult; supposing them to be at all times alike free from partiality and from prejudice; still the number of plays thrust upon their hands must prevent their doing equal justice to all, and must frequently deter a man of real talents, either from pride or modesty, from entering a competition clogged with delay, solicitation, and other circumstances, *haud subeunda ingenio suo*. It is unnecessary to add, that increasing the number of theatres, and diminishing their size, would naturally tend to excite a competition among the managers, whose interest it is to make experiments on the public taste; and that this would infallibly secure any piece of reasonable promise a fair opportunity of being represented. It is by such a competition that genius is discovered; it is thus that horticulturists raise whole beds of common flowers, for the chance of finding among them one of those rare varieties which are the boast of their art.

---

[1] This and other similar expressions, which now excite a melancholy interest, are suffered to remain, for the reason stated in the note, page 147.

The exclusive privilege of the regular London theatres is equally, or in a greater degree, detrimental to the performer; for it is with difficulty that he fights his way to a London engagement; and when once received, he is too often retained for the mere purpose of being laid aside, or *shelfed* as it is technically called; that is, rendered a weekly burden upon the pay-list of the theatre, without being produced above four or five times in the season to exhibit his talents. Into this system the managers are forced, from the necessity of their situation, which compels them to enlist in their service every performer who seems to possess buds of genius, although it ends in their being so crowded together that they have no room to blossom. In fact, many a man of talent thus brought from the active exercise of a profession, to be paid for remaining inactive in obscurity in London, and supported by what seems little short of eleemosynary bounty, either becomes careless of his business or disgusted with it; and, at any rate, stagnates in that mediocrity to which want of exercise alone will often condemn talent.

Thirdly, and especially, the magnitude of these theatres has occasioned them to be destined to company so scandalous, that persons not very nice in their taste of society must yet exclaim against the abuse as a national nuisance. We are aware of the impossibility of excluding a certain description of females from public places in a corrupt metropolis like London; but in theatres of moderate size, frequented by the better class, these unfortunate persons would feel themselves compelled to wear a mask at least of decency. In the present theatres of London, the best part of the house is openly and avowedly set off for their reception; and no part of it that is open to the public at large is free from their intrusion, or at least from the open display of the disgusting improprieties to which their neighbourhood gives rise. And these houses, raised at an immense expense, are so ingeniously misconstructed, that in the private boxes you see too little of the play, and in the public boxes greatly too much of a certain description of the company. No man of delicacy would wish the female part of his family to be exposed to such scenes; no man of sense would wish to put youth of the male sex in the way of such temptation. This evil, if not altogether arising from the large size of the theatres, has been so incalculably increased by it, that, unless in the case of strong attraction, prostitutes and their admirers usually form the principal part of the audience. We censure, and with justice, the corruption of morals in Paris. But in no public place in that metropolis is vice permitted to bear so open and audacious a front as in the theatres of London. Barefaced vice is never permitted to insult decency. Those who seek it must go to the haunts to which it is limited. In London, if we would enjoy our most classical public amusement, we are braved by her on the very threshold.

We notice these evils, without pretending to point out the remedy. If, however, it were possible so to arrange interests, that the patents of the present theatres should cover four, or even six, of smaller size, dedicated to the same purpose, we conceive that more good actors would be found, and more good plays written; and, as a necessary consequence, that good society would attend the theatre in sufficient numbers to enforce respect to decency. The access to the stage would be rendered easy to both authors and actors; and although this might give scope to some rant and false taste, it could not fail to call forth much excellence, that must otherwise remain latent or repressed. The theatres would be relieved of the heavy expense at present incurred, in paying performers who do not play; and in each maintaining three theatrical corps for the separate purposes of tragedy, comedy, and musical pieces; only one of which can be productive labourers on the same evening, though all must be supported and paid. According to our more thrifty plan, each of these companies would be earning at the same time the fruits of their professional industry. The hours of representation, in one or more of these theatres, might be rendered more convenient to those in high life, whilst the middling classes might enjoy a rational and classical entertainment after the business of the day.

Such an arrangement might indeed be objected to by those who entertain a holy horror of the very name of a theatre, and who imagine impiety and blasphemy are inseparable from the drama. We have no room left to argue with such persons, or we might endeavour to prove that the dramatic art is in itself as capable of being directed either to right or wrong purposes, as the art of printing. It is true, that even after a play has been formed upon the most virtuous model, the man who is engaged in the duties of religion will be better employed than he who is seated in a theatre, and listening to it. To those abstracted and enrapt spirits, who feel or suppose themselves capable of remaining constantly involved in heavenly thoughts, any sublunary amusement may justly seem frivolous. But the mass of mankind are not so framed. The Supreme Being, who claimed the seventh day as his own, allotted the other six days of the week for purposes merely human. When the necessity of daily labour is removed, and the call of social duty fulfilled, that of moderate and timely amusement claims its place, as a want inherent in our nature. To relieve this want, and fill up the mental vacancy, games are devised, books are written, music is composed, spectacles and plays are invented and exhibited. And if these last have a moral and virtuous tendency; if the sentiment expressed tend to rouse our love of what is noble, and our contempt of what is mean; if they unite hundreds in a sympathetic admiration of virtue, abhorrence of vice, or derision of folly; it will remain to be shown how far the spectator is more criminally engaged, than if he had passed the evening in the idle gossip of society, in the feverish pursuits of ambition, or in the unsated and insatiable struggle after gain—the graver employments of the present life, but equally unconnected with our existence hereafter. (W. S—TT.)

DRAMMEN, a seaport-town of Norway, stift of Aggerhuus, situated on both sides of the Drammen, near its mouth in the Christiania fiord, 24 miles S.W. of Christiania. It consists of three ports, Brognaes on the northern, and Stroemsoe and Tangen on the southern bank of the river. It is a place of extensive trade, and exports more timber (chiefly logs) than any other town in Norway. The chief manufactures are spirits, sailcloth, ropes, tobacco, leather, oil, and carriages. Pop. about 9000.

DRAN, Henri-François le, a celebrated French surgeon, born at Paris in 1685, was the son of a surgeon of the same name, who, while serving with the army, had been distinguished for practical dexterity in the treatment of gunshot wounds. Young Le Dran entered on the surgical career under the auspices and direction of his father, and early attained to eminence in his profession. He became surgeon-major and demonstrator of anatomy at La Charité, member of the royal academy of surgery, consulting surgeon of the camps and armies of the king, and associate of the Royal Society of London. Apart from his professional

Drawing.

pursuits, almost no particulars of his life have been preserved. He died at Paris on the 17th October 1770, at the advanced age of eighty-five. Le Dran was the author of a variety of works on surgery, of which we shall here subjoin a very brief account. 1. *Parallèle des différentes manières de tirer la Pierre hors de la Vessie*, Paris, 1730, 1740, 8vo, with plates; translated into German, Berlin, 1737, 8vo, and into English, London, 1738, 8vo. Le Dran, in this work, condemns the small, and shows himself a partizan of the large apparatus; recommending, however, that the incision should be made a little lower than Collot had been accustomed to make it, and that it should be of an extent sufficient to prevent the dilaceration of the bladder. He approves of the high operation only in the case where the bladder is sound and the calculus very voluminous. In order to obviate the too frequent lesion of the rectum in using the staff described by Albinus for the lateral operation of Rau, Le Dran invented a new staff, which enabled him to avoid such a casualty, and contributed materially to his success. 2. *Observations de Chirurgerie, auxquelles on a joint plusieurs Réflexions en faveur des Etudiants*, Paris, 1731, 2 vols. 12mo: translated into German, Nuremberg, 1738, 8vo, and into English, 1739, 8vo. This collection is rich in facts well chosen, and reported with candour and precision. The author does not dissemble his faults, and speaks of his success without ostentation. 3. *Traité des opérations de Chirurgerie*, Paris, 1731 and 1742, 8vo; London, 1749, 8vo, with additions by Cheselden. This work, in which the author ascribes an imaginary influence to the animal spirits, is nevertheless valuable, as containing an accurate description of a great number of operations, and many practical facts alike curious and interesting. If a new method is spoken of, he never fails to indicate the author of the discovery. 4. *Réflexions pratiques sur les plaies d'armes à feu*, Paris, 1737, 1740, 1759, 12mo; Amsterdam, 1745, 12mo: Nuremberg, in German, 1740, 8vo. To the excellent precepts of Ambroise Paré, the author has here added the fruits of his own experience; and he has contributed to check in some cases the use, then too exclusive, of the seton. He has also advocated the method of large incisions, and justly proscribed the application of sindons or pledgets of linen soaked with brandy, in the first dressing of gunshot wounds. 5. *Suite du Parallèle de la Taille*, Paris, 1756, 8vo. 6. *Consultations sur la plupart des Maladies qui sont du ressort de la Chirurgerie*, Paris, 1765, 8vo. 7. *Traité économique de l'Anatomie du corps humain*, Paris, 1768, 12mo. This work is full of superannuated hypotheses and material omissions. 8. *Récit d'une guérison singulière du plomb fondu dans la Vessie*, and *Lettre sur la dissolution du plomb dans cet organe*, Paris, 1749. Here Le Dran gives an account of his experiments for dissolving lead by means of mercury, and evinces great credulity in attributing to mercury certain imaginary qualities. Besides the works above enumerated, a great number of interesting observations by Le Dran may be found in the *Mémoires* of the Academy. (J. B—E.)

Drastic ‖ Drawing.

DRASTIC (δραστικός, from δράω, *to accomplish*), an epithet applied to medicines that are potent in operation; as a drastic cathartic.

DRAVE (German *Drau*), a river in the Austrian dominions, one of the principal affluents of the Danube. It rises on what is called the Toblachheath in the Pusterthal of Tyrol, not far from Innichen, and after a course of nearly 400 miles falls into the Danube some miles E. of Eszec. It flows at first E.N.E. to Linz, where it receives the Isel; thence its course is generally E.S.E. passing through Carinthia and Styria, and afterwards forming the boundary between Croatia and Sclavonia on the S. and Hungary on the N. The principal towns on its banks are Linz, Villach, Marburg, Pettau, and Fridau. Its principal affluents are, on the left, the Isel, Möll, Liser, Gurk, Lavant, and Mur; and on the right the Gail. Its course is rapid; and its bed, though rocky, is navigable for flat-bottomed boats to Villach.

DRAWBACK, in *Commerce*, a certain amount of duties or customs paid back or remitted to an importer of foreign goods on their exportation; or a certain amount of excise paid back or allowed on the exportation of some home manufactures. See COMMERCE.

DRAWING.

DRAWING is the art of representing forms upon a flat surface, by means of any sort of instruments, such as pencils, chalks, and the like. It is also a word used to denote the forms or contours of the figures in compositions, or in sculpture generally. Thus we say that the drawing in a picture, or the drawing of a statue, or any other figure, is of a high or an inferior kind, good or bad.

History.

This art is well known to be of the most remote antiquity, and it has been in use amongst the most barbarous and most civilized nations for a variety of purposes. The hieroglyphic figures, whether carved or painted, upon the ancient Egyptian obelisks and temples, the ornaments of the same description upon their buildings and sarcophagi, together with the like productions amongst the Mexicans, prove the ancient origin of the art. Some of the purest and best of the Egyptian sculptures, and particularly the figures of the harpers, described and illustrated by Bruce the traveller, exhibit a knowledge and correctness of taste in the art far surpassing what is usually admitted, and show that the Greek school in this, as well as in their other acquirements, was greatly indebted to the Egyptians for pointing out the road to that excellence of form and dignity of character and expression which their matchless works possess.

Greece and Rome.

Although examples of drawings by the Greeks have not come down to us, their magnificent statues assure us that their proficiency in the art must have been of the highest order; and certain expressions of Pliny, in describing their pictures, evidently indicate that the Greeks must have attained to the utmost excellence in drawing, at the period of their glory as a nation. It is not our intention to load this article with ancient historical information respecting the fine arts, otherwise many curious anecdotes might be introduced; but we cannot pass over the mention of Alexander's emotion on seeing a picture of Palamedes when betrayed by his friends, which forcibly reminded the hero of his own treatment of Aristonicus; nor can we refrain from noticing the picture of Agamemnon and Iphigenia by Timanthes, so highly extolled by Cicero, Quintilian, Valerius Maximus, and Pliny, as satisfactory proofs of the excellence of the ancients in drawing and painting, as well as in their sculptures and architecture. From the emotions which the higher excellencies of the pictures by the Greek artists produced in these gifted men, a fair inference may be drawn as to the perfection to which the art must have attained at the period of Grecian glory; and consequently drawing, even in the confined sense of the word, must have also been in a corresponding state of advancement. Their principal schools were at Sicyon, Rhodes, Athens, and Corinth; and when Greece was subdued by the Romans, the conquerors, alive to the benefits to be derived from the sciences and arts, encouraged the cultivation of them in their own capital, to which the

Greek artists resorted, and laid the foundation of the Roman school.

Revival of the fine arts.

From the conquests of Alaric and Attila in the fifth century, the arts lay prostrate and neglected, until their revival about the year 1450 at Florence, where Dominico Ghirlandaio, the master of Michel Angelo, practised painting with considerable reputation, which his pictures show he well merited.

Michel Angelo.

We have now arrived at the golden age of the arts amongst the moderns, for Michel Angelo must be admitted to have been the first to discover and practise them with the classical discernment and skill which ultimately led him to the highest eminence amongst his contemporaries as a painter, a sculptor, an architect, and engineer, and deservedly placed his reputation on a level with the greatest names of antiquity. Till his time painters were considered, as mere mechanics or labourers, and their employment was almost entirely confined to making representations of saints, and other figures used by the superstitious of the age. It was at this period, and surrounded by the wretched examples of such artists as Cimabue, Giotto, and others, that Michel Angelo, upon examining the torso of the Belvidere, instantly abandoned the barbarous taste and style of his master, and bounded into that sublime path which has been the admiration of all. "The poetry of the art," says Sir Joshua Reynolds, "he possessed in the most eminent degree; and the same daring spirit which first urged him to explore the unknown regions of the imagination, impelled him forward in his career beyond those limits which his followers, destitute of the same incentives, had not strength to pass. He was the bright luminary from whom painting has borrowed a new lustre, under whose hands it assumed a new appearance, and became another and superior art."

Raffaelle Santio.

Raffaelle Santio, the pupil of Pietro Perugino, was born on Good Friday in the year 1483, and died on Good Friday in the year 1520, so that he only lived thirty-seven years. He must be admitted to have surpassed all the moderns in drawing and painting, though his design does not possess those sublime conceptions to be found in the works of his rival Michel Angelo. Generally speaking, the choice of his subjects is simple and pleasing, for he cared not to grapple with those severe attitudes and expressions to be found in the works of his gifted contemporary; but his compositions are invariably correct and harmonious, and his drawing careful, elegant, and pure. It is to his school that we would recommend the student to look for those examples which will be of the greatest practical benefit to him in drawing; a circumstance which ought to be his first and principal aim.

It is not the proper place here to enter into the history of painting in Italy after its revival by the two great masters whose names and characteristic excellencies we have just mentioned. This we reserve for the article PAINTING; and we now proceed to explain the practical details of the management and manipulation of drawing in its various styles.

Drawing, as we have already stated, is that part of the art which represents the forms of objects upon a flat surface, and may be divided into outlining and shading; and as the chief attributes of almost all objects are embraced in the correctness of their forms, the student of art should labour with the utmost pains and assiduity in order to acquire severe accuracy in his outline, without which the most dexterous shading and finishing will be worse than thrown away.

In whatever department the genius of the student may lead him to practise, habits of correctness will be most successfully cultivated by drawing the human figure, the knowledge of which is the basis of all true excellence. The study ought to be begun by copying the most simple parts, such as we have exhibited in Plates CCVII., CCVIII., CCIX., CCX.; and the greatest anxiety to attain accuracy in the gentle undulations of form ought to be evinced. We would recommend that perspective should be studied at the earliest stage of the pupil's practice. By means of a knowledge of its rules, which are simple, much time will be spared to the student, and excellence more speedily acquired than when directed only by his eye in the practice of drawing, whatever the object may be.

Drawing in chalk.

Although it matters little what the instrument may be which is used in the practice of drawing, yet, upon the whole, we would recommend black and white chalks as the most to be preferred. They are easily procured, and convenient for use. They are usually fixed in an instrument of brass or steel, as represented below, the white chalk being placed at the one end, and the black at the other.

The paper should be slightly tinged with colour, so that the white chalk which is put upon the lights may tell properly. Crayon paper is the best. The outline being carefully made, first with charcoal as slightly as possible, and then corrected and smoothed with the black chalk, the shading may be executed as the taste of the student inclines. It may either be done with careful hatchings at particular angles, or in one solid smooth mass, or by a combination of both, which is probably the most advisable mode of practice. Too much attention to elaborate hatchings may divert the attention of the student from the more essential excellencies of the outline, and proper balance of light and shade; and a too careless manner in using his materials may lead to equal disadvantages, for in art, as in every thing else, carelessness in the beginning can never lead to excellence in the end. Much time in laying in the shadows may be spared by using an instrument called a stump, made of a piece of chamois leather rolled up in a cylindrical form, in a tight manner, tied round with thread, and shaped to a blunt point, as represented below.

A little chalk-powder may be dusted upon the shadow if extensive, and rubbed in with the instrument above described, and afterwards the part finished up with the chalk. The white chalk should not be used until the drawing is completed with the black, otherwise it is apt to get injured by admixture, which in no instance should be the case, for there ought always to be a space between the two chalks occupied by the tint of the paper.

The black chalk will be found to work very well upon white as well as coloured paper; but the process is more tedious, in consequence of all the middle or light tints having to be attended to and executed, which, in the case of the other paper, the tint produces. Errors in outline or shading may be rectified by rubbing out the defect with a piece of bread squeezed into a convenient shape between the finger and thumb.

After the student has acquired some degree of proficiency in using the chalk, and imitating any drawing or print which may be given him, he should next begin to copy from real substances, or what is technically termed drawing from "the round."

Here a wide field is opened up to him in the study of

Drawing.

the antique statues; and while striving to attain accuracy in copying these noble reliques of art, he should consider deeply their high character and expression. It is not to be expected that a very extensive set of examples of the antique, or a discussion and detail of their merits, can be given here; all that we can do is to lead the student to the proper source whence he may draw supplies; and with this view we would recommend him to peruse and contemplate the statues of the Apollo Belvidere, the Venus de' Medici, the Gladiator Borghese, the Torso of the Belvidere, and the matchless group of the Laocoon, at the time he is copying them in the way of practice. See Plates CCXI., CCXII., CCXIII., CCXIV., CCXV

Red chalk.

We have hitherto only considered the drawing of the human figure, and that in black and white chalks. Another very good way of producing a spirited effect is, by a union of both these with red chalk, a method much practised by the old masters in their academy figures, &c.

Measurement of the human figure.

The following are the measures of the human body, as taken by Fresnoy from the ancient statues. The ancients have commonly allowed eight heads to their figures, though some of them have allowed but seven. The figure is ordinarily divided into ten faces; that is to say, from the crown of the head to the sole of the foot, in the following manner:

From the crown of the head to the forehead is the third part of a face.

The face begins at the root of the lowest hairs which are upon the forehead, and ends at the bottom of the chin.

The face is divided into three proportionable parts, the first contains the forehead, the second the nose, and the third the mouth and the chin; from the chin to the pit betwixt the collar-bones is two lengths of a nose.

From the pit betwixt the collar-bones to the bottom of the breast one face.

From the bottom of the breast to the navel one face.

From the navel to the genitories one face.

From the genitories to the upper part of the knee two faces.

The knee contains half a face.

From the lower part of the knee to the ankle two faces.

From the ankle to the sole of the foot half a face.

A man, when his arms are stretched out, is from the longest finger of his right hand to the longest finger of his left, as broad as he is long.

From one side of the breast to the other, two faces.

The bone of the arm, called humerus, is the length of two faces from the shoulder to the elbow.

From the end of the elbow to the root of the little finger, the bone called cubitus, with part of the hand, contains two faces.

From the box of the shoulder-blade to the pit betwixt the collar-bones, one face.

If you would be satisfied in the measure of breadth from the extremity of one finger to the other, so that this breadth should be equal to the length of the body, you must observe that the boxes of the elbows with the humerus, and of the humerus with the shoulder-blade, bear the proportion of half a face when the arms are stretched out.

The sole of the foot is the sixth part of the figure.

The hand is the length of a face.

The thumb contains a nose.

The inside of the arm, where the muscle disappears which makes the breast (called the pectoral muscle), to the middle of the arm, four noses.

From the middle of the arm to the beginning of the head five noses.

The longest toe is a nose long.

The utmost parts of the teats and the pit betwixt the collar-bones of a woman make an equilateral triangle.

For the breadth of the limbs no precise measures can be given, because the measures themselves are changeable, according to the quality of the persons, and according to the movement of the muscles.

The best example of the measures of an ancient statue are by Audran, an author whom Sir Joshua Reynolds recommends as being the most useful; and on this department of our subject we now add the following table of the measurements and comparisons of the three celebrated statues of the Apollo, the Venus, and the Hercules, as published by Volpato and Morghen at Rome, in a work called *Il Principi del Disegno.* To preserve uniformity in the measurements, the head of each figure is divided into twelve parts, and each part into six minutes.

	Apollo.		Venus.		Hercules.	
	Parts.	Min.	Parts.	Min.	Parts.	Min.
From the beginning of the head to the root of the hairs	3	0	3	0	3	0
From the root of the hairs to the eyebrows, or beginning of the nose	3	0	3	0	3	0
From the eyebrows to the end of the nose	3	0	3	0	3	0
From the end of the nose to the bottom of the chin	3	0	3	0	3	0
From the chin to the articulation of the clavicle with the sternum	5	1	4	3½	6	0
From the clavicle to the end of the breast	9	3½	10	5	9	4
From the end of the breast to the middle of the umbilicus	10	5½	8	2	10	4
From the umbilicus to the symphysis pubis	7	4½	11	4½	8	2
From the symphysis pubis to the middle of the patella	24	0	18	2	23	3
From the middle of the patella to the beginning of the flank	28	2	27	3	30	1½
From the same to the swell of the foot	23	3½				
From the swell of the foot to the end of the figure, or to the ground	4	4				
From the patella to the ground			25	3		
From the patella to the end of the heel of the right leg					29	2½
The length of the sole of the foot	14	1½				
The highest part of the foot from the ground			3	5½	6	1½
From the instep to the end of the toes			9	0½	10	1½
From the clavicle or collar-bone to the beginning of the deltoid muscle	9	0	6	3		
The length of the whole clavicle on the right side					14	1
From the clavicle to the nipple	10	4½	6	0½	10	4
From one end of the breasts to the other	15	0	11	2	15	1½
The greatest breadth of the trunk, taken a little below the beginning of the thorax	18	3			22	4

	Apollo.		Venus.		Hercules.	
	Parts.	Min.	Parts.	Min.	Parts.	Min.
The breadth of the trunk from the end of the breast			15	4½		
The narrowest part of the same, taken at the beginning of the flank	15	3	15	1	19	3½
The greatest breadth of the ossa ilei, where the flanks project most	16	4	17	5	21	1½
From the highest part of the deltoid muscle to the end of the biceps	17	0½				
From the beginning of the os humeri to the cubit			20	2	22	1½
From the end of the biceps to the beginning of the hand	16	0	14	0	15	1½
The greatest breadth of the fore-arm in front	4	5	5	0	8	2
The greatest breadth of the arm in front	5	3	4	5	6	1
Breadth of the pulse of the arm in front					5	1
The greatest breadth from one trochanter to the other	17	5	19	3	22	0
The greatest breadth of the thigh in front	9	2½	9	5		
The greatest breadth of the left thigh					11	0½
The greatest breadth of the knee opposite the middle of the patella	5	3½	5	0	6	4
The greatest breadth of the calf of the leg	6	3½	6	3½	7	5½
The greatest breadth between the inner and outer ankle	4	0½	4	0	4	3
The narrowest part of the foot	3	3	3	3	3	5
The broadest part of the same	5	0	5	1	6	4½
From the last vertebra of the neck to the lower part of the os sacrum					38	4
From the end of the os sacrum to the end of the glutæus					6	4
From the end of the glutæus to the beginning of the gastrocnemius muscle					15	4
From the beginning of the gastrocnemius to the end of the figure					30	1

In the foregoing table, we by no means have set down the ancient formula as an infallible guide, since the changes which the human form undergoes from infancy to old age preclude the possibility of limiting its measurements to definite proportions, and much depends upon the order or rank of the figure to be represented. Thus the Apollo Belvidere and the Venus de' Medici have more than ten faces in their length; and in other respects these figures, which by their authors were intended to represent divinities, are considerably different in their proportions from others of the antique statues. It is enough if something approximating to accuracy of measurement be kept in view when the student is engaged in making his drawing; and this he should do without the use of compasses or any other mathematical means, which ultimately cramp his powers of imitation, and retard his progress towards perfection.

Light and shade, or chiar' oscuro.

Light and shade are the means by which the actual appearance of substance in the object represented is conveyed, and they should be studied with every attention, from the objects themselves which are assumed as the models for imitation. No rules can be laid down so good as the study of nature herself, and no language can explain the beauties of her varied appearances of lights, shadows, or reflections.

It is by means of light and shade also that the figures in a picture or composition are made to keep their proper places: thus the principal figure is generally illuminated with the strongest and broadest light, and the others kept subordinate. It is with considerable diffidence, however, that we state this as the practice most to be approved of: every artist, and indeed every school, has a peculiar mode of management in this, and we are aware that a different practice has often produced excellent results.

The general rule with regard to the relative proportions of light, shadow, and middle tint in a well-ordered effect is, that there should be rather more shadow than light, and more middle tint than either of the former, provided the subject does not require a different arrangement. In the infinite variety of forms of composition of the various schools, rules for the attainment of excellence can hardly be laid down with safety; and we must on this account refer the student to the contemplation of the works of the most esteemed masters, for examples to direct him in the practice of the chiar' oscuro of his pictures.

The study of anatomy is of the utmost importance towards a correct knowledge of the human figure, and is most beneficial in leading the way to an accurate representation of its various parts and attitudes. Without it no proper estimate can be formed of the movements of the joints of the limbs, nor of the swellings and undulations of the muscles, which, when in action, are constantly varying, and must be seized at the moment. It was by the careful study of this branch of science that Michel Angelo, Leonardo da Vinci, and other eminent artists, attained to such excellence in representing the forms when engaged in action, and displayed that accuracy of outline and show of energy which appear in the various members of their figures.

Drawing in Indian ink, sepia, bistre, &c.

The most necessary preparation for all drawings executed with Indian ink, sepia, bistre, or the like, is an accurate outline, which should be made with a black-lead pencil, or pen and ink if the work is only meant to be finished in a sketchy manner. Care must be taken in both to regulate the strength of the touch or line by the nearness or distance of the object represented. The shades should be laid in a good deal lighter at first than they are intended to be when the drawing is finished, and the hard edges of the touches softened with a water brush. The greater the attention paid to the subject as a whole in this stage, and the broader and less minute the washes are laid on, the better; for it is only as the drawing advances towards completion that the minutiæ should be attended to. In Pl. CCXVIII. we have given an example of the method of proceeding with a drawing washed in with one colour only. Fig. 1 exhibits the outline; fig. 2 the first broad wash; fig. 3 the second working; and fig. 4 the finished drawing. Each shading should be allowed to dry thoroughly before the succeeding wash is laid on; and there are many modes, we had almost said tricks, by which certain excellent effects are produced, which are only to be acquired by practice. Thus the use of a sharp pointed penknife will be found most serviceable in taking out irregularly-formed lights in the foreground; and much advantage will be found in wiping out lights and middle tints with a towel or handkerchief during the progress of the work; but regarding these no rules can be laid down. The artist must use his own discretion; though too much of such practice is not to be recommended.

The study of landscape ought to be commenced by imitating the most simple forms, as in the following figures.

Fig. 1.

Fig. 2.

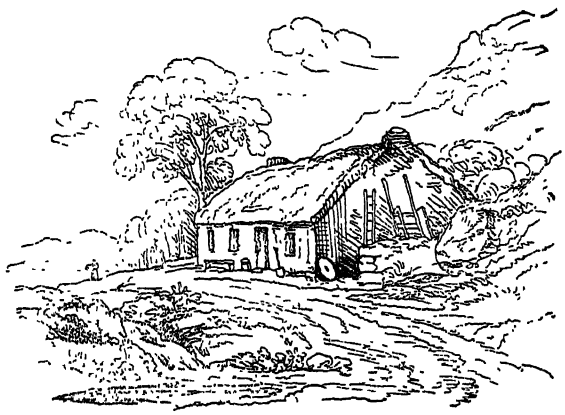


Fig. 3.

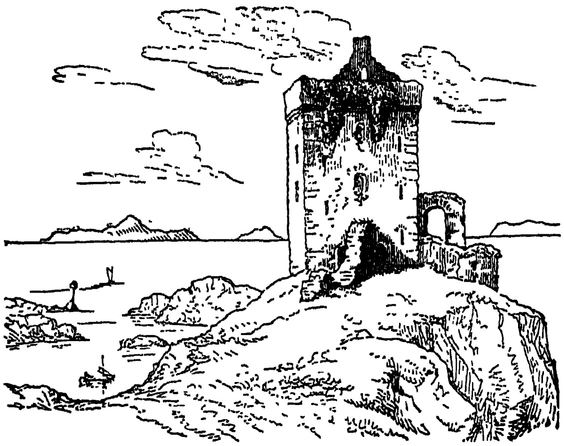
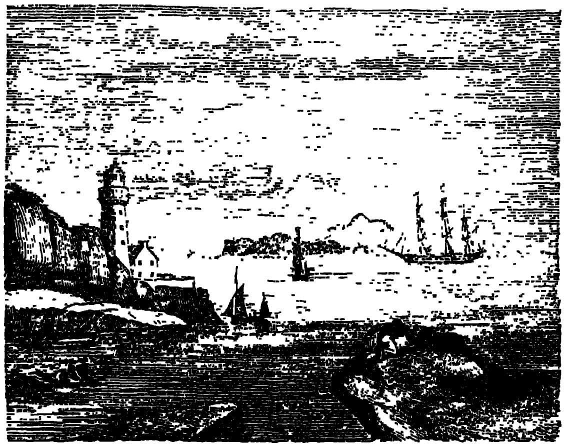


Fig. 4.



These or similar figures may be copied two or three times over before attempting such a work as we have given in Plate CCXVIII. Plate CCXVII. exhibits two examples of the style of sketching landscape by Claude; and we strongly recommend Turner's *Liber Studiorum* to the careful perusal of the young artist in this department. The studies of the human figure by Raffaelle, Parmegiano, and others, or their imitations by Rodgers, are the best. (Plate CCXVI.)

Drawing in water colours.

There is no branch of the art in which such a variety of means may be adopted for attaining the same end, namely, the imitation of nature, as in water-colour drawing; consequently we shall not attempt to lay down particular rules for the guidance of the student. Practice, as we have already stated, is the only means of arriving at the wished-for perfection; we shall therefore limit our notice to a few of the details most in use among painters in water colours.

The substances used in painting in water colours are to be had in all the shops in prepared or moist cakes, which are mixed with a little water on a stoneware pallet or plate.

Paper.

The paper upon which the drawing is to be made may be either smooth or rough; and if greasy on the surface, so that the colours do not adhere pleasantly, it may be sponged over, or the colours may be mixed with a little ox-gall,

Ox gall.

either in its native or prepared state. One drop of gall in the former condition, or the size of a large pin head in the latter, will be enough to saturate a tea-cupful of water for the purpose of mixing with or softening off the colours.

Colours.

The paints chiefly used are ultra-marine blue, indigo, Antwerp and cobalt blues, gamboge, ochre, Indian, and crome yellows, Indian red, vermilion, lake, carmine, burnt ochre, and brown pink reds; and although these may be denominated the primaries out of which all other modifications of tints can be made up, yet we may add to them a number of browns which will be found to be serviceable, such as terra di sienna, both raw and burnt, Vandyke brown, umber, sepia, &c.

Pasting the paper on the board or frame.

The paper ought to be stretched upon a drawing board or frame, which is effected by soaking it in water, or by sponging it over on both sides, then removing the superabundant water with a piece of blotting paper or towel, and afterwards folding back the edge for about an inch all round, and applying the paste to the folded portion, and also to that part of the drawing board which the paper is to adhere to. The part so pasted should be pressed strongly, or the finger may be dipped into the paste and rubbed upon the pasted edge, and then the paper sponged all over, that the pasted edge may be permitted to dry more quickly than the centre part. Care must be taken not to let any of the paste touch the middle of the paper, which would destroy the drawing when cut from the board.

Whatever may be the subject, it will be advisable to begin with light colour, and gradually work up both effect of light and shadow, and strength of tint, in a broad manner, without much attention to minutiæ, as already described in Indian ink drawing. The earlier water-colour painters were in the practice of working with a gray or neutral tint at the commencement of their drawings; and as this method is very simple, it will be the best for beginners, though in the end there will not be produced that richness of effect, and freshness, depth, and warmth of colour, which is the result of the contrary practice of the best masters of the present day; we mean the laying on of the colours almost at once, without any under preparation of neutral tint. In landscape painting, the paper where the

Sky.

sky is represented ought to be well soaked with water from a sponge, and afterwards dried moderately with a towel or piece of bibulous paper, to make the tints lie on

more solidly. The tints are then to be blended into each other while the surface is damp, and this should be done with large brushes. After the sky and distance are laid in, the middle and foregrounds should be added, in all cases keeping the brushes well filled with colour, and the details worked out as the taste or ability of the artist may lead him, for it is impossible to prescribe rules where no two artists follow the same practice.

Fore-ground.

Ultra-marine.

The appearance of air may be given to the distance by washes of blues or neutral tints; and the spaces where sharp distinct lights are situated may be scraped out with a pen-knife, or the touches may be laid in with clean water, and after being allowed to remain upon the paper for a minute or less, they may be rubbed out with a piece of stale bread. Another mode of leaving out the lights is to touch the places with pipe-clay, used in a liquid state, with a camel's-hair pencil, and afterwards the colour may be freely laid over them; the parts where the clay is laid have then only to be rubbed with bread or Indian rubber, to remove the tint, and expose the clean paper. Should any error, either in outline or effect of chiar' oscuro, have been committed, the whole space can be removed with a sponge and water, without much injury to the paper; indeed many of the best artists of the present day rub out and lay in their colours almost alternately, by which means a very great variety of surface and tint is obtained which could not be effected by any other process.

Removing of errors.

We have thus endeavoured to give what we hope will be found a satisfactory account of practical drawing, whether in chalk or water colour; and it now remains for us to recommend, for the student's careful perusal, Leonardo da Vinci *on Painting;* the works of Sir Joshua Reynolds; Burnet *on Light and Shadow in Painting, on Colour in Painting, on Composition in Painting;* the works of the old masters, whether their drawings or etchings; and, above all, the study of nature. Every one who has long been in the habit of copying from drawings alone, of whatever description, must have felt considerable diffidence in attempting to draw from real objects or from nature. This arises from the fear of being unable properly to reduce and hold in their relative place, on a sheet of paper, the objects which present themselves to the eye. To remove this obstacle, we would recommend that too much should not be attempted at the first, but the most simple subjects chosen, and these represented in a careful manner; the outline on the light side of the objects to be done in a delicate manner, and that on the shadow side in a bold style, and the shading to be also conducting upon similar principles. The most careful attention to representing the various forms should be practised in the outline, for on the accuracy of it depends the balance or fitness of the whole design or picture. By thus habituating the eye to a correct delineation of the parts, it has little difficulty in coming at the power of representing the general effect and appearance of the whole; and thus a picture, whether consisting of figures, rocks, trees, or marine objects, is managed with comparative ease; while, on the other hand, when a design has been commenced without due attention to the outline and balance of the objects, a loose and disjointed performance is produced.

Drawing from nature.

Many other difficulties present themselves at first to the anxious student, and not the most unimportant is the feeling which seizes him upon the contemplation of works of excellence when seen in a finished form; but let him not despond, for much pains have been used, and great and palpable errors committed, even by the most accomplished masters, in the details of their works, which, the more accurate they are, the greater has been the difficulty encountered. As an illustration of this, we have thought it proper to direct attention to the variety of lines used to represent the objects of Plate XIV., taken from a sketch by Raffaelle. The subject is the study for a portion of the picture of the School of Athens, and contains much valuable information to the learner respecting the progress of this great master in the management of his compositions, of one of the most important of which this is the first rough sketch.

Description of the Plates.

Plate V. Initiatory lessons for drawing the various parts of the face. Figs. 1, 2, 3, represent the human eye in a variety of positions. Figs. 4 and 5, the nose. Figs. 6, 7, 8, the nose and mouth.

Plate VI. Second lesson. Figs. 1 and 2, the ear. Figs. 3, 4, 5, studies of heads.

Plate VII. Plate of male and female hands in a variety of positions as represented in figures 1 to 11.

Plate VIII. contains eight figures or studies of the human foot.

Plate IX. Studies from the antique. Fig. 1, Thalia; fig. 2, Clio; both examples of sitting figures. Fig. 3, Bacchus. Fig. 4, Venus of Arles. Fig. 5, a Discobolus.

Plate X. Studies from the antique. Fig. 1, Hercules and Telephus. Fig. 2, the Torso of Michel Angelo. Fig. 3, Jason. Fig. 4, the Dying Gladiator.

Plate XI. Studies from the antique. Fig. 1, Venus de Medicis Fig. 2, Venus of the Capitol.

Plate XII. Study from the antique. Fig. 1, the Apollo Belvidere.

Plate XIII. Study from the antique. Fig. 1, Group of the Laocoon.

Plate XIV. Specimen of sketching by Raffaelle.

Plate XV. Specimens of sketching by Claude Lorraine.

Plate XVI. Example of the mode of conducting a drawing in Indian ink, bistre, sepia, &c., from outline to finished performance. (W. H. L.)

DRAY (Lat. *traha, a sledge*), a kind of cart used by brewers for carrying barrels of beer or ale: also a sledge.

DRAYTON, MICHAEL, a celebrated English poet, was born at Harshull in Warwick in 1563. The events of Drayton's life are involved in great obscurity. It is believed that he went to Oxford, which he quitted without taking his degree, and that he afterwards entered the army. In 1593 he published his first work, under the title of *The Shepherd's Garland*, a collection of pastoral poems, in a style which was then becoming highly popular in England. As a whole, this work was utterly unworthy of its author's powers, and it is now almost entirely forgotten, with the exception of the ballad of *Dowsabel*, which Percy incorporated in his *Reliques*. The *Shepherd's Garland* was reprinted in 1619, under the title of *Eclogues*. To the historical poetry of his era Drayton made two valuable contributions in his *Barons' Wars*, and *England's Heroical Epistles*, works in themselves highly interesting, and in many passages both touching and imaginative, though neither of them exhibits a just conception of the poet's privilege of idealizing the actual. Drayton's fame as a poet, however, rests on his *Polyolbion*, the greatest of his works. The general outline of this composition is descriptive, though it partakes largely of the nature of didactic, historical, and pastoral poetry. The thinly disguised design of the author is to furnish a topographical description of England; a purpose so dangerously prosaic, that his greatest work, though redeemed by many passages of fine fancy and sentiment, as well as splendid diction, has hardly ever perhaps been read through from beginning to end. The immense length of the poem, as well as its occasional obscurity and cumbrousness, have likewise greatly interfered with its popularity. The measure which Drayton adopted for the *Polyolbion* is the Alexandrine, which has rarely been managed with greater skill. The *Barons' Wars* again are written in the *Ottava rima*. Drayton's little fairy tale, entitled *Nymphidia*, is a composition which, in its peculiar vein, has never been surpassed.

After the publication of the *Polyolbion*, the only event

of importance in the life of Drayton was his appointment to the office of poet laureate. He died in 1631, and his tomb may still be seen in the Poet's Corner of Westminster Abbey.

DREAMS are those thoughts which pass through the mind, and those imaginary transactions in which we often fancy ourselves engaged, when in the state of sleep. Of all the subjects upon which the mind of man has speculated, there is perhaps none which has more perplexed philosophers than that of dreaming.

In regard to the immediate cause of dreaming, the opinions of the ancients were very various. Aristotle observes —Every object of sense produces upon the human soul a certain impression, which remains for some time after the object that made it is removed; and which, being afterwards recognised by the perceptive faculty in sleep, gives rise to the varied images which present themselves.

Amongst English writers on this subject, none have written with more acuteness in support of his theory than Baxter. He supposes that our dreams are prompted by *separate spirits*—an opinion generally entertained by the heathen, and which opinion has given rise, in all ages and in all countries, to endless superstition and imposture—(*Essay on the Phenomenon of Dreaming*, vol. ii., 3d edit., 1745).

Professor Dugald Stewart, in endeavouring to reduce the phenomenon of dreaming to *some established principles*, remarks, that in sleep those operations of the mind are suspended which depend on our *volition*. He then says that, if the suspension of our voluntary operations in sleep be admitted as a fact, there are only two suppositions which can be advanced concerning its cause;—the one is, that the power of volition is suspended; the other, that the will loses its influence over those faculties of the mind and those members of the body which, during our waking hours, are subjected to its authority. Now it may be shown that the former is not consistent with fact, whence the latter follows as a necessary consequence. Hence it is inferred that all our mental operations which are independent of our *will* may continue during sleep; and that the phenomenon of dreaming may, perhaps, be produced by these, diversified in their apparent effects in consequence of the suspension of our voluntary powers. Two obvious consequences follow:—1st, That when we are asleep, the succession of our thoughts, in so far as it depends on the association, may be carried on by the operation of the same unknown causes by which it is produced while we are awake; and, 2d, That the order of our thoughts in these two states of our minds must be very different, inasmuch as in the one it depends solely on the laws of association, and in the other on those laws combined with our own voluntary exertions.

If, then, the succession of our thoughts during sleep is regulated by the same general laws of association to which it is subjected while we are awake, and if the circumstances which discriminate dreaming from our waking thoughts are such as must necessarily arise from the suspension of the *will*, this may account for the inaccurate estimate we form of *time* when dreaming: the rapidity of thought is such that in the twinkling of an eye a crowd of ideas may pass before us, to which it would take a long discourse to give utterance; and transactions may be conceived which it would require days, or even years, to realize. But in sleep the conceptions of the mind are mistaken for realities, and therefore our estimate of time will be found not according to our experience of the rapidity of thought, but according to our experience of the time requisite for realizing what we conçeive.—(Stewart's *Elements of the Philosophy of the Human Mind*, pp. 328–348.)

There seems a strong analogy between dreaming and insanity. Dr Abercrombie defines the difference between the two states to be, that in the latter the erroneous impression, being permanent, affects the conduct; whereas, in dreaming, no influence on the conduct is produced, because the vision is dissipated on awaking.

Dreams appear to be ordinarily the re-embodiment of thoughts which have before, in some shape or other, occupied the mind. They are broken fragments of our former conceptions revived, and heterogeneously brought together. If they break off from their connecting chain, and become loosely associated, they exhibit ofttimes absurd combinations, but the *elements still subsist*. If, for instance, any irritation, such as pain, fever, &c., should excite the *perceptive* organs while the reflective ones are under the influence of sleep, we have a consciousness of objects, colours, or sounds being presented to us, just as if the former organs were actually stimulated by having such impressions communicated to them by the external senses; whilst, in consequence of the repose of the reflecting power, we are unable to rectify the illusion, and conceive that the scenes passing before us, or the sounds that we hear, have a real existence. This want of mutual co-operation between the different faculties of the mind may account for the *disjointed* character of dreams. This position might be fully substantiated by an appeal to the evidence of fact. Dr Beattie speaks of a man who could be made to dream anything by whispering in his ear. Dr Gregory relates of himself that, having once had occasion to apply a bottle of hot water to his own feet when he retired to bed, he dreamed that he was ascending the side of Mount Ætna, and that he found the heat of the ground almost insufferable. Persons who have had a blister applied to their head have been known to dream of being scalped by a party of North American Indians. Sleeping in a smoky room, we may dream of a house or a city being in flames. The smell of a flower applied to the nostrils may call forth the idea of walking in a garden; and the sound of a flute may excite in us the most pleasurable associations.

The only one of our mental powers which is not diminished while dreaming is fancy, or imagination. We often find *memory* and *judgment* alternately suspended and exercised. Sometimes we fancy ourselves contemporaneous with persons who have lived ages before: here memory is at work, but judgment is set aside. We dream of carrying on a very connected discourse with a deceased friend, and are not conscious that he is no more: here judgment is awake, but memory suspended.

How God revealed himself by dreams, and raised up persons to interpret them, the Scriptures abundantly testify. That divine dreams, which actually were imparted to God's servants, should be imitated in fictitious representation by ancient and modern writers, was consistent no less with the general objects of superstition and imposture than with those of literature. Hence divine dreams became the constant appendages of the heathen mythology, and accounts, real and fictitious, of communications in vision, were interwoven in every production. Information which was superior to the vulgar philosophy of the time, intimated its discoveries as suggestions imparted by *inspiration*. If a warning was to be conveyed, what so affecting as the admonition of a departed friend! Such machinery was particularly adapted to works of imagination; and the poems of antiquity, as well as those of modern times, were frequently decorated with its ornaments.

DREDGING. See NAVIGATION, *Inland*.

DRELINCOURT, CHARLES, an eminent Calvinistic divine, was born in July 1595 at Sédan, where his father was register to the supreme council. After officiating for some time as Protestant pastor at Langres, he removed in 1620 to Paris, where he was settled in the church of Charenton. He is best known in England by his *Catechism* and *Consolations against the Fears of Death*, works which have been translated and frequently reprinted. His controversial works, which are directed chiefly against the claims of the Papacy, are numerous, and include the *Ju-*

bilee, the *Roman Combat*, the *Jesuit's Owl*, an *Answer to Father Coussin*, *Disputes with the Bishop of Bellai*, an *Answer to Lamilletière*, *Dialogues against the Missionaries*, the *False Pastor convicted*, the *False Face of Antiquity*, the *Pretended Nullities of the Reformation*, an *Answer to Prince Ernest of Hesse*, an *Answer to the Speech of the Archbishop of Sens*, *Defence of Calvin*, the *Abridgment of Controversies*, and other works. He married the daughter of a rich merchant at Paris, by whom he had sixteen children. His third son, professor of physic at Leyden, was physician to the prince and princess of Orange before their accession to the crown of England. Drelincourt died in November 1660.

DRENTHE, a province of Holland, bounded on the N. and N.E. by Groningen, E. and S.E. by Hanover, S. by Overyssel, and W. by Friesland. Area 1028 square miles. Pop. (1853) 87,944. The soil is generally poor, a great part of it being heaths and marshes; and in fact little more than one-half of the entire province is capable of cultivation. The capital is Assen, with about 4500 inhabitants.

DRESDEN, the capital of the kingdom of Saxony, and one of the finest cities of Europe, is situated on both sides of the Elbe, at an altitude of 402 feet above the level of the sea, 72 miles E.S.E. of Leipzig, and 100 S.S.E. of Berlin. Lat. 51. 2. 54. N., Long. 13. 44. 47. E. It occupies the most beautiful and highly cultivated portion of the valley of the Elbe, and is approached on almost every side through avenues of trees, while the distance is bounded by gentle eminences covered with plantations and vineyards. Its delightful situation, and the numerous objects of interest which it contains, have not undeservedly acquired for it the designation of the "German Florence." The city itself, however, when examined in detail, will in some measure disappoint the anticipations formed of it when seen from a distance, there being a want of fine streets and imposing public buildings. On the left bank of the Elbe stand the Altstadt or old town, Friedrichstadt, and several suburbs which constitute the larger portion of the city, while on the opposite bank is the Neustadt or new town. The Weisseritz, a small affluent of the Elbe, separates Friedrichstadt from the Altstadt. The streets of the Altstadt are narrow and the houses lofty, which give to this part of the town a gloomy appearance; in the Neustadt the streets are wide and regular, and the houses well built. The Elbe is here crossed by two bridges, the one an elegant stone bridge of sixteen arches, 1380 feet in length and 42 in breadth: the other, forming a portion of the line of railway leading from Leipzig through Dresden to Prague, is a still finer bridge, 1420 feet in length, 54 feet wide, and 40 feet above the river, having, besides two lines of railway, a carriage way and two foot ways. The Altstadt was formerly surrounded with fortifications, but these were demolished by the French in 1810, and the space occupied by them has been appropriated to gardens and promenades. The Royal Palace is an irregular antique building, having externally the appearance of a fortress rather than of a royal residence; but the interior is richly decorated, and in every way worthy of its destination. It contains the proposition-saal in which the sessions of the legislature are opened, the royal library, the hall of audience with a splendid ceiling painted by Sylvester, the parade chamber with paintings by the same master, the royal audience chamber, the chamber of ceremonies, and the porcelain cabinet, the walls of which are ornamented with porcelain. Opening upon the palace-yard is the celebrated Green Vault (Grüne Gewölbe), so called probably from the colour of the hangings with which the chambers were originally decorated, and containing an immense collection of precious stones, pearls, and works of art in gold, silver, amber, and ivory. These are arranged in eight apartments, each exceeding the previous one in the splendour and richness of its contents, and are estimated at above a million sterling in value. Near the palace, and communicating with it, is the celebrated gallery of paintings, the finest collection north of the Alps, containing numerous specimens of the Italian, French, Flemish, Dutch, German, and modern schools, including Raphael's Madonna di San Sisto, six paintings by Correggio, several by Titian, Paul Veronese, Caracci, Guido, Rubens, Vandyck, Teniers, Holbein the younger, Rembrandt, Claude, &c. Beneath the picture gallery is a fine collection of plaster casts of the most famous antique statues, made under the superintendence of the celebrated artist Raphael Mengs. A new picture gallery has been in progress since 1846, and will be opened in 1854-55. The Zwinger, a fine group of buildings surrounding an inclosure planted with orange trees, was erected in 1711, and originally intended to form the vestibule to a new palace designed by Augustus II. It contains the historical museum, museum of natural history, and cabinet of prints and drawings. The S.E. angle was burned down during the revolt of May 1849, and still remains a ruin. The historical museum, formerly the armoury, is undoubtedly one of the finest collections of the kind in Europe. Though less interesting as a historical collection than the Ambras collection at Vienna, it yet surpasses that one in armour of rich and elaborate workmanship. The museum of natural history, though inferior to many of the kind on the Continent, still contains many objects of interest to the scientific. The cabinet of engravings is one of the most complete collections of copperplates in Europe, containing everything interesting in the history of the art, or valuable from practical excellence. It contains in all about 300,000 engravings, arranged in classes. The Palace of the Princes contains a handsome chapel, a gallery of portraits of princes of the Saxon and Bavarian lines, a porcelain cabinet, a library of 10,000 volumes, and a cabinet of engravings. A covered way leads from this palace to the opera-house, which is capable of accommodating 8000 spectators. The new theatre, near the Catholic church, is one of the handsomest in Germany, and is capable of containing 1700 persons. The Bruhl Terrace, extending along the left bank of the Elbe, is approached from the foot of the old bridge by a grand flight of broad steps. It commands an extensive view of the surrounding scenery, and is a favourite resort of the inhabitants. Contiguous to it is the Bruhl Palace, in which are the academy of fine arts, and a collection of 50 landscapes by Canaletto. The Japanese Palace in the Neustadt, so named from some grotesque oriental figures and ornaments with which it is decorated, was built by Augustus II. for a summer residence, and hence is sometimes called the Augusteum. It is now appropriated to public purposes, and the beautiful pleasure grounds which surround it form a most agreeable promenade for the citizens. It contains the museum of antiquities and modern statuary, occupying ten saloons, and enriched with some of the finest antique statues in Germany, a cabinet of coins, a public library containing about 300,000 volumes, 2800 MSS., and a very large collection of maps, besides the celebrated porcelain cabinet, containing more than 60,000 pieces of china. The Court Roman Catholic church, built in 1739-56, is a large edifice in the Italian style. Externally it is profusely decorated, and by many considered deficient in taste; but internally it is chaste, elegant, and imposing, and altogether is one of the finest in Germany. It contains paintings by Rubens and Mengs, and a fine organ by Silbermann, and is surmounted by a steeple 378 feet in height. The church of Our Lady is also a magnificent building, with a cupola 320 feet in height, resembling that of St Peter's at Rome, and contains a fine organ of 6000 pipes. The Cross Church, Sophia Church, and the synagogue are also elegant buildings. Among the other public edifices may be noticed the mint, arsenal, medical and surgical school, house of assembly, royal guard house, new general

post-office, town-hall, trades'-hall, Maximilian's Palace, and cavalry and infantry barracks. Dresden has a great number of literary and scientific institutions, including a botanic garden, observatory, schools of medicine, surgery, and veterinary science, academy of arts, two colleges, a high school, &c. There are also numerous charitable institutions, as asylums, hospitals, &c., and excellent public baths. The celebrated Dresden china is not made here, but at Meissen, about 14 miles distant. In 1849 the population of Dresden amounted to 94,092, of whom 88,181 were Lutherans, 553 Reformed, 4411 Roman Catholics, and 672 Jews; 167 were blind, 110 deaf and dumb, and 128 insane. In 1852 the population was 104,500: during that year the deaths were 3340, and the births 3916: of the latter 1446 were illegitimate.

DREUX (the *Durocassæ*, or *Durocasinum-Castrum*, of the Romans), the chef-lieu of an arrondissement in the department of Eure-et-Loir. The town lies at the foot of a hill crowned by the ruins of the old castle of the counts of Dreux. In the middle of these ruins Louis-Philippe erected a chapel with splendid vaults as a burying-place for the members of his family.

The antiquity of Dreux is considerable. In 1188 it was taken and burnt by the English; and at the close of the sixteenth century it formed the scene of a bloody battle between the Catholics and Calvinists. In 1593 the town was taken by Henry IV., after an obstinate siege of eighteen days. The walls were razed, and Dreux thenceforth entirely lost its political importance. Dreux contains tribunals of first instance and of commerce, and a communal college. Pop. (1852) 6250.

DREVET, Pierre, the younger, an eminent French engraver, was born in 1697, at Paris, where his father had acquired considerable reputation in the same department of art. He was a member of the royal academy of painting and sculpture, and died at Paris in 1739, at the age of forty-two. In his portraits, which are highly elaborate, he particularly excelled in representing lace, silk, fur, velvet, and other ornamental parts of dress. Of his historical prints—which, in point of neatness and exquisite workmanship, are scarcely to be equalled—the most esteemed is the Presentation of Christ in the Temple; a very large plate, lengthwise, from Luigi de Bologna. This print is very valuable, but the first impressions of it are rarely to be met with. Among his portraits, the best are those of Bossuet and of Samuel Bernard. The first impressions of the latter are before the words *Conseiller d'Etat* were inserted upon the plate.

DRIFFIELD, Great, a market-town and seat of a poor-law union, in the east riding of Yorkshire, 28 miles E. by N. from York, and 196 N. by W. from London by road. The town—which consists of one principal street, from which some smaller ones diverge—is agreeably situated at the foot of the Wolds, and is connected with the port of Hull by a navigable canal. It stands in the centre of a fertile district, the inhabitants of which are chiefly engaged in agriculture; and an important market is held in the town every Thursday, in which extensive transactions take place in corn and cattle. The principal public buildings in Great Driffield are the corn exchange, the dispensary, the mechanics' institution, and the station of the Hull and Scarborough railway. Besides the parish church, it contains places of worship for Independents, Methodists, and Baptists; and also national and infant schools. In the town is a manufactory of chemical manure, while in the neighbourhood are numerous flour-mills, and mills for bone-crushing. The living of Great Driffield is a vicarage, with the perpetual curacy of Little Driffield attached, in the archdeaconry of the east riding, and diocese of York. Pop. (1851) 3792.

DRIFT, in *Navigation*, the angle which the line of a ship's motion makes with the nearest meridian, when she drives with her side to the wind and waves, and is not governed by the helm. It also implies the distance which the ship drives on that line.

Drift, in *Mining*, a passage cut between shaft and shaft; or a way wrought under the earth.

Drift-*Sail*, a sail used under water, veered out right a-head by sheets, as other sails are. It serves to keep the ship's head right upon the sea in a storm, and to prevent her driving too fast in a current.

Drift-*Wood*, trees or timber carried out to sea by rivers when in flood; timber drifted or floated by water.

DRILL (Sax. *thirlian*, to *perforate;* Ger. *drillen*, to *turn*, to *twist*), a tool with a steel point, used for perforating metal, ivory, and other hard substances. It is worked by a moderate pressure, with a whirling motion, which is usually communicated to it either by a *drill-bow*, or by means of a nut made to play on a spiral shaft in the end of which the steel point is fixed. The extremity of the borer is generally somewhat flattened, and of an angular shape, thus ⌣, with sharp edges.

Drill, in *Agriculture*, a machine for sowing seeds in regular rows. See Agriculture, vol. ii., p. 274.

DRILLING, the training or exercising of soldiers.

DRINK. See Dietetics.

DRIPSTONE, or Label. See index to Architecture.

DRIVING, in *Metallurgy*, is said of silver, when, in the operation of refining, after the lead is burnt away, the remaining copper rises upon its surface in red fiery bubbles.

Driving, in sea language, is said of a ship when her anchor fails to hold her fast, and she floats away with the wind or tide. A vessel is also said to drive when she scuds before a gale.

DROGHEDA, a town in the province of Leinster, in Ireland, situated in the middle of a small district called the county of the town of Drogheda, between the counties of Louth and Meath, is built on both sides of the river Boyne, about 4 miles from its mouth, and 31½ miles north of the city of Dublin. The entire extent of the county is 9 square miles, or 5780 acres. In the earliest notices of it by ancient writers it is called Inver-Colpa, or the Port of Colpa, and afterwards Tredagh. Drogheda, the name it is at present known by, signifies "the Bridge over the Ford." The portions on each side of the Boyne were formerly distinct towns, under separate jurisdictions, distinguished by the names of Drogheda on the side of Meath, and Drogheda on the side of Uriel, the ancient appellation given to the county of Louth and some adjoining districts. Drogheda is now divided into the parishes of St Peter, St Mary, and part of that of Ballymakenny; and contained, in 1831, a population of 17,365; in 1841, of 17,300; and in 1851, of 16,845.

Formerly the municipal government of the town was vested in the mayor, two sheriffs, two justices of the peace, and a recorder, to whom a charter had been granted under the following circumstances: Whilst the town was split into two jurisdictions, the inhabitants were incessantly in a state of mutual hostility, in consequence of trading vessels landing their cargoes in the southern town, to avoid the payment of pontage duty levied on all vessels discharging on the northern or Louth side. Much blood was frequently shed on these occasions. At length Philip Bennett, a monk residing in the town, took occasion, on the festival of Corpus Christi, to preach a sermon before the constituted authorities of both sides, in which he inculcated the blessings of union so emphatically, and followed up the subject so effectively at an entertainment to which he invited them in his convent the same day, that they all joined in sending a deputation to Henry IV. to obtain a new charter, by which both parts were embodied into a single corporation. This event took place in the year 1412. The charter was afterwards confirmed with alterations by James I. The mayor was honoured by Edward IV. with a sword of state, and L.20 a-year for

Drogheda.

its maintenance, in reward of the services performed by the townsmen in an engagement at Malpas Bridge, where this magistrate, at the head of 500 archers and 200 pole-axemen, contributed to the defeat of O'Reilly and his confederates. Previously to the union Drogheda returned two members to parliament. The number has since been reduced to one, who is elected by a constituency consisting of 586 electors. For municipal purposes the town has been divided by the late act into the three wards of Westgate, Fairgate, and Laurencegate, and is governed by the corporation, which consists of a mayor, 6 aldermen, and 18 councillors, under the title of the "Mayor, Sheriffs, Burgesses, and Commonalty of the town of Drogheda."

The town has always been considered by the English as a place of much importance. In the reign of Edward III. it was classed, along with Dublin, Waterford, and Kilkenny, as one of the four staple towns of Ireland. Richard II. received in it the submissions of O'Neal, O'Donnel, and other chieftains of Ulster and Leinster. The right of coining money was granted to it. Parliaments were several times assembled in it, in one of which the value of money was raised, by altering the silver groat or fourpenny piece to sixpence. In another parliament, also held here, in the beginning of the reign of Edward IV., the town was granted the right of having a university, with the same privileges as that of Oxford. The plan however failed, owing to the poverty of the town and the unsettled state of the country; and an attempt lately made by the corporation to re-assert the right was also unsuccessful. One of the Earls of Desmond was beheaded here on a charge of high treason, brought against him in parliament by the Earl of Worcester when lord-lieutenant. Here also the celebrated statutes known by the name of Poyning's Laws, which made such a change in the political relations between England and Ireland, were enacted. In the civil wars of 1641 the town was besieged by O'Neal and the northern Irish forces; but was gallantly defended by Sir Henry Tichbourne, and after a long blockade relieved by the Marquis of Ormond. The same nobleman relieved it a second time, when invested by the parliamentary army under Colonel Jones. In 1649 Cromwell appeared before it at the head of a numerous and well-appointed army. The town was taken after a short though spirited defence; and nearly every individual in it, without distinction of age or sex, was put to the sword. Thirty only escaped, who were afterwards transported as slaves to Barbadoes. In 1690 it was garrisoned by King James's army; but after the decisive battle of the Boyne it surrendered to the conqueror without a struggle, in consequence of a threat that quarter would not be granted if the town were taken by storm. Its subsequent history is not marked by any circumstance of striking political notoriety.

Of the ancient fortifications very few relics remain. The only one of its four gates still in existence is that of St Laurence, which forms a very picturesque object. The modern town, built chiefly on the northern bank of the Boyne, is divided into four principal parts or quarters, by the two main streets that intersect each other at the Tholsel. The bridge which connects this portion with the southern is narrow, and by no means well suited to the great and increasing current of passengers and vehicles that take advantage of it. The principal public buildings are, the mayoralty-house, to which a suite of assembly-rooms is attached; the Tholsel, a square building of cut stone, with a cupola; the corn-market, the linen-hall, two parish churches, and several Roman Catholic chapels, the largest of which is that of St Peter. There are also several religious houses, in one of which, the abbey of Dominican nuns, without St Laurence's gate, is still preserved the head of Oliver Plunket, Roman Catholic archbishop of Armagh, who was executed at Tyburn in the year 1681, on an unfounded charge of treason. His body, having been interred in St Giles', London, was afterwards removed to the Continent. A classical school, under the endowment of Erasmus Smith, is maintained here. There are also several free schools, the principal of which, called the Patrician school, accommodates 150 pupils. Among the charitable institutions is one for the reception of thirty-six clergymen's widows, who are each provided with a house and an annuity of L.26 during life, arising from bequests made by two archbishops of Armagh. Here is also an alms-house for twenty-four aged widows, an infirmary, and a mendicity association for the suppression of street-begging, by which poor persons are provided with food and employment, but are not lodged.

Drohiczyn || Droitwich.

The former importance of Drogheda may also be inferred from the numerous remains of its monastic institutions. The principal were, the hospital of St Mary, for the sick and infirm; the priory of St Laurence, which was granted to the corporation on the dissolution of the monasteries; the Dominican friary, of which a tower of stately proportions still exists; the Grey friary, and the Augustinian friary; all in the northern part of the town. On the southern side were the hospital of the Knights of St John of Jerusalem, and the Carmelite friary. The archbishops of Armagh had a palace in the town, built by Archbishop Hampton about the year 1620.

Drogheda was until lately the seat of an extensive manufacture of coarse linens, on the decline of which the cotton manufacture supplied its place. Brewing and tanning are carried on largely. Four fairs are held annually, on May 12, June 22, August 26, and October 29. It is also a great place of export for grain, hides, and butter. Vessels of 200 tons can lie at the quay. The communication with the country is facilitated by means of the Boyne navigation, which is carried on for 9 miles, chiefly in the bed of the river, to Slane; 6 miles of still water navigation continue it thence to Navan, and 7 more to Trim. The chief articles conveyed by it are coal, slate, timber, iron, and salt upwards; grain, yarn, and linen downwards. The salmon fishery on the Boyne was once very valuable; the fish is is highly esteemed for its flavour.

About 4 miles west of the town is the village of Old Bridgeton, memorable for the celebrated and decisive victory gained by William of Orange over James II. The battle, which marks one of the great epochs in Irish history, is fully detailed in every general account of the country. The precise point where the main body of the British army crossed the Boyne during the action, and where the aged Duke Schomberg was killed whilst leading on his men, is marked by an elegant obelisk 150 feet high, having on each side of its pedestal an appropriate inscription.

DROHICZYN, a town of Russian Poland, province of Bialystock, and 58 miles S.S.W. of the town of that name. It stands on the right bank of the Bug, and has four churches, three convents, a Piarist college, and about 2000 inhabitants. It was formerly the capital of Podlachia.

DROHOBYCZ, a town of Austrian Galicia, circle of Sambor, and 17 miles S.E. of the town of that name. It is situated on the Tiszmanicka; is a place of considerable trade, particularly in corn, cattle and salt; and contains several churches, convents, and schools, and about 8000 inhabitants, including the suburbs. In the vicinity are some salt mines.

DROITWICH, a municipal and parliamentary borough and the seat of a poor-law union in Worcestershire, is situated on the river Salwarpe, 7 miles N.N.E. of Worcester, and 116 miles N.W. by W. from London. The borough returns one member to parliament, and is governed by a municipality consisting of four aldermen and twelve councillors, one of whom is mayor. The livings are in the archdeaconry and diocese of Worcester. Pop. (1851) 3125; of extended parliamentary borough, 7096. From a very remote date, Droitwich has been famous for its *wyches* or salt

springs. These were known to the Romans, who had a station called *Salinæ* on the spot now occupied by the town of Droitwich. In the formation of the Oxford and Wolverhampton railway, remains of a Roman villa were discovered, containing some interesting and valuable relics which have been carefully preserved. In "Domesday Book," mention is made of a tax imposed upon the salt mines of Droitwich. King John granted a charter to the borough.

The chief public buildings of Droitwich are the Court Chamber, a handsome edifice, and the churches of St Andrew and St Peter, besides the chapels of the Plymouth Brethren and the Methodists. Droitwich also possesses national and infant schools, and an admirably conducted hospital, which maintains about forty men and women, besides educating 100 young persons of both sexes. Droitwich possesses a very large trade in salt, of which it produces annually upwards of 60,000 tons. The canals and railways which pass the town at short distances afford great facilities for the transit of this article to other parts of the country.

DROME, a department in the S.E. of France, bounded on the W. by the Rhone, which separates it from Ardèche; on the N. and N.E. by the department of Isère; on the E. by that of the Hautes-Alpes; on the S.E. by that of Basses-Alpes; and S. by that of Vaucluse. Its greatest length from north to south is about 78 miles; its greatest breadth nearly 50 miles; its area about 2500 square miles. Pop. (1851) 326,846.

Though separated from the maritime Alps by the departments of the Hautes and Basses-Alpes, Drôme is covered in its eastern parts by spurs of that chain. One of the largest of these spurs forms, for a considerable distance, the eastern boundary of the department, on which side it throws up the three lofty peaks of Embel, Tous, and Ventoux. The ridges (for the most part wooded) which traverse the department with tolerable regularity from east to west, are all off-shoots from this Alpine spur. These ridges divide the department in its whole extent into three great natural divisions or valleys, with a general slope westwards to the Rhone. These valleys are that of the Isère in the north, that of the Drôme, from which the department derives its name, and which occupies the central portion of the province, and that of the Aigues which occupies all its southern part. The affluents of the Rhine which water this southern portion are the Roubion, the Berre, the Dèze, the Aigues, and the Ouvèze. The soil of the department, naturally not very fertile, is thin and sandy. The disposition of its various elevations presenting a series of basins rising over each other in the manner of an amphitheatre, is very favourable to the construction of artificial canals for the purposes of irrigation. These canals are very numerous, and are managed with much skill by the inhabitants. As the department is generally mountainous, its climate is rather cold than temperate, but on the whole bracing and healthy. Snow is visible on the mountain-tops during the greater part of the year; but the summer-heat in the valleys that border the Rhone is intense. The prevailing winds are those of the north and south.

In the more inaccessible mountains bears, wild-goats, and chamois are found in great numbers, as well as some of the larger kinds of birds of prey. In the lower grounds wolves and foxes abound. On the islands in the Rhone and on the banks of some of the inland lakes, some colonies of beavers are still to be seen. The department abounds in game, both great and small of every kind; but except the sheep and swine the domestic animals are nowise remarkable. The principal forest-trees found in Drôme are the pine, the beech, and the oak. In the valleys the olive, chestnut, almond, and mulberry trees are a great source of wealth to the natives. Black truffles of the finest quality also grow in great abundance. The botanical flora of the department is rich and various. The mineral wealth of the department is considerable, as in various parts of it are found mines of iron, copper, lead, and coal, besides marble and granite quarries. Rock-crystal of fine quality is also found, as well as black and red clay for pottery, chalk, &c. There are numerous mineral wells throughout the department; the most celebrated is that of Dieu-le-fit. For administrative and political purposes the department is divided into the four arrondissements of Valence, Die, Montélimart, and Nyons, comprising 28 cantons and 360 communes: it forms part of the seventh military division, the headquarters of which are at Lyons: its legal tribunals are under the royal court of Grenoble. It returns four deputies to the imperial parliament, and is divided into the four electoral arrondissements of Valence, Romans, Montélimart, and Crest. Agriculture is not very far advanced in the Drôme. About two-fifths of the soil are arable and yield good corn crops, though barely sufficient for the requirements of the people. Two-sevenths of the entire surface are covered with woods, while two-ninths of it are unimprovable moorland. Large quantities of excellent wines are made in the Drôme, and of these nearly nine millions of gallons are annually exported. The best of these wines are the red and white hermitage. The territorial revenues of the department are estimated at about half-a-million sterling. The manufacturing and commercial industry of the department is very considerable. The most important article of produce is silk, of which about 500,000 lbs. are annually produced. Besides this, however, there are important manufactures of coarse cloths, serges, cotton-yarn, oil, brandy, leather, paper, bricks, &c. The total number of workshops and factories in the department is 711, besides 500 wind and water mills, and 5 blast-furnaces. The total number of annual fairs is 440.

DROMEDARY. See index to MAMMALIA.

DROMORE, a town of Ireland, county of Down, on the Lagan, 84 miles N. by E. of Dublin, on the great northern road to Belfast. Pop. (1851) 1872. The chief branch of manufacture carried on is that of linens, and many of the inhabitants are employed as linen weavers. The cathedral or parish church, a mean structure, contains the remains of Jeremy Taylor, and other bishops.

DRONE, the male of the honey bee. Sometimes other flies also are so named. See BEE.

DRONERO, a town of Piedmont, province of Coni, and 10 miles W.N.W. of the town of that name. It stands on the Maira, here crossed by a fine bridge, and contains about 7000 inhabitants. The chief manufacture is that of linens.

DRONFIELD, a township of England, Derbyshire, $5\frac{1}{2}$ miles N.N.W. of Chesterfield. The parish church is a fine old building, with a tower and spire, chiefly in the decorated style. The principal manufactures are cutlery and iron wares. Pop. (1851) 2469.

DRONTHEIM, a town of Norway. See TRONDHEIM.

DROPPING-TUBE, a convenient instrument for measuring liquids drop by drop. It is a glass tube with a hollow bulb near its lower end, which terminates in a small orifice.

DROPSY (Lat. *hydrops*), in *Medicine*, an unnatural collection of serous fluid in any part of the body. See PATHOLOGY.

DROSSEN, a town of Prussia, province of Brandenburg, and government of Frankfurt, 16 miles N.E. of the town of that name. Manufactures—woollen and linen goods. Pop. (1849) 4647.

DROWNING. This term usually signifies the extinction of life by total submersion; but it ought also to be applied to that species of suffocation which is produced by the exclusion of atmospheric air from the lungs by any liquid; for the effects produced in all such cases are similar. Drowning, therefore, may be considered as having taken place when the animal perishes from immersion of its head, or even from the obstruction to the air passages by a fluid.

The ordinary phenomena of drowning may be witnessed by submerging a small animal in a glass vessel filled with water. The animal at first struggles violently, and is soon observed to make a forcible *expiration*, as is indicated by the escape of bubbles of air from its mouth and nose. It next attempts to inspire; an effort marked by the strong heaving of its thorax, and convulsive efforts of its abdominal muscles. This effort is vain, and is speedily followed by the extrication of a few more air bubbles from its lungs. These convulsive motions are repeated at shorter intervals, while smaller portions of air are forced from the lungs at each succeeding expiration, until the air cells are deprived of a considerable portion of the air they contained at the moment of submersion. Insensibility soon comes on; but convulsive movements of the limbs mark the progress of cerebral congestion, and the influence of unoxygenated blood on the centre of the nervous system.

After these struggles, the animal is apparently dead; but a feeble motion may still be perceived in the chest; and before it ceases altogether, the muscles of the thorax are once more thrown into action by an ineffectual effort to breathe. Brodie has remarked, that in drowning, the action of the heart and diaphragm cease almost at the same instant. Unless the animal be removed from the water before the movements of the heart and diaphragm have entirely ceased, it perishes, and a minute or two more are sufficient to destroy it. If the animal be removed from the water while the heart and diaphragm are yet in action, it may escape from the immediate risk of suffocation, but yet may die from injury to the brain, produced by congestion of dark blood on that organ. Bichat, Cruickshank, and Brodie, have proved that dark unoxygenated blood acts as a poison on the brain, causing diminished nervous energy, laborious respiration, feeble pulse, dilated pupils, stupor, and convulsive twitches of the voluntary muscles.

Signs of death from Drowning.—The signs of death from drowning are *external* and *internal*. 1. The external signs most usually perceived are—either a very pale countenance, or the face bloated and livid; the lips, and not unfrequently the whole head, swelled; the eyes half open, and the pupils much dilated; the tongue swelled, and protruded between the teeth, so as to be in contact with the inner surface of the lips; the lips and nose often lined with a whitish froth; the chest and epigastrium tumid, and much arched; the ends of the fingers usually excoriated; and the spaces under the nails often filled with sand or mud. 2. The most usual internal signs are more or less cerebral congestion; but in some cases no morbid change appears in the brain. We usually find the blood in the vessels of the head, and indeed in the whole body, of a blackish colour. There is generally frothy mucus in the trachæa, which is sometimes tinged with blood; the lungs are dilated and gorged with blood; the diaphragm descends low into the abdomen, and has lost more or less of its concave surface towards that cavity. The right cavities of the heart, and the great vessels connected with it, are gorged with black blood, whilst the left side and its vessels are usually found empty. The blood in the body always remains fluid, and readily flows wherever an incision is made. Water is sometimes found in the bronchial tubes and cells of the lungs; and not unfrequently some water has been swallowed in the act of drowning. These symptoms will generally enable us to detect a death from drowning, if we examine the body before putrefaction is advanced.

The immediate cause of death from drowning has given rise to much controversy; and physiologists have appealed to contradictory experiments and observations in support of their different hypotheses. But this difference of opinion has originated in physiologists supposing that the suspension of the vital functions on submersion always depended on the same proximate cause. It is singular that the very dissimilar appearances which the face presents in different cases did not suggest some difference in the cause of death. In some drowned persons, the face is remarkably pale, and rather pinched; in others, the countenance is livid, and the whole head swelled; the first indicating the deficiency of blood in the head, the latter its redundancy. This led Dr Desgranges to the conclusion that there were two different modes in which drowning proved fatal.

The first, which he terms *nervous or syncopal asphyxia*, occurs when the person, either from the terror of impending fate, the effect of surprise, or from the sudden immersion in extremely cold water, faints at the instant of immersion. The instantaneous arrestation of the movements of the heart in such cases prevents the transmission of unoxygenated blood to the brain; the principle of life is merely suspended; the resources of the animal machine are not destroyed, but are capable of being again called into action by suitable means. The second, Desgranges terms *asphyxia by suffocation.* In this species the heart continues to act for some time after respiration is impossible. The brain thus becomes loaded with black or unoxygenated blood, which is known to act as a direct sedative or a poison on that delicate organ. When this has gone on for a short time, its functions are annihilated, and cannot be restored when the body is again exposed to atmospheric air. In this second species water often finds its way into the air tubes, and even into the cells of the lungs, during the vain efforts of the individual to breathe.

These distinctions are important, will serve to explain most of the anomalies which have been observed as effects of submersion, and render probable the very extraordinary instances of resuscitation after long-continued submersion, which have been related by men worthy of credit, but which have appeared marvellous to those whose ideas of drowning are founded on a few experiments made on the lower animals forcibly submerged.

Amongst individuals who have recovered from insensibility induced by long submersion, by far the majority are those who have been affected by *syncopal asphyxia*, in whom there has been instantaneous arrestation of the motion of the heart, and suspension of consciousness. This distinction will enable us also to explain why, when several persons are submerged together, some will be found quite irrecoverable; whilst others, who have been considerably longer under water, may be capable of resuscitation.

The recovery from *syncopal asphyxia* is well illustrated by a case given by Plater. A female, condemned for infanticide, was inclosed in a sack, according to the provisions of the *Caroline Code* of Germany, and thrown into the Rhine. She fainted at the moment of immersion; and, after having been under water for a quarter of an hour, was drawn out and restored to life.

Pouteau relates the history of a man at Lyons who suddenly fell into a river covered with ice, and remained submerged for three hours, yet was restored to life by the long-continued assiduity of his medical attendant. Morgagni mentions the case of a man who was resuscitated after having been under water for half a day; and Pechlin relates the instance of a Swedish gardener who was submerged in a frozen pond for sixteen hours, and yet was recovered by similar means. This case is so extraordinary that we give it in the author's own words:—

"Hortulanus Tronningholmensis etiamnum vivens, annos natus 65 pro illâ ætate satis adhuc valens et vegetus, cùm ante 18 annos, alii in aquas delapso opem ferre vellet, forte fortunâ et ipse per glaciem incautiùs procedens, aquas incidit 18 ulnas profundas: ubi ille, corpore erecto quasi ad perpendiculum, pedibus fundo adhæsit. Constitit sic per 16 horas, antequàm produceretur in auras. Hoc statu dum 16 horas permansit frustrà quæsitus, tandem repertum, conto in caput infixo, cujus etiam sensum se habuisse dixit, fundo extraxerunt, sperantes ex more aut persuasione gentis revicturum

esse. Itaque pannis linteisque productum obvolvunt, ne aëre admitti possit perniciosus futurus subito illapsu: custoditum sic satis ab aëre sensim sensimque tepidiori loco admovent mox calidis adoriuntur fasciis, fricant, radunt, et sufflaminatum tot horis sanguinis corporisque motum negotiosâ illâ operâ reducunt: denique antapoplecticis et genialibus liquoribus vitæ reddunt et pristinæ mobilitati. Retulit is atque ostendit se etiamnum in capite circumferre vestigia violentiæ à conto illatæ, et cephalalgiis vexari gravissimis. Et propter hunc ipsum casum, religiosè à popularibus, et hujusce rei restibus probatum, Serenissimæ Reginæ matris munificentiâ et annuo stipendio est donatus—et Serenis. Principi—oblatus vivus sui testis—Consignatam manu habes Historiam D. Tilasii, Biblioth. Reg. Præfecti, qui testatus est se prænovisse mulierem, quæ tres ipsos dies sub aquis hæsit, et similem in modum, quo Hortulanus ille, resuscitata, adhuc dum lucis plenâ fruitur usurâ. Accedit Nob. Burmanni—fides, qui confessus est,—se in pago Boness parochiæ Pithoviæ concionem frequentâsse funebrem, in quâ, dum acta rescenseret Præco Senis cujusdam septuagenarii Laur. Jonæ—audiverit ex ore Concionatoris, vivum eum, adolescentem septemdecim annorum, aquis submersum, septem demum hebdomadâ (rem prodigiosam!) extractum ad se rediisse vivum et incolumen."—(Pechlin, *De Aer. et Alim. def.* c. 10.)

In all such cases, Desgranges conceives that the capability of recovery is to be attributed to the sudden arrestation of the vital motions at the moment of immersion. The action of the heart and of the lungs ceasing simultaneously, no vitiated blood could be transmitted to the brain. A stop would at the same time be put to all secretions and excretions, so that there could be no expenditure of vital power. How long this suspension might continue without extinction of vitality, is unknown; but something resembling it occurs in some long-continued paroxysms of hysteria, and in persons who have for several days lain apparently dead, but have been resuscitated. The causes of death from drowning are regarded as rather more complex by Devergie. He considers it as produced in *five* modes: by simple asphyxia; by syncope; by cerebral commotion, in which the vital functions are affected through the medium of the nerves; by apoplexy; by a union of several of these causes. Death from asphyxia combined with syncope, or with cerebral congestion, he states as including five-eighths of all the cases of drowning.

Drowning has been ascribed to water finding its way into the stomach and air passages; but this opinion was proved to be fallacious by Senac and Cullen. The former denied that water ever entered the lungs; but Morgagni showed that it actually does sometimes enter the air cells; and he ascribes the frothy mucus found in the fauces and air-tubes to the intermixture of air with that water. The opinion of Morgagni on this last point is, however, incorrect; for the froth is found in many cases of asphyxia from noxious gases, in epilepsy, and apoplexy; and in the experiments of Dr Marshall Hall, it was observed in dogs that had been bled to death. It appears to be produced by the escape of air from the lungs mixing with the natural mucus lining the air passages, and indeed is common to all cases of laborious respiration. Goodwyn and Cullen showed the insufficiency of the water which finds its way into the lungs in drowning to cause speedy death.

The excoriation of the ends of the fingers is produced by the person endeavouring to save himself by catching at the bottom, or the first solid which meets his hands; and the sand and mud under the nails have the same origin. In fact, we are by these marks often able to discover whether a person has been drowned, or thrown into the water after death. The tumid state of the chest, and descent of the diaphragm into the abdomen, are caused by the violent efforts made to dilate the chest for the relief of the sense of suffocation. The fluidity of the blood is remarkable, and seems almost universal in drowning. This appearance takes place wherever death is caused by the exclusion of oxygen, or when the blood does not undergo the usual changes in the lungs.

Treatment of Drowned Persons.—Various directions have been given for the treatment of persons who have been found in a state of asphyxia from submersion. The subject claimed the especial attention of De Haen, of John Hunter, and Cullen, each of whom has made many judicious remarks on the best means of restoring animation; and the Humane Society of London laid down twelve general rules for the recovery of drowned persons, which were, on the whole, useful, although some of them are now completely obsolete.

The principal objects in such cases should be,—

1st, *To restore or keep up the animal heat.*

2d, *To induce a renewal of respiration.*

3d, *To rouse latent animation by the exhibition of stimuli.*

1. As soon as the body is removed from the water, the wet clothes should be taken off, and the body rolled in warm blankets or dry clothing, while it is transporting to the nearest house. The body should be carried in the arms of men, or on a bier, with celerity but without jolting, to a room which, in hot weather, should have the windows open, but in winter should have a fire. The head, during the transporting, should not be suffered to hang down, but be laid in an easy position. When brought into the apartment in cold or damp weather, the body should be laid on a mattress before a fire, when the surface is to be diligently rubbed with dry warm flannel, both to dry the surface, and to rouse the excitability of the capillaries. Whilst this is going on, it is important to permit the free access of warm air. No more persons should be present than are useful about the patient; and the Humane Society limit the number to six. Sometimes the body has been placed in warm water; but this practice is objectionable. Some recent experiments have rendered it more than probable that the influence of the free application of air to the general surface of the body is not unimportant in restoring animation in cases of asphyxia; and the cutaneous circulation is more readily induced by dry and diligent frictions of the surface than by immersion in warm water. Applications of bags of hot sand, bran, or the like, to different parts of the body, as the arm-pits, scrobiculus cordis, and extremities, are obvious means of restoring animal heat not to be neglected; and in some instances much benefit seems to have been derived from switching the soles and palms with twigs, or striking them with the open hand. Whilst these means are being employed, we must not neglect the important object, viz.

2. The restoration of respiration, by *insufflation* of the lungs. The best and simplest mode of effecting this object is, to introduce the nozzle of a pair of common bellows into one nostril, whilst the operator closes the other nostril and the mouth with his left hand, and applies his right to the thyroid cartilage, pressing it gently backward, in order to shut up the *æsophagus*, and prevent the air entering the stomach instead of the lungs. The bellows should be wrought by an assistant, so as moderately to inflate the chest. A third person is to press the chest with his hands to expel the air. These motions are to be alternated, so as to imitate the natural breathing as much as possible. This mode of insufflation is much preferable to the proposal of introducing a tube into the *glottis*, and still more so to the hazardous operation of tracheotomy, which never can be necessary in a case of simple drowning, and which, even in the hands of the celebrated surgeon Mr Justamond, proved fatal, by permitting the infiltration of blood into the air passages.

When a sufficient supply of oxygen gas can be obtained,

Drowning.

it would probably expedite recovery; but perhaps it should not in general be employed undiluted. Where a pair of bellows cannot be obtained, the life of a person may be saved by introducing any sort of pipe into the nostril, as above directed, and blowing air from the mouth of the operator into the lungs of the drowned person. In this case, care should be taken not to use the air from the lungs of the operator, but merely that which his mouth contains, thrown forward by the compression of his cheeks, in the manner used with the common blow-pipe. But a pair of bellows should always be preferred.

In the original directions of the Humane Society, it was laid down that the body, especially if the subject were a child, "is to be well shaken every ten minutes, in order to render the process of animation more certain." This practice is justly condemned by most modern authors, as either useless or dangerous. All the benefit of "shaking" may be obtained by frictions and switchings, without the risk of extinguishing the feeble remains of animation by rude concussions, "pullings, and pushings," which have been generally employed in cases of asphyxia. It is scarcely necessary to caution the practitioner against the exploded practice of hanging the drowned person by the heels, or laying him across a barrel with his head hanging downwards; a practice of which even Fothergill approves, on the principle of making him disgorge the water that might have found its way into the stomach and lungs, which was erroneously imagined to be the chief cause of suspended animation.

3. The application of various stimulants internally and externally to facilitate resuscitation, is limited, but not unimportant. The vapour of ammonia, to irritate the Schneiderian membrane of the nose, has been generally adopted, and is useful in rousing the dormant excitability. When a tube can be introduced into the stomach, a portion of warm spirit and water, with or without ammonia, will generally be useful. The introduction of warm stimulants by the anus is likewise desirable, both to rouse the latent powers of life by their stimulant effect, and to restore the animal heat.

Another rule of the Humane Society recommended the injection of tobacco smoke into the fundament. This practice was borrowed from the savage Indians of North America; but it is of very questionable utility. The excessive faintness produced by this strong narcotic is a great objection to its employment in cases where the powers of life are already too low; and we have abundant means of exciting the peristaltic motion of the alimentary canal, by aloetic and other warm purgatives, without running the risk of extinguishing the feeble remains of vitality by the introduction of a narcotic. The objection is still stronger to infusions of the plant, which have also been recommended.

The application of voltaic electricity bids fair to aid resuscitation, especially if not used too strong. It has a powerful effect in rousing the voluntary muscles, but its influence on the heart is doubtful. Yet there can be no doubt of its capability of stimulating the diaphragm and abdominal muscles, to cause the dilatation of the chest; and its application to the parts of the body most suitable for this end, as about the lower ribs and the pit of the stomach, should be tried. Common electricity is less suited to this purpose; but neither should be passed through the head, lest the excitability of the nervous system should be exhausted by so powerful and general a stimulant.

Blood-letting was reprobated by John Hunter; and in cases of drowning where there are marks of *syncopal asphyxia*, it will probably prove injurious; but when there are decided marks of cerebral congestion, venesection, under the direction of a medical practitioner, will facilitate recovery.

These methods of resuscitation should be diligently employed for four or five hours at least, before the case is given up as hopeless. It is a vulgar and a dangerous error to suppose that because our efforts do not seem successful for one or two hours, that the patient is irrecoverably dead. There are instances of persons submerged, in whom no symptoms of returning animation have been obvious until after four, or even six hours of unremitted efforts. (T. S. T.)

Drugget || Druids.

DRUGGET (Fr. *droguet*), a coarse but rather flimsy woollen fabric, and sometimes half wool half thread; sometimes corded, but usually plain.

DRUIDÆ, or DROIUM, in *Ancient Geography*, a very ancient town, the principal place of the Gallic Druides or Druidæ, as they are called; now *Dreux* in the Orleannois. Here, according to Cæsar, they met every year in a consecrated grove. The town was also called *Durocases*.

DRUIDS, DRUIDES, or DRUIDÆ, the priests or ministers of religion amongst the ancient Celtæ or Gauls, the Britons, and the Germans.

Some authors derive the word from the Hebrew דרושים, *derussim*, or *drussim*, which they translate *contemplatores*. Picard (*Celtopæd.* lib. ii. p. 58) believes the druids to have been thus called from *Druis* or *Dryius*, their leader, the fourth or fifth king of the Gauls, and father of Saron or Naumes. Pliny, Salmasius, Vigenère, and others, derive the name from δρυς, *quercus, oak*, on account of their inhabiting, or at least frequenting and teaching, in forests; or perhaps because, as Pliny says, they never sacrificed except under the oak. But it is hard to imagine how the druids should have come to speak Greek, even although Cæsar assures us that they had the Greek letters. Ménage derived the word from the old British *drus*, a dæmon or magician; and Borel, from the Saxon *dry*, a magician, or rather from the old British *dru* or *derw*, an oak; whence he supposes δρυς to be derived, which indeed is not an improbable supposition. Becanus (lib. i.) takes *druis* to be an old Celtic and German word, formed from *trowis* or *truwis*, a doctor of the truth and the faith; and in this etymology Vossius is disposed to acquiesce.

General account of the druids.

The druids were the first and most distinguished order among the Gauls and Britons. They were chosen out of the best families; and the honours of their birth, joined with those of their function, procured them the highest veneration among the people. They were conversant in astrology, geometry, natural philosophy, politics, and geography: they were the interpreters of religion, and the judges in secular affairs: whoever refused obedience to them was declared impious and accursed. We know but little as to their peculiar doctrines, only that they believed the immortality of the soul, and, as is generally supposed, in the metempsychosis; though it appears highly probable that they did not believe in this last doctrine, at least not in the sense of the Pythagoreans.

The chief settlement of the druids in Britain was in the isle of Anglesey, the ancient *Mona*, which they chose for this purpose, as it was well stored with spacious groves of their favourite oak. They were divided into several classes or branches, namely, the *vacerri*, *bardi*, *eubages*, *symnothii* or *semnothei*, and *saronidæ*. The *vacerri* are held to have been the priests; the *bardi* were the poets; the *eubages* were the augurs; and the *saronidæ* were the civil judges and instructors of youth. As to the *semnothei*, who are said to have been immediately devoted to the service of religion, it is probable that they were the same with the *vacerri*. Strabo, however, and Picard after him in his *Celtopædia*, do not comprehend all these different orders under the denomination of Druids, as species under their genus, or parts under the whole, but make them quite different conditions or orders. Strabo in effect only distin-

Druids.

guishes three kinds, *bardi*, *vates*, and *druids*. The *bardi* were the poets; the *vates*, ουατεις, apparently the same with the *vacerri*, were the priests and naturalists; and the *druids* were those who, besides the study of nature, applied themselves to that of morality.

Diogenes Laertius assures us in his prologue, that the druids were the same among the ancient Britons with the sophoi or philosophers among the Greeks, the magi among the Persians, the gymnosophists among the Indians, and the Chaldeans among the Assyrians.

Their garments were remarkably long; and, when employed in religious ceremonies, they always wore a white surplice. They generally carried a wand in their hands; and wore a kind of ornament enchased in gold about their necks, called the *druid's egg*. Their necks were likewise decorated with gold chains, and their hands and arms ornamented with bracelets. They wore their hair very short, and their beards remarkably long.

The druids had one chief or arch-druid in every nation, who acted as high priest, or *pontifex maximus*. He possessed absolute authority over the rest, and commanded, decreed, or punished, at pleasure. At his death he was succeeded by the most considerable amongst the survivors; and if there were several pretenders, the matter was ended by an election, or else put to the decision of arms.

The druids, we have observed, were in the highest esteem. They presided at sacrifices and other ceremonies, and had the direction of every thing relating to religion. The British and Gallic youth flocked to them in crowds to be instructed by them. With the children of the nobility, Mela tells us, they retired into caves, or the most desolate parts of forests, and kept them there sometimes for twenty years under their discipline. Besides the immortality and metempsychosis, their disciples were here instructed in the motion of the heavens and the course of the stars, the magnitude of the heavens and the earth, the nature of things, the power and wisdom of the gods, and a variety of other doctrines. They preserved the memory and actions of great men in their verses, which they never allowed to be written down, but made their pupils get by heart. In their common course of learning, they are said to have taught them twenty-four thousand such verses. By this means their doctrines appeared more mysterious by being unknown to all but themselves; and having no books to recur to, they were the more careful to fix these doctrines in their memory.

They worshipped the Supreme Being under the name of *Esus* or *Hesus*, and the symbol of the oak; and had no other temple than a wood or a grove, where all their religious rites were performed. Nor was any person admitted to enter that sacred recess, unless he carried with him a chain, in token of his absolute dependence on the Deity. Indeed their whole religion originally consisted in acknowledging that the Supreme Being, who made his abode in these sacred groves, governed the universe, and that every creature ought to obey his laws and pay him divine homage.

They considered the oak as the emblem, or rather the peculiar residence, of the Almighty; and accordingly chaplets of it were worn both by the druids and the people in their religious ceremonies, whilst the altars were strewed with its leaves and encircled with its branches. The fruit of it, especially the misletoe, was thought to contain a divine virtue, and to be the peculiar gift of heaven. It was therefore sought for on the sixth day of the moon with the greatest earnestness and anxiety, and when found it was hailed with raptures of joy. As soon as the druids were informed of this fortunate discovery, they prepared every thing for the sacrifice under the oak, to which they fastened two white bulls by the horns; then the arch-druid, attended by a prodigious number of people, ascended the tree, dressed in white, and, with a consecrated golden knife or pruning-hook, cropped the misletoe, which he received in his *sagum* or robe, amidst the rapturous exclamations of the people. Having secured this sacred plant, he descended the tree; the bulls were sacrificed; and the Deity invoked to bless his own gift, and render it efficacious in those distempers in which it should be administered.

The consecrated groves, in which they performed their religious rites, were fenced round with stones, to prevent any person's entering between the trees, except through the passages left open for that purpose, and which were guarded by some inferior druids, to prevent any stranger from intruding into their mysteries. These groves were of different forms; some quite circular, others oblong, and more or less capacious as the votaries in the districts to which they belonged were more or less numerous. The area in the centre of the grove was encompassed with several rows of large oaks set very close together. Within this large circle were several smaller ones surrounded with large stones; and near the centre of these smaller circles were stones of a prodigious size and convenient height, on which the victims were slain and offered. Each of these being a kind of altar, was surrounded with another row of stones, the use of which cannot now be known, unless they were intended as cinctures to keep the people at a convenient distance from the officiating priest.

Suetonius, in his life of Claudius, assures us that the druids sacrificed men; and Mercury is said to have been the god to whom they offered these victims. Diodorus Siculus observes, that it was only upon extraordinary occasions they made such offerings; as, to consult what measures to take, or to learn what should happen to them, by the fall of the victim, the tearing of his members, and the manner in which his blood gushed out. Augustus condemned the custom, and Tiberius and Claudius punished and abolished it.

We learn from Cæsar that the druids were the judges and arbiters of all differences and disputes, both public and private; they took cognizance of murders, inheritances, boundaries, and limits, and decreed rewards and punishments. Such as disobeyed their decisions they excommunicated, which was their principal punishment; the criminal being thereby excluded from all public assemblies, and avoided by all the world, so that nobody durst speak to him, for fear of being polluted.[1] Strabo observes they had sometimes interest and authority enough to stop armies upon the point of engaging, and accommodate their differences.

Their opinions and philosophy.

It has been disputed whether the druids were themselves the inventors of their opinions and systems of religion and philosophy, or received them from others. Some have imagined that the colony of Phocians which left Greece and built Marseilles in Gaul about the 57th olympiad, imported the first principles of learning and philosophy, and communicated them to the Gauls and other nations in the west of Europe. It appears indeed that this famous colony contributed not a little to the improvement of that part of Gaul where it settled, and to the civilization of its inhabitants. "The Greek colony of Marseilles,"

[1] The *aquæ et ignis interdictio* of the Roman law was probably borrowed from and founded on the druidical excommunication, just as the "letters of intercommuning" in the reigns of Charles II. and James II. were a reproduction of the Roman penalty.

Druids. says Justin, "civilized the Gauls, and taught them to live under laws; to build cities, and enclose them with walls; to raise corn; to cultivate the vine and olive; and, in a word, made so great a change both in the face of the country and the manners of its inhabitants, that Gaul seemed to be translated into Greece, rather than a few Greeks transplanted into Gaul." But though we may allow that the druids of Gaul and Britain borrowed some hints and embellishments of their philosophy from this Greek colony, and perhaps from other quarters, there is some reason to believe that the substance of it was their own. Others have suggested that the druids derived their philosophy from Pythagoras, who published his doctrines at Crotona in Italy, where he lived above twenty years, in the highest reputation for his virtue, wisdom, and learning. This conjecture seems to be confirmed by the remarkable expression of Ammianus Marcellinus, "That the druids were formed into fraternities, as the authority of Pythagoras decreed." It has also been observed, that the philosophy of the druids bore a much greater resemblance to that of Pythagoras than to that of any of the other sages of antiquity. But it seems probable that Ammianus meant no more by the above expression than to illustrate the nature of the druidical fraternities, by comparing them to those of the Pythagoreans, which were well known to the Romans; and the resemblance between the Pythagorean and druidical philosophy may perhaps be best accounted for, by supposing that Pythagoras learned and adopted some of the opinions of the druids, as well as imparted to them some of his discoveries, or that both were derived from a common source. It is well known that this philosopher, animated by the most ardent love of knowledge, travelled into many countries in pursuit of it, and got himself admitted into every society that was famous for its learning. It is therefore highly probable in itself, as well as directly asserted by several authors, that Pythagoras heard the druids of Gaul, and was initiated into their philosophy.

Learning of the druids.

From the concurring testimonies of several authors, it appears that physiology or natural philosophy was the favourite study of the druids of Gaul and Britain. Cicero tells us that he was personally acquainted with one of the Gaulish druids, Divitiacus the Æduan, a man of quality in his own country, who professed to have a thorough knowledge of the laws of nature, or of that science which the

Physics.

Greeks called *physics* or *physiology*. According to Diodorus Siculus, Strabo, Cæsar, Mela, Ammianus Marcellinus, and others, they entered into many disquisitions and disputations in their schools, concerning the form and magnitude of the universe in general, and of this earth in particular, and even concerning the most sublime and hidden secrets of nature. On these and similar subjects they formed a variety of systems and hypotheses, which they delivered to their disciples in verse, that the latter might the more easily retain them in their memories, since they were not allowed to commit them to writing. Strabo has preserved one of the physiological opinions of the druids concerning the universe, viz. that it was never to be entirely destroyed or annihilated, but was to undergo a succession of great changes and revolutions, which were to be produced sometimes by the power and predominacy of water, and sometimes by that of fire. This opinion, he intimates, was not peculiar to them, but was entertained also by the philosophers of other nations; and Cicero speaks of it as a truth universally acknowledged and undeniable. "It is impossible for us," says he, "to attain a glory that is eternal, or even of very long duration, on account of those deluges and conflagrations of the earth, which must necessarily happen at certain periods." This opinion, which was entertained by the most ancient philosophers of many different and very distant nations, was probably neither the result of rational inquiry in all these nations, nor communicated from one of them to others, but descended to them all from their common ancestors of the family of Noah by tradition, though corrupted and misunderstood through length of time. The agreement of the druids with the philosophers of so many other nations in this opinion about the alternate dissolution and renovation of the world, gives us reason to believe that they agreed with them also in their opinion of its origin from two distinct principles: the one intelligent and omnipotent, which was God; the other inanimate and inactive, which was matter. We are told by Cæsar that they had many disquisitions about the power of God; and, no doubt, amongst other particulars, about his creative power. But whether they believed with some that matter was eternal, or with others that it was created, and in what manner they endeavoured to account for the disposition of it into the present form of the universe, we are entirely ignorant, though they certainly had their speculations on these subjects. We are only informed that they did not express their sentiments on these and similar heads in a plain and natural, but in a dark, figurative, and enigmatical manner. This might incline us to suspect that Pythagoras had borrowed from them his doctrines about numbers, to the mystical energy of which he ascribes the formation of all things; for nothing can be more dark and enigmatical than that doctrine. The druids disputed likewise about the magnitude and form of the world in general, and of the earth in particular, of which things they pretended to have a perfect knowledge. We know not what their opinions were about the dimensions of the universe or of the earth, but there is reason to think that they believed both to be of a spherical form. This is visibly the shape and form of the sun, moon, and stars, the most conspicuous parts of the universe; and hence it was natural and easy to infer that such was also the form of the world and of the earth. This seems to have been the prevailing opinion among philosophers of all nations; and the circle was the favourite figure of the druids, as appears from the form both of their houses and places of worship. Besides these general speculations about the origin, dissolution, magnitude, and form of the world and of the earth, the druids engaged in particular inquiries into the natures and properties of the different kinds of substances. But all their discoveries in this most useful and extensive branch of natural philosophy, whatever they were, have been entirely lost.

Astronomy.

Astronomy also appears to have been one of the chief studies of the druids of Gaul and Britain. "The druids," says Cæsar, "have many disquisitions concerning the heavenly bodies and their motions, in which they instruct their disciples." Mela, speaking of the same philosophers, observes, "that they profess to have great knowledge of the motions of the heavens and of the stars." Some knowledge of this science indeed was not only necessary for measuring time in general, marking the duration of the different seasons, regulating the operations of the husbandman, directing the course of the mariner, and for many other purposes in civil life; but it was especially necessary for fixing the times and regular returns of their religious solemnities, of which the druids had the sole direction. Some of these solemnities were monthly, and others annual. It was therefore necessary for them to know, with some tolerable degree of exactness, the number of days in which the sun and moon performed their revolutions, that these solemnities might be observed at their proper seasons. This was the more essential, as some of these solemnities were attended by persons from different and very distant countries, who were all to meet at one place

on one day, and who must have had some rule to discover the annual return of that day.

Their method of computing time.

The most perceptible division of time by means of the two great luminaries is into day and night; the former occasioned by the presence of the sun above the horizon, the latter by his absence, which is in some measure supplied by the moon and stars. The druids computed their time by nights, and not by days; a custom which they had received by tradition from their most remote ancestors, and in which they were confirmed by measuring their time very much by the motions of the moon, the mistress and the queen of night. As the changes in the aspect of that luminary are most conspicuous, they engaged the attention of the most ancient astronomers of all countries, and particularly of the druids, who regulated all their great solemnities, both sacred and civil, by the age and aspect of the moon. "When no unexpected accident prevents it, they assemble upon stated days, either at the time of the new or full moon; for they believe these to be the most auspicious times for transacting all affairs of importance." Their most august ceremony, that of cutting the misletoe from the oak by the archdruid, was always performed on the sixth day of the moon. Nay, they even regulated their military operations by this luminary, and avoided, as much as possible, to engage in battle whilst the moon was on the wane. As the attention of the druids was so much fixed on this planet, it could not be very long before they discovered that she passed through all her various aspects in about thirty days; and by more accurate observations, they would gradually find, that the real time of her performing an entire revolution was very nearly twenty-nine and a half days. This would furnish them with the division of their time into months, or revolutions of the moon; of which we know with certainty they were possessed. But this period, though of great use, was evidently too short for many purposes, and particularly for measuring the seasons; which, they could not fail to perceive, depended on the influences of the sun. By continued observation they discovered that about twelve revolutions of the moon included all the variety of seasons, which began again and revolved every twelve months. This suggested to them that larger division of time called a year, consisting of twelve lunations or three hundred and fifty-four days, which was the most ancient measure of the year in almost all nations. That this was for some time at least the length of the druidical year, is both probable in itself, and apparent from the expression of Pliny, that "they began both their months and years, not from the change, but from the sixth day of the moon;" which is a demonstration that their years consisted of a certain number of lunar revolutions, as they always commenced on the same day of the moon. But as this year of twelve lunar months falls eleven days and nearly one fourth of a day short of a real revolution of the sun, this error would soon be perceived, and call for reformation; though we are not informed of the particular manner in which it was rectified. Various arguments might be collected to render it very probable that the Britons were acquainted with a year exact enough for every purpose of life when they were first invaded by the Romans; but it will be sufficient to mention one, which is taken from the time and circumstances of that invasion. The learned Dr Halley has demonstrated that Cæsar arrived in Britain, in his first year's expedition, on the 26th day of August; and Cæsar himself informs us, that at his arrival the harvest was finished, except in one field, which by some means or other was more backward than the rest of the country. This is a proof that the British husbandmen knew and used the most proper seasons for ploughing, sowing, and reaping. The druids, as we are told by Pliny, had also a cycle or period of thirty years, which they called an age, and which likewise commenced on the sixth day of the moon; but that author has not acquainted us on what principle this cycle was formed, nor to what purpose it was applied. We can hardly suppose that this was the cycle of the sun, which consists of twenty-eight years, and regulates the dominical letters. It is more probable, that whilst the druids made use of the year of twelve lunar months, and had not invented a method of adjusting it to the real revolution of the sun, they observed that the beginning of this year had passed through all the seasons, and returned to the point whence it set out, in a course of about thirty-three years; which they might therefore denominate an age. Others may perhaps be of opinion that this thirty years cycle of the druids is the same with the great year of the Pythagoreans, or a revolution of Saturn. Some have imagined that the druids were also acquainted with the cycle of nineteen years, which is commonly called the cycle of the moon. But the evidence of this depends entirely on the truth of that supposition, that the Hyperborean island, which is described by Diodorus Siculus, was Britain, or some of the British isles. Amongst many surprising things, that author states, concerning the Hyperborean island, that "its inhabitants believed that Apollo descended into their island at the end of every nineteen years; in which period of time the sun and moon, having performed their various revolutions, return to the same point, and begin to repeat the same revolutions. This is called by the Greeks the great year, or the cycle of Meton."

Their knowledge of the stars

We are told both by Cæsar and Mela, that the druids studied the stars as well as the sun and moon; and that they professed to know, and taught their disciples, many things concerning the motions of these heavenly bodies. From these testimonies we may conclude that the druids were acquainted with the planets, distinguished them from the fixed stars, and carefully observed their motions and revolutions. If this discovery was the result of their own observations, it would be gradual, and it would be a long time before they found out all the planets. They might perhaps have received assistance and information from Pythagoras, or from some other quarter. But whether this discovery of the planets was their own, or communicated to them by others, it is highly probable that they were acquainted with the precise number of these wandering stars. Dio Cassius says, that the custom of giving the name of one of the planets to each of the seven days of the week was an invention of the Egyptians, and from them was gradually communicated to all the other nations of the world; and that in his time this custom was so firmly established, not only among the Romans, but among all the rest of mankind, that in every country it appeared to be a native institution. The knowledge of the planets, and perhaps the custom of giving their names to the days of the week, was brought out of Egypt into Italy by Pythagoras, more than five hundred years before the beginning of the Christian era; and from thence it could not be very long before it reached Gaul and Britain. But though we have little or no reason to doubt that the druids knew the number and observed the motion of the planets, yet it may be questioned whether they had discovered the times in which these bodies performed their several revolutions. Some of the planets, as Jupiter and Saturn, take so great a number of years in revolving, that it required a very extraordinary degree of patience and attention to discover the precise periods of their revolutions. If we could be certain that the island in which the ancients imagined Saturn lay asleep was one of the British isles, as Plutarch intimates it was, we might be inclined to think that the British druids were not ignorant of the length of the period

in which the planet Saturn performs a revolution; for that same author, in another treatise, tells us, that "the inhabitants of that island kept every thirtieth year a solemn festival in honour of Saturn, when his star entered into the sign of Taurus." If we could depend upon this testimony, we should have one positive proof that the druids of the British isles were acquainted with the constellations, and even with the signs of the zodiac; and that they measured the revolutions of the sun and planets, by observing the length of time between their departure from and return to one of these signs. But history supplies no direct evidence that this was really the case. The druids of Gaul and Britain, indeed, as well as the ancient philosophers of other countries, had a general plan or system of the universe, and of the disposition and arrangement of its various parts, in which they instructed their disciples. This is both probable in itself, and is plainly intimated by several authors of the greatest authority. But we cannot be certain whether this druidical system of the world was of their own invention, or was borrowed from others. If it was borrowed, it was most probably from the Pythagoreans, to whom they were the nearest neighbours, and with whom they had the greatest intercourse; or at all events from some oriental sect, order, or caste, of which many are of opinion that they originally sprung.

It has been imagined that the druids had instruments of some kind or other, which answered the same purposes as our telescopes, in making observations on the heavenly bodies. The only foundation of this very improbable conjecture is an expression of Diodorus Siculus, in his description of the famous Hyperborean island. "They say further, that the moon is seen from that island, as if she were but at a little distance from the earth, and having hills or mountains like ours on the surface." But no such inference can be reasonably drawn from this expression, which in reality merits little more regard than that which, according to Strabo, was said of some of the inhabitants of Spain, that "they heard the hissing noise of the sun every evening when he fell into the western ocean."

The application of the druids to the study of philosophy and astronomy amounts almost to a demonstration that they applied also to the study of arithmetic and geometry; for some knowledge of both these sciences is indispensably necessary to the natural philosopher and astronomer, as well as of great and daily use in the common affairs of life. If we were certain that Abaris, the famous Hyperborean philosopher, the friend and scholar of Pythagoras, was really a British druid, as some have imagined, we should be able to produce direct historical evidence of their arithmetical knowledge. For Iamblicus, in the life of Pythagoras, says, that "he taught Abaris to find out all truth by the science of arithmetic." It may be thought improbable that the druids had made any considerable progress in arithmetic, as this may seem to have been impossible by the mere strength of memory, without the assistance of figures and of written rules. But it is very difficult to ascertain what may be done by memory alone, when it has been long exercised in this way. We have had examples of persons who could perform some of the most tedious and difficult operations in arithmetic by the mere strength of memory. The want of written rules could be no great disadvantage to the druids, as the precepts of this, as well as of the other sciences, were couched in verse, which would be easily got by heart and long remembered. Though the druids were unacquainted with the Arabic numeral characters, which are now in use, we have no reason to suppose that they were destitute of marks or characters of another kind, which, in some measure, answered the same purposes, both in making and recording their calculations. In particular, it is believed that they made use of the letters of the Greek alphabet for both these purposes. This seems to be pretty distinctly intimated by Cæsar, who, in speaking of the druids of Gaul, observes, that "in almost all other public transactions and private accounts or computations, they make use of the Greek letters." And this is further confirmed by what he says of the Helvetii, a people of the same origin, language, and manners, with the Gauls and Britons. "Tables were found in the camp of the Helvetii written in Greek letters, containing an account of all the men capable of bearing arms who had left their native country, and also separate accounts of the boys, old men, and women." There is historical evidence of the druids being also well acquainted with geometry. "When any disputes arise," says Cæsar, "about their inheritances, or any controversies about the limits of their fields, they are entirely referred to the decision of their druids." But besides the knowledge of mensuration which this implies, both Cæsar and Mela plainly intimate that the druids were conversant in the most sublime speculations of geometry; "in measuring the magnitude of the earth, and even of the world."

Skill in mechanics.

There are still many monuments remaining in Britain and the adjacent isles, which cannot so reasonably be ascribed to any race as to that of the ancient Britons, and which lead us to think that they had made great progress in this department of knowledge, and could apply the mechanical powers so as to produce very astonishing effects. As these monuments appear to have been designed for religious purposes, we may be certain that they were erected under the direction of the druids. Many obelisks or pillars, of one rough unpolished stone each, are still to be seen in Britain and its isles. Some of these pillars are both very thick and lofty, erected on the summits of barrows and of mountains; and some of them, as at Stonehenge, have ponderous blocks of stone raised aloft, and resting on the tops of the upright pillars. We can hardly suppose that it was possible to cut these prodigious masses of stone, some of them above forty tons in weight, without wedges, or to raise them out of the quarry without levers. But it certainly required still greater knowledge of the mechanical powers, and of the method of applying them, to transport those huge stones from the quarry to the places of their destination; to erect the perpendicular pillars, and to elevate the imposts to the tops of these pillars. If the prodigious stone in the parish of Constantine, Cornwall, was really removed by art from its original place, and fixed where it now stands, it is a demonstration that the druids could perform the most astonishing feats by their skill in mechanics. That the British druids were acquainted with the principles and use of the balance, we have reason to believe, not only from the great antiquity of that discovery in other parts of the world, but also from some druidical monuments which are still remaining in this island. These monuments are called *logan stones*, or rocking stones, and each of them consists of one prodigious block of stone, resting upon an upright stone or rock, and so equally balanced, that a very small force, sometimes even that of a child, can move it up and down, though hardly any force is sufficient to remove it from its station. Some of these stones may have fallen into this position by accident, but others of them evidently appear to have been placed in it by art. That the ancient Britons understood the construction and use of wheels, the great number of their war-chariots and other wheel carriages is a sufficient proof; and that they knew how to combine them together and with the other mechanical powers, so as to form machines capable of raising and transporting very heavy weights, we have good rea-

son to believe. In a word, if the British druids were wholly ignorant of the principles and the use of any of the mechanical powers, it was most probably of the screw, though even of this we cannot be certain.

Medicine.

In Germany and in the northern nations of Europe the healing art was chiefly committed to the old women of every state; but in Gaul and Britain it was entrusted to the druids, who were the physicians as well as the priests of these countries. Pliny says expressly, that "Tiberius Cæsar destroyed the druids of the Gauls, who were the poets and physicians of that nation;" and he might have added, of the Britons. The people of Gaul and Britain were probably induced to devolve the care of their health on the druids, and to apply to these priests for the cure of their diseases, not only by the high esteem they had of their wisdom and learning, but also by the opinion which they entertained, that a very intimate connection subsisted between the arts of healing and the rites of religion, and that the former were most effectual when they were accompanied by the latter. It appears indeed to have been the prevailing opinion of the nations of antiquity, that all internal diseases proceeded immediately from the anger of the gods; and that the only way of obtaining relief from these diseases was by applying to the priests to appease their anger by religious rites and sacrifices. This was evidently the opinion and practice of the Gauls and Britons, who in some dangerous cases sacrificed one man as the most effectual means of curing another. "They are much addicted," says Cæsar, "to superstition, and hence those who are afflicted with a dangerous disease sacrifice a man, or promise that they will sacrifice one, for their recovery. For this purpose they make use of the ministry of the druids, because the latter have declared that the anger of the immortal gods cannot be appeased, so as to spare the life of one man, but by the life of another." This way of thinking also gave rise to that great number of magical rites and incantations with which the medical practices of the druids, and indeed of all the physicians of antiquity, were attended. "Nobody doubts," says Pliny, "that magic derived its origin from medicine, and that, by its flattering but delusive promises, it came to be esteemed the most sublime and sacred part of the art of healing."

Botany.

That the druids made great use of herbs for medicinal purposes, there is sufficient evidence. They not only had a most superstitious veneration for the misletoe of the oak, on a religious account, but they also entertained a very high opinion of its medicinal virtues, and esteemed it as a kind of panacea, or remedy for all diseases. "They call it," says Pliny, "by a name which in their language signifies *All-heal*, because they have an opinion that it cures all diseases." They believed it to be in particular a specific against barrenness, and a sovereign antidote against the fatal effects of poisons of all kinds. It was also esteemed an excellent emollient and discutient for softening and discussing hard tumours, and good for drying up scrofulous sores, and curing ulcers and wounds; and, provided it was not suffered to touch the earth after it was cut, it was thought to be a very efficacious medicine in epilepsy. It has been thought useful in this last calamitous disease by some modern physicians. The pompous ceremonies with which the misletoe was gathered by the druids have been already described. The selago, a kind of hedge hyssop resembling savin, was another plant much admired by the druids of Gaul and Britain for its supposed medicinal virtues, particularly in all diseases of the eyes. But its efficacy, according to them, depended very much upon its being gathered exactly in the following manner: The person who gathered it was to be clothed in a white robe; to have his feet bare, and washed in pure water; to offer a sacrifice of bread and wine before he proceeded to cut it, which he was to do with his right hand covered with the skirt of his garment, and with a hook of some more precious metal than iron. When it was cut, it was to be received and kept in a new and very clean cloth. Gathered exactly according to this whimsical ritual, it was affirmed to be not only an excellent medicine, but also a powerful charm and preservative against misfortunes and unhappy accidents of all kinds. The druids also entertained a high opinion of the herb samolus or mashwort, from its sanative qualities, and gave directions for gathering it, not less fanciful than those which have already been mentioned. The person who was to perform that office was to do it fasting, and with his left hand; he was on no account to look behind him, nor to turn his face from the herbs he was gathering. It would be tedious to relate the extravagant notions they entertained of the many virtues of the vervain, and to recount the ridiculous mummeries which they practised in gathering and preparing it, both for the purposes of divination and physic. It is easy to see that Pliny's information was very imperfect; and that, like many of the other Greek and Roman writers, he designedly represented the philosophers of Gaul and Britain in an unfavourable light. The herb called *Britannica* by the ancients, which some think was the great water-dock, and others the *cochlearia* or scurvy-grass, was probably much used in this island for medicinal purposes, as it derived its name from Britain, and was thence exported to Rome and other parts. Though these few imperfect hints are all that we can now collect of the botany of the British druids, yet there is some reason to think that they were not contemptible botanists. Their circumstances were peculiarly favourable for the acquisition of this kind of knowledge. For as they spent most of their time in the recesses of mountains, groves, and woods, the spontaneous vegetable productions of the earth constantly presented themselves to their view, and courted their attention.

The opinions which, it is said, the druids of Gaul and Britain entertained of the anguinum or serpent's egg, both as a charm and as a medicine, are romantic and extravagant in a very high degree. This extraordinary egg was formed, as they pretended, by a great number of serpents, interwoven and twined together; and when it had been formed, it was raised up in the air by the hissing of these serpents, and was then to be caught in a clean white cloth before it fell to the ground. The person who caught it was obliged to mount a swift horse, and to ride away at full speed to escape from the serpents, who pursued him with great rage, until they were stopped by some river. The way of making trial of the genuineness of the egg was no less extraordinary. It was to be encased in gold, and thrown into a river, and if it was genuine it would swim against the stream. "I have seen," says Pliny, "that egg; it is about the bigness of a moderate apple, its shell is a cartilaginous incrustation, full of little cavities, such as are on the legs of the polypus; it is the insignia or badge of distinction of the druids." The virtues which they ascribed to this egg were many and wonderful. It was particularly efficacious in rendering those who carried it about with them superior to their adversaries in all disputes, and in procuring them the favour and friendship of great men. Some have thought that this whole affair of the serpent's egg was a mere fraud, contrived by the druids to excite the admiration and pick the pockets of a credulous people, who purchased these wonder-working eggs from them at a high price. Others have imagined that this story of the anguinum, of which there is an ancient monument in the cathedral at Paris, was an emblematical representation of the doctrine of the druids concerning the creation of the

world. The serpents, say they, represent the divine wisdom forming the universe, and the egg is the emblem of the world formed by that wisdom. It may be added, that the virtue ascribed to the anguinum, of giving those who possessed it a superiority over others, and endearing them to great men, may perhaps be intended to represent the natural effects of learning and philosophy. But in so doubtful a matter every one is of course at liberty to form what judgment he thinks proper.

Rhetoric. As the influence and authority of the druids in their country depended very much upon the reputation of their superior wisdom and learning, they wisely applied to the study of those sciences which most directly contributed to the support and advancement of that reputation. In this number, besides those already mentioned, we may justly reckon rhetoric, which was diligently studied and taught by the druids of Gaul and Britain, who to the charms of their eloquence were indebted for much of the admiration and authority which they enjoyed. They had indeed many calls and opportunities to display their eloquence, and to discover its great power and efficacy; as, when they were teaching their pupils in their schools; when they discoursed in public to the people on religious and moral subjects; when they pleaded causes in the courts of justice; and when they harangued in great councils of the nation, and at the heads of armies ready to engage in battle, sometimes with a view to inflame their courage, and at other times with a design to allay their fury, and dispose them to make peace. Though this last was certainly a difficult task amongst fierce and warlike nations, yet such was the authority and eloquence of the druids, that they frequently succeeded in it. "They pay a great regard," says Diodorus Siculus, "to their exhortations, not only in the affairs of peace, but even of war; and these are respected both by their friends and enemies. They sometimes step in between two hostile armies, who are standing with their swords drawn and their spears extended, ready to engage; and by their eloquence, as by an irresistible enchantment, they prevent the effusion of blood, and prevail upon them to sheath their swords. So great are the charms of eloquence and the power of wisdom even amongst the most fierce barbarians." The British kings and chieftains, who were educated by the druids, were famous for their eloquence. This is evident from the many noble speeches which are ascribed to them by the Greek and Roman writers. For though these speeches may not be genuine, yet they are a proof that it was a well-known fact that these princes were accustomed to make harangues on such occasions. This we are expressly told by Tacitus: "The British chieftains, before a battle, fly from rank to rank, and address their men with animating speeches, tending to inflame their courage, increase their hopes, and dispel their fears." These harangues were called, in the ancient language of Britain, *brosnichty-kah*, which is literally translated by Tacitus, *incitamenta belli*, incentives to war. The genuine posterity of the ancient Britons long retained their taste for eloquence, and their high esteem for those who excelled in that art. "Orators," says Mr Martin, "were in high esteem, both in these islands (the Hebrides) and the continent, until within these forty years. They sat always among the nobles or chiefs of families in the streah or circle. Their houses and little villages were sanctuaries, as well as churches, and they took place before doctors of physic. The orators, after the druids were extinct, were brought in to preserve the genealogy of families, and to repeat the same at every succession of a chief; and upon the occasion of marriages and births, they made epithalamiums and panegyrics, which the poet or bard pronounced. The orators, by the force of their eloquence, had a powerful ascendant over the greatest men in their time. For if any orator did but ask the habit, arms, horse, or any other thing belonging to the greatest man in these islands, it was readily granted him; sometimes out of respect, and sometimes for fear of being exclaimed against by a satire, which in those days was reckoned a great dishonour."

Magic and divination. If the British druids, considering the times in which they lived, had made no contemptible proficiency in several parts of real and useful learning, it cannot be denied that they were also great pretenders to superior knowledge in certain vain and fallacious sciences, by which they excited the admiration, and took advantage of the ignorance and credulity, of mankind. These were the sciences, if they may be so called, of magic and divination, by means of which they pretended to work a kind of miracles, and exhibit astonishing appearances in nature; to penetrate into the counsels of heaven; to foretel future events, and to discover the success or miscarriage of public or private undertakings. Their own countrymen not only believed that the druids of Gaul and Britain were possessed of these powers, but they were celebrated on this account by the philosophers of Greece and Rome. "In Britain," says Pliny, "the magic arts are cultivated with such astonishing success, and so many ceremonies, at this day, that the Britons seem to be capable of instructing even the Persians themselves in these arts. They pretend to discover the designs and purposes of the gods. The Eubates or Vates in particular investigate and display the most sublime secrets of nature; and by auspices and sacrifices they foretel future events." They were so famous for the supposed veracity of their predictions, that they were not only consulted on all important occasions by their own princes and great men, but even sometimes by the Roman emperors. Nor is it very difficult to account for all this. The druids finding that the reputation of their magical and prophetical powers contributed not a little to the advancement of their wealth and influence, naturally endeavoured to strengthen and establish it by all their art and cunning. Their knowledge of natural philosophy and mechanics enabled them to execute such works, and to exhibit such appearances, or to make the world believe that they did exhibit them, as were sufficient to gain them the character of great magicians. The truth is, that nothing is more easy than to acquire this character in a dark age, and among an unenlightened people. When the minds of men are haunted with dreams of charms and enchantments, they are apt to fancy that the most common occurrences in nature are the effects of magical arts. The following strange story, which we meet with in Plutarch's Treatise of the Cessation of Oracles, was probably occasioned by something of this kind. "There are many islands which lie scattered about the isle of Britain, after the manner of our Sporades. They are generally unpeopled, and some of them are called the *Islands of the Heroes*. One Demetrius was sent by the emperor [probably Claudius] to discover these parts. He arrived at one of these islands [supposed by some to be Anglesey, but more probably one of the Hebrides] next adjoining to the isle of Britain before mentioned, which was inhabited by a few Britons, who were esteemed sacred and inviolable by their countrymen. Immediately after his arrival the air grew black and troubled, and strange apparitions were seen; the winds rose to a tempest, and fiery spouts and whirlwinds appeared dancing towards the earth." This was probably no more than a storm of wind, accompanied with rain and lightning, a thing neither unnatural nor uncommon: but Demetrius and his companions having heard that the British druids, by whom this isle was chiefly inhabited, were great magicians, imagined that it was raised by them, and fancied that they saw many strange and unnatural sights.

The druids did not think proper to undeceive them; for when they inquired about the cause of this storm, they were told that it was occasioned by the death of one of those invisible beings or genii who frequented their isle; a wonderful and artful tale, very well calculated to increase the superstitious terrors of Demetrius and his crew, and to determine them to abandon this enchanted isle, with a resolution never to return. Stonehenge, and several other works of the druids, were, for many ages after the destruction of their whole order, believed to have been executed by the arts of magic and enchantment; nor is it improbable that they persuaded the vulgar in their own times to entertain the same opinion of these works, by concealing from them the real arts by which they had been erected. The natural and acquired sagacity of the druids, with their long experience and great concern in the conduct of affairs, enabled them to form very probable conjectures about the event of enterprises. These conjectures they pronounced as oracles when they were consulted; and they pretended to derive them from the inspection of the entrails of victims, the observation of the flight and feeding of certain birds, and many other mummeries. By these and similar arts they obtained and preserved the reputation of prophetic foresight among an ignorant and credulous people. But these pretensions of the druids to magic and divination, which contributed so much to the advancement of their fame and fortune in their own times, have brought very heavy reproaches upon their memory, and have made some learned moderns declare that they ought to be expunged out of the catalogue of philosophers, and esteemed no better than mere cheats and jugglers. This censure is evidently too severe, and might have been pronounced with equal justice upon all the ancient philosophers of Egypt, Assyria, Persia, Greece, and Rome, who were great pretenders to magic and divination, as well as the druids. "I know of no nation in the world," says Cicero, "either so polite and learned, or so savage and barbarous, as not to believe that future events are presignified to us, and may by some men be discovered and foretold." The only conclusion, therefore, that can be fairly drawn from the successful pretensions of the British druids to the arts of magic and of divination, is this: That they had more knowledge than their countrymen and contemporaries, but had not so much virtue as to resist the temptation of imposing upon their ignorance to their own advantage.

DRUM is a martial instrument in the form of a cylinder, hollow within, and covered at the two ends with vellum, which is stretched or slackened at pleasure by means of small cords or sliding knots. It is beat upon with sticks. Drums are sometimes made of brass, but most commonly of wood. The drum is said by Le Clerc to have been an oriental invention, and to have been brought into Spain by the Arabians, or perhaps rather the Moors.

Kettle DRUMS are two sorts of large basons of copper or brass, rounded in the bottom, and covered with vellum or goat skin, which is kept fast by a circle of iron round the body of the drum, with a number of screws to screw up and down. Drums are much used in the army, as also in operas, oratorios, concerts, and the like. See MUSIC, § *Musical Instruments*.

DRUMMOND, WILLIAM, was born at Hawthornden on the 13th of December 1585. His father was Sir John Drummond, descended from the family of Carnock, a branch of the more illustrious family of Stobhall, from which the king derives his remote lineage through Anabella Drummond, the mother of James the First. The poet's mother was Anne the daughter of William Fowler;[1] and she is described as "a woman of excellent breeding, and of a good and virtuous life." William was the eldest of four sons, and there were three daughters by the same marriage. The earlier part of his education he received at the High School of Edinburgh, where he began to distinguish himself by the superiority of his talents; and being afterwards removed to the university, which was then a very recent institution, he took the degree of A. M. in the year 1605. We are particularly informed that he did not confine his attention to the metaphysical learning commonly taught in the schools, but likewise applied himself to the study of mathematics and of ancient authors. During the following year, his father sent him to complete his education in France; and in the university of Bourges he is said to have devoted himself with great assiduity and success to the study of the civil law; a study necessary to a lawyer, and useful to a scholar. After an absence of four years, he returned to his native country in 1610; and his friends now expected that he would devote himself to the practice of a lucrative profession, for which he seemed eminently qualified by his talents and learning.[2] The bar must however have presented very few attractions to a youth of his elegant taste and delicate sensibility: the municipal law was then but a dreary path, beset with thorns which never blossomed; and, what was particularly discouraging, there was not a single elementary book, there were no institutions of our law, from which a young student could derive a comprehensive knowledge of those principles which were afterwards to direct his practice. His systematic doctrines were indeed to a great extent borrowed from the ancient civilians, and the study of the civil law was generally prosecuted in some foreign university; but, besides an indispensable attendance in the courts, his final preparation for the practice of his profession consisted in reading the statute law, and such collections of maxims and reports as were then circulated in manuscript. Nor was Drummond compelled by any domestic considerations to overcome his repugnance: he was beyond the reach of that original impulse which has directed many a lawyer to reputation and emolument; for, about the period of his return from the continent, the death of his father left him in possession of an estate sufficient to maintain him in the liberal style of a gentleman.

[1] He is commonly described as Sir William Fowler, secretary to the queen, but this account of his quality is evidently erroneous. The secretary was his son, who bore the same name with himself; nor does it appear that either of them received the honour of knighthood. The son followed the queen to England; and a list of the officers of her council, dated in October 1603, describes him as "Secretarie, and Master of the Requests." (Lodge's Illustrations of British History, vol. iii. p. 209.) In 1587, we find him denominated parson of Hawick; and the records of the presbytery, 2 Sept. 1612, mention him as then dead. It is however more than probable that he continued a layman, and, at a period when such irregular proceedings were not uncommon, enjoyed the temporalities of that living without residence and without qualification. His poems are not unknown to those who are acquainted with the literary history of that age. Of some of his manuscripts, as well as those of his nephew, Mr Laing has given an account in the Transactions of the Society of Antiquaries of Scotland, vol. iv.

[2] President Lockhart is said to have averred, that if he had followed the legal profession, he might have made the best figure of any lawyer in his time. But the accuracy of this tradition, says Mr Maitland, "may reasonably be doubted. Drummond has left a record of the books read by him between 1606 and 1614, from which it is apparent that literature occupied a much larger portion of his attention than law. In the detail of his studies, which were in a great measure confined to the most popular poetry and romances of the time, he mentions no other work on law than the Institutes of Justinian." (Introduction to Drummond's Poems. Edinb. 1832, 4to.)

He now retired to his family residence at Hawthornden, six miles from Edinburgh, and resumed the study of the Greek and Latin classics. The immediate vicinity presents an air of such romantic beauty, that a poet could scarcely have found a more suitable habitation: his house is erected on the edge of a woody cliff which overhangs the river Esk; and at one extremity of the variegated and sequestered glen stand the ruins of the baronial castle and the collegiate church of Roslin. The ancient caves of Hawthornden, and the adjacent moor of Roslin, where Comyn and Fraser gained a signal victory over the English, have likewise their peculiar effect in impressing the imagination. Near the poet's house is a seat hewn in the solid rock, and still described by the name of the Cypress-grove; a name which it obtained from the circumstance of his having frequented this spot when engaged in the composition of a work which bears that title.

Here Damon ' sat' whose songs did sometime grace
The murmuring Esk; may roses shade the place.

In this delightful seclusion he devoted himself to the general improvement of his mind, and to the occasional exercise of his fine talents; and many of his poems appear to have been composed about this period of his life.[1] He chiefly cultivated the familiarity of the university men, and other individuals of genius and learning: among his own countrymen, he enjoyed the particular friendship of the earl of Stirling, the earl of Ancram, Arthur Johnston, and John Adamson; and among the English poets, his greatest intimacy and correspondence was with Ben Jonson and Michael Drayton. The grandfather of Jonson was originally from Annandale, where Johnstone is still a very prevalent name. In the year 1619, when this celebrated poet had attained the age of forty-five, he travelled from London on foot, for the express purpose of paying Drummond a visit; and at Hawthornden he spent three or four weeks with every appearance of satisfaction.[2] The heads of some of Jonson's conversations on subjects of literature, together with his own impressions of Jonson's character, he committed to writing, with the manifest intention of occasionally referring to this as a private record: many years after his death, this paper was communicated to the public, apparently in a somewhat mutilated form; and as it does not represent his distinguished guest as altogether faultless, the amiable and esteemed writer has incurred the virulent and unmeasured censure of Mr Gifford, the late editor of Jonson's works.[3] If Drummond had resembled some more recent authors, who have violated all the decencies of private life by ministering to the gross appetite of the public with ridiculous or disparaging tales of their friends and acquaintance, the justice of this strong condemnation could not safely have been disputed; but what person of ordinary candour will thus censure an act which, to all human appearance, was entirely unconnected with malevolent or ungenerous motives?

The poet's tranquillity was exposed to a severe interruption from the unfortunate issue of his first love. He became deeply enamoured of a beautiful young lady, the daughter of Cunningham of Barns; he met with a suitable return, and a day was fixed for their nuptials, but before that day arrived, her life was terminated by a rapid fever. Such an event as this, which would have affected a lover of the most ordinary sensibility, could not but sink deeply into the heart of one who had assiduously cherished the softer feelings, and whose habits of seclusion were so directly calculated to preserve a lasting impression of melancholy. He was so overwhelmed with grief that he found it necessary to try the effect of a change of objects; and he accordingly retired to the continent, where he spent about eight years. His longest residence was at Paris and Rome; but he travelled through France, Germany, and Italy, visited the most celebrated universities, and conversed with men of learning. In the course of his peregrinations, he is said to have formed an excellent collection, not only of the ancient classics, but likewise of the best writers in the French, Italian, and Spanish languages. He presented to the university of Edinburgh a collection of books and manuscripts, of which he printed a catalogue in the year 1627, prefixing to it an appropriate preface written in Latin. Of this well-known collection, the value, that is, the extrinsic or pecuniary value, which was far from being inconsiderable at first, has been immensely encreased by the lapse of two centuries. It contains many Scottish and English publications of singular rarity. When Drummond returned to Scotland, he found his countrymen divided by fears and animosities. He now spent some time at the residence of his brother-in-law Sir John Scot of Scotstarvet, a learned man, and an encourager of learning. Having continued in a state of celibacy till the age of forty-seven, he in 1632 married Elizabeth Logan; a lady in whom he traced a strong resemblance to his first mistress. She is commonly represented as the grand-daughter of Sir Robert Logan of Restalrig; but, according to Hay, her father, who was altogether unconnected with that family, was minister of Edleston in the county of Peebles, and her mother was the daughter of a shepherd.[4] Of this marriage there were five sons and four daughters. John, the eldest son, died in his youth; William was knighted by Charles the Second, and lived to an advanced age;[5] Robert was married, but died about the age of forty without children; the two youngest, Richard and James, died in their infancy. The eldest daughter Elizabeth was married to Dr Henryson, an eminent physician in Edinburgh;[6] but the other three, Margaret, Anabella, and Jane, died very young.[7] The father was a decided

[1] The first edition of his poems has the following title: "Poems, amorous, funerall, diuine, pastorall, in Sonnets, Songs, Sextains, Madrigals. By W. D. the author of the Teares on the Death of Mœliades." Edinbvrgh, printed by Andro Hart, 1616, 4to. Another edition, or the same edition with a new title, bears "Poems, by William Drvmmond of Hawthorne-denne. The second impression." Edinbvrgh, printed by Andro Hart, 1616, 4to.

[2] To this visit another poet of exquisite talents makes the following allusion:

Then will I dress once more the faded bower,
Where Jonson sat in Drummond's classic shade.
COLLINS's Ode to John Home.

[3] Gifford's Memoirs of Jonson, p. cxxx.—This charge has been sufficiently repelled by Sir Walter Scott in his Provincial Antiquities of Scotland, vol. ii. p. 133. See likewise Dr Drake's Mornings in Spring, vol. i. p. 286.

[4] Hay's Memoirs, vol. ii. p. 105. MS. Adv. Lib.

[5] Sir William Drummond is more celebrated for his jovialty than for his literature. See Dr Pennecuik's Poems, p. 49. 52. An honourable instance of his humanity is recorded in the Memoirs of George Brysson, p. 285.

[6] This was probably Henry Henryson, M. D. of Elvingston, whose Latin version of the hundred and fourth psalm occurs in the *Octupla*. Edinb. 1696, 8vo. He is more commonly called Henderson, which is a corruption of the other name. Elizabeth, the heiress of her father Dr Henry Henderson of Elvington, was married to John Clerk of Pennecuik. (Inquisitionum Abbreviatio, vol. i. Haddington, 341.)

[7] Douglas's Baronage of Scotland, p. 573, compared with Sage's Life of Drummond, p. vi.

cavalier, and wielded his pen, though not his sword, in the king's service; and being reputed a malignant, he was exposed to some of the usual molestations of those unhappy times. The tragical fate of his sovereign is said to have hastened his own dissolution: we are informed by Bishop Sage that Drummond, being weakened by hard study and disease, was so overwhelmed with extreme grief and anguish that he died on the 4th of December 1649.[1] But as the king was executed on the 30th of January, an interval of more than ten months must have occurred between his death and that of his faithful subject; an interval so long as to render the biographer's inference somewhat questionable. He had nearly completed the sixty-fourth year of his age. His remains were interred in the church of Lasswade, which stands at the distance of about a mile from Hawthornden. He appears through life to have maintained a character of uniform respectability; uniting with his other qualities that of consistent piety, and blending morality with his devotion. His death was affectionately lamented by his friend Colonel Lauder of Hatton, who has left several other specimens of his poetical talents, and who was not the only Scottish soldier of this period that evinced his love of the Muses.

Drummond was evidently a man of superior talents and accomplishments. We are informed that he was familiarly acquainted with the best Greek and Latin authors: his long residence on the continent afforded him an excellent opportunity of acquiring a knowledge of the living languages; and he is said to have spoken French, Italian, and Spanish, as fluently as his native tongue. To his graver qualifications he added no mean proficiency in music; and he occasionally sought a relaxation from his studies by playing on the lute, "which he did to admiration." He seems to have devoted a considerable portion of his time to the invention or improvement of various instruments and machines, applicable to various purposes of peace or war. They are curiously enumerated, to the extent of sixteen, in a patent which he obtained in the year 1627, and which secured to him the sole right and property within the kingdom of Scotland for the space of twenty-one years.[2]

His literary productions exhibit considerable variety. His compositions in prose chiefly consist of the Cypress Grove, some political tracts, and the History of the five Jameses; a work which embraces the history of Scotland from 1423 to 1542.[3] "The best of Drummond's prose works," says Mr Headley, "is his Cypress Grove, which, though quaint in its style, is worth reading for its vein of dignified morality." His history, which has alternately been the object of extravagant commendation and unsparing censure, cannot now be regarded as a work of much value or interest: the author's materials are not generally drawn from recondite sources, and his manner is too rhetorical. For the reputation which he still retains, Drummond is chiefly indebted, not to his historical, but to his poetical excellence; and, in the opinion of competent judges, he is entitled to a distinguished place among the English poets of that age. As few of his poems extend to a considerable length, his genius cannot be estimated by the success of any great and continued effort; but notwithstanding the shortness of his flights, he generally soars on bright and steady wings. He is conspicuous for his delicate sensibility and warmth of fancy; and with these qualities, so essential in an amatory poet, he unites uncommon skill in versification. His taste seems in a great measure to have been formed upon the Italian model, nor are his compositions entirely free from Italian conceits; but he commonly maintains a degree of elegant simplicity to which few English poets of that age have attained.

The reputation which Drummond enjoyed during his life, appears to have suffered some diminution after his death. He was a gentleman, says Edward Phillips, "who imitating the Italian manner of versifying, vented his amours in sonnets, canzonets, and madrigals, and, to my thinking, in a style sufficiently smooth and delightful; and therefore why so utterly disregarded and layd aside at present, I leave to the more curious palats in poetry."[4] After an interval of more than a century, the same complaint of unmerited neglect was repeated by Mr Headley. "Without ostentatious praise (which is always to be suspected), it is but truth to observe that many of his sonnets, those more especially which are divested of Italian conceits, resemble the best Greek epigrams in their best taste, in that exquisite delicacy of sentiment, and simplicity of expression, for which our language has no single term, but which is known to all classical readers by the word ἀφελεια. It is in vain we lament the fate of many of our poets, who have undeservedly fallen victims to a premature oblivion, when the finished productions of this man are little known and still less read."[5]

Drummond's sonnets form a very considerable proportion of his poetical works. The following four may be selected as a specimen of the entire collection; and they are here exhibited in modern orthography.

I know that all beneath the moon decays,
  And what by mortals in this world is brought,
  In Time's great periods shall return to nought;
That fairest states have fatal nights and days:
I know how all the Muse's heavenly lays,
  With toil of spright which are so dearly bought,
  As idle sounds, of few or none are sought,
And that nought lighter is than airy praise:
I know frail beauty like the purple flower,
  To which one morn oft birth and death affords;
  That love a jarring is of minds' accords,
When sense and will invassal reason's power.
Know what I list, this all cannot me move
But that, O me! I both must write and love.

With flaming horns the Bull now brings the year,
  Melt do the horrid mountains' helms of snow,
  The silver floods in pearly channels flow,
The late-bare woods green anadems do wear;
  The nightingale, forgetting winter's woe,
Calls up the lazy morn her notes to hear;
  Those flowers are spread which names of princes bear,
  Some red, some azure, white, and golden grow.
Here lows a heifer, there bewailing strays
  A harmless lamb, not far a stag rebounds;
The shepherds sing to grazing flocks sweet lays,
  And all about the echoing air resounds.

[1] Sir Thomas Urquhart is said to have expired in a paroxysm of laughter, on hearing of the restoration of Charles the Second; a statement which is rendered sufficiently probable by the record of similar cases, and by the eccentric character of the individual. Aretæus, an ancient physician, specifies unextinguishable laughter as one of the causes of death: γελως ἀσβεστος μεχρι θανατου. (De Causis et Signis Morborum, lib. i. p. 35. edit. Boerhaave. Lugd. Bat. 1735, fol.) And other ancient writers have mentioned the names of different persons who died of excessive joy. (Valerius Maximus, lib. ix. cap. xii. Plinii Hist. Nat. lib. vii. cap. liii.) According to the common account, Sophocles was of this number.

[2] Drummond's Works, p. 235. Edinb. 1711, fol.

[3] Of his History of Scotland, the first edition is that of London, 1655, fol. The introduction was written by Mr Hall of Gray's Inn. There are other three editions.

[4] Phillips's Theatrum Poetarum, or compleat Collection of the Poets, part ii. p. 192. Lond. 1675, 12mo.

[5] Headley's Biographical Sketches (p. xlv.) prefixed to Select Beauties of Ancient English Poetry. Lond. 1787, 2 vols. 8vo.

Hills, dales, woods, floods, and every thing doth change,
But she in rigour, I in love am strange.

Trust not, sweet soul, those curled waves of gold,
With gentle tides which on your temples flow,
Nor temples spread with flakes of virgin snow,
Nor snow of cheeks with Tyrian grain enroll'd;
Trust not those shining lights which wrought my woe,
When first I did their burning rays behold,
Nor voice, whose sounds more strange effects do show
Than of the Thracian harper have been told.
Look to this dying lily, fading rose,
Dark hyacinth, of late whose blushing beams
Made all the neighbouring herbs and grass rejoice,
And think how little is 'twixt life's extremes.
The cruel tyrant that did kill those flowers,
Shall once, aye me! not spare that spring of yours.

What doth it serve to see sun's burning face,
And skies enamell'd with both the Indies' gold,
Or moon at night in jetty chariot rolled,
And all the glory of that starry place?
What doth it serve earth's beauties to behold,
The mountains' pride, the meadows' flowing grace,
The stately comeliness of forests old,
The sport of floods, which would themselves embrace?
What doth it serve to hear the Sylvans' songs,
The wanton merle, the nightingale's sad strains,
Which in dark shades seem to deplore my wrongs?
For what doth serve all that this world contains,
Sith she, for whom those once to me were dear,
No part of them can have now with me here?

To some of his compositions, which he has described as songs, this title is by no means applicable; it is neither applicable to the vein of poetry, nor to the measure of the verse. One striking poem, which he entitles a song, is written in heroic couplets, and contains such passages as this:

And tell me, thou who dost so much admire
This little vapour, smoke, this spark or fire,
Which life is call'd, what doth it thee bequeath
But some few years which birth draws out to death?
Which if thou paragon with lustres run,
And them whose career is but now begun,
In day's great vast they shall far less appear,
Than with the sea when matched is a tear.
But why would'st thou here longer wish to be?
One year doth serve all nature's pomp to see,
Nay, even one day and night: this moon, that sun,
Those lesser fires about this round which run,
Be but the same which, under Saturn's reign,
Did the serpenting seasons interchain.
How oft doth life grow less by living long,
And what excelleth but what dieth young?[1]

His collection of sacred verses, which he entitles Flowres of Sion,[2] contain much poetical imagery and expression. Some of the topics cannot be very safely approached by a poet, who must place his chief reliance on the exercise of his fancy; and the subsequent lines of this writer may sometimes occur to the recollection of his reader:

Who would this Eden force with wit or sense,
A cherubim shall find to bar him thence.

One of the longest poems in this collection, entitled a Hymne on the fairest Faire, contains the following among many other striking passages:

Ah! as a pilgrim who the Alps doth pass,
Or Atlas' temples crown'd with winter's glass,
The airy Caucasus, the Apennine,
Pyrenes cliffs where sun doth never shine,
When he some heaps of hills hath over-went,
Begins to think on rest, his journey spent,
Till, mounting some tall mountain, he doth find
More heights before him than he left behind:
With halting pace so while I would me raise
To the unbounded circuits of thy praise,
Some part of way I thought to have o'er-run,
But now I see how scarce I have begun,
With wonders new my spirits range possest,
And wand'ring wayless in a maze them rest.

It has been suggested by Mr Headley that one would be induced to suppose Pope must have remembered these lines when he wrote a well-known passage in his Essay on Criticism. The subsequent couplet, which occurs in the same hymn, is remarkable for its energetic simplicity:

Uncomprehensible by reachless height,
And unperceived by excessive light.

Another poem of considerable length he entitles the Shadow of the Judgment. It is left in an unfinished state, and is not included in the collection published under the direction of Sir John Scot;[3] but it nevertheless contains many passages worthy of the author's reputation. An elegant critic has remarked that the following verses, describing God moved to wrath, are in Milton's manner:

So seeing earth, of angels once the inn,
Mansion of saints, deflowred all by sin,
And quite confus'd by wretches here beneath,
The world's great sovereign moved was to wrath.
Thrice did he rouse himself, thrice from his face
Flames sparkle did throughout the heavenly place:
The stars, though fixed, in their rounds did quake,
The earth, and earth-embracing sea did shake:
Carmel and Hæmus felt it, Athos' tops
Affrighted shrunk, and near the Ethiops
Atlas, the Pyrenees, the Apennine,
And lofty Grampius, which with snow doth shine.
Then to the synod of the sprights he swore,
Man's care should end, and time should be no more.

Drummond's poem in commemoration of Prince Henry[4] commences in a strain somewhat bombastic, but it contains some elegant and striking passages. The subsequent lines exhibit a very favourable specimen of his versification; and it is proper to recollect that the poem was printed so early as the year 1613. He describes the lamented youth as rejoicing to look down to the azure bars of heaven,

And in their turning temples to behold,
In silver robe the moon, the sun in gold,
Like young eye-speaking lovers in a dance,
With majesty by turns retire, advance.
Thou wonderest earth to see hang like a ball,
Clos'd in the ghastly cloister of this all;

Ὁν οἱ θεοι φιλουσιν ἀποθνησκει νεος.
MENANDRI Fragmenta, p. 48. edit. Meineke.

[2] Flowres of Sion. By William Drvmmond of Hawthorne-denne. To which is adjoyned his Cypresse Groue. 1623, 4to. Edenbovrgh, printed by Iohn Hart, 1630, 4to.

[3] Poems by that most famous wit Mr William Drummond of Hawthornden. . Lond. 1656, 8vo. The editor was Edward Phillips, the nephew of Milton. The same edition was exhibited under a new and fantastic title, with the date of 1659. A more extensive collection of his poems is to be found in the Works of William Drummond of Hawthornden. Edinb. 1711, fol. Bishop Sage's life of the author is prefixed to this publication. But the most complete, as well as the most elegant edition was printed under the superintendence of Mr Maitland: "The Poems of William Drummond of Hawthornden." Edinb. 1832, 4to. The book however is not published: it was the splendid contribution of William Macdowall, Esq. of Garthland to the Maitland Club.

[4] Teares on the Death of Mœliades. Edinbvrgh, printed by Andro Hart, 1613, 4to. His two sonnets and epitaph, which appear in this publication, are likewise inserted in the "Mavsolevm, or choisest Flowres of the Epitaphs, written on the Death of the neuer-too-much lamented Prince Henrie." Edinb. 1613, 4to. A third edition of the "Teares on the Death of Mœliades" soon followed. Edinb. 1614, 4to. The second we have not seen.

And that poor men should prove so madly fond
To toss themselves for a small foot of ground;
Nay, that they even dare brave the powers above,
From this base stage of chance that cannot move.
All worldly pomp and pride thou seest arise
Like smoke, that scatt'reth in the empty skies.
Other hills and forests, other sumptuous tow'rs,
Amaz'd thou find'st excelling our poor bow'rs;
Courts void of flattery, of malice minds,
Pleasure which lasts, not such as reason blinds.

Forth Feasting, a poem written in the year 1617 on the king's visit to his native country,[1] may be considered as his best performance; it abounds with poetical imagery, and the versification possesses uncommon terseness and harmony. In all poems of the same age and denomination, the reader must necessarily expect a certain sprinkling of mythology; this is a prevailing vice, an endemic disease, among the poets of that period; but Forth Feasting is enlivened by an elegant vein of fancy, and contains various passages of distinguished felicity. In the following nervous lines, he pays a warm and not unmerited compliment to the monarch's love of peace:

Now, where the wounded knight his life did bleed,
The wanton swain sits piping on a reed,
And where the cannon did Jove's thunder scorn,
The gaudy huntsman winds his shrill-tun'd horn;
Her green locks Ceres without fear doth dye,
The pilgrim safely in the shade doth lie,
Both Pan and Pales careless keep their flocks,
Seas have no dangers save the winds and rocks:
Thou art this isle's Palladium, neither can,
While thou art kept, it be o'erthrown by man.
Let others boast of blood and spoils of foes,
Fierce rapines, murders, Iliads of woes,
Of hated pomp, and trophies reared fair,
Gore-spangled ensigns streaming in the air,
Count how they make the Scythian them adore,
The Gaditan, the soldier of Aurore;
Unhappy vauntry! to enlarge their bounds,
Which charge themselves with cares, their friends with wounds,
Which have no law to their ambitious will,
But, man plagues, born are human blood to spill:
Thou a true victor art, sent from above,
What others strain by force to gain by love;
World-wand'ring Fame this praise to thee imparts,
To be the only monarch of all hearts.

When the successor of this king visited his northern dominions in the year 1633, Drummond contributed the verses for the pageants which welcomed his arrival in Edinburgh.[2] These verses, although they do not exhibit passages equal to those which we have lately examined, are not destitute of merit. Of the frequent compression and harmony of his couplets, every reader must be sufficiently aware; and the excellence of his versification has been highly extolled by an English critic. Waller and Denham are often regarded as the great improvers of a mode of versification which was carried to greater perfection by Dryden; but the Tears on the Death of Mœliades, and Forth Feasting, were composed several years before either of those poets had reached the age of manhood.[3] J. B—E.

DRUMMOND, *Sir William*, of Logie-Almond, a distinguished scholar, acute philosopher, and accomplished writer, died at Rome, of a lingering and painful disease, on the 29th of March 1828. The date of his birth we have not been able to ascertain, and consequently cannot pretend to determine his age at the time of his decease.

He seems to have been early ambitious of literary distinction, and in 1794 he published *A Review of the Government of Sparta and Athens*, large 8vo; a work which, though not destitute of merit, and exhibiting considerable traces of a vigorous mind, yet gave no promise of that bold spirit of speculation for which its author was afterwards so much distinguished. At the close of the year 1795, he was returned to parliament for the borough of St Mawes, in the representation of which a vacancy had occurred; and in the two following parliaments, which met respectively in 1796 and 1801, he sat for the town of Lostwithiel. At the time of his second election he had been appointed envoy-extraordinary to the court of Naples.

In the year 1798, he published *The Satires of Persius Translated*, 8vo, which happened to appear about the same time with the rival translation of the Roman satirist by Mr Gifford, author of the Baviad and Mæviad, and afterwards editor of the *Quarterly Review*. This translation alone would have been sufficient to fix his reputation as an accomplished classical scholar; and, in point of fact, it has been much admired by all who are competent to appreciate the difficulty of the task which he so successfully performed. It would not be easy, indeed, to overrate the skill with which the niceties of Persius have been discriminated, or the felicity with which the idiomatic peculiarities of that difficult author have been converted into equivalent forms of expression. Drummond's versification is easy, graceful, and precise; and though it wants the piquancy of allusion, the congenial bitterness of spirit, and the occasional point and concentration, which impart so strong a zest to the translation of Mr Gifford, it is yet distinguished for greater freedom and equal fidelity, two things which Drummond has shown that it is not impossible to reconcile.

In the year 1801, Mr Drummond being then ambassador to the Ottoman Porte, was honoured with the order of the Crescent, which was confirmed by license, in the London Gazette, dated the 8th of September 1803.

In 1805 Sir William published his *Academical Questions*, in 4to, and thereby greatly extended his fame as an author. Hitherto he had appeared only in the character of an elegant and accomplished scholar; but in this work he boldly entered the domain of philosophy, and in a free and fearless spirit attacked every species of dogmatism, whether consecrated by time, or sustained by authority, exposing the weakness of the human understanding, and mortifying the pride of pretended wisdom, by a collection of what appear to be insoluble cases and indeterminate problems. In this work, however, it is only the task of demolition which he proposes to accomplish; and it must be owned that he has spread abroad the rubbish and scattered the dust of philosophical systems in a somewhat ap-

---

[1] Forth Feasting. A Panegyricke to the Kings most excellent Majestie. Edinbvrgh, printed by Andro Hart, 1617, 4to.—This poem occurs in the Muses Welcome, p. 25.

[2] Drummond's verses appeared in a publication entitled "The Entertainment of the high and mighty Monarch Charles, King of Great Britaine, France, and Ireland, into his auncient and royall Citie of Edinbvrgh, the fifteenth of Iune 1633." Printed at Edinbvrgh by Iohn Wreittoun, 1633, 4to. The last work which he himself is known to have published bears the following title: "To the Exequies of the Honovrable Sr Antonye Alexander, Knight, &c. A pastorall Elegie." Edinbvrgh, printed in King James his College, by George Anderson, 1638, 4to. Mr Maitland has reprinted the *Polemo-Middinia* from the earliest edition that has been traced. Edinb. 1684, 4to.

[3] Neve's Cursory Remarks on some of the Ancient English Poets, particularly Milton, p. 49. Lond. 1789, 8vo.—With respect to the supposed merit of Waller and Denham as improvers of English versification, the reader may consult Mr Crowe's Treatise on English Versification, p. 166. Lond. 1827, 8vo.

palling manner. "The author of *Academical Questions*," says the able critic of the work in the *Edinburgh Review*, "is indubitably a person of great reading, and much natural acuteness; but he has taken too wide a range, and indulged somewhat too much in a vein of controversial declamation. He often seems to think more of demolishing his antagonist than of enlightening his reader; and sometimes appears to enlarge upon a topic as much for the display of his eloquence as for the support of his reasoning. By frequent reference to the Greek writers, and continual allusions to the usages of antiquity, he expected perhaps to seduce the scholars of the South into metaphysical investigations, and to engage the attention of polite readers by a certain vivacity and polish in the turn of his expression. If this was his view, however, he certainly ought not to have plunged at first into the great gulf of substance and entity." (*Edinburgh Review*, vol. vii. p. 185.) To these observations, however, it is proper to add, that the author avowedly reserved the full exposition of his own theory for a subsequent volume, though in point of fact it never appeared; and that in this preliminary publication he conceived himself to be only clearing out the foundation on which it was his intention afterwards to build.

In the year 1810, Sir William Drummond, in conjunction with Robert Walpole, Esq. published *Herculanensia*, in 4to, containing archæological and philological dissertations, and a copy of a manuscript found amongst the ruins of Herculaneum; and in 1811 appeared an *Essay on a Punic Inscription found in the Isle of Malta*, royal 8vo; both works of great merit and erudition. Sir William was also an occasional, if not a frequent, contributor to the *Classical Journal;* in which his papers on subjects of antiquity, particularly the zodiac of Denderah, which occupied without exhausting his ingenuity, attracted the general admiration of the learned, if not always on account of their soundness, at least by reason of the acuteness and originality they display, and the resources of learning which the author had always at command for the illustration of his peculiar views. About this time, Sir William Drummond, whose residence at Constantinople had turned his attention to oriental literature, sacred as well as profane, consigned the fruits of his researches and investigations into the historical books of the Old Testament, in his *Œdipus Judaicus.* This singular work was never published, having been printed solely for distribution amongst the author's friends and acquaintance; but as he had caused a considerable impression to be struck off, copies of it soon found their way into the hands of persons connected with the periodical press, and those of others; and, as might have been expected, it was most fiercely attacked. The first onset was made by a churchman of the name of D'Oyly, in *Letters to the Right Hon. Sir William Drummond, in Defence of particular Passages of the Old Testament against his late work entitled "Œdipus Judaicus;"* and the attack was renewed in the *Quarterly Review*, with equal vigour and ability. Whether it was altogether fair thus openly to stigmatize a book which had never been published, we shall not stop to inquire; more especially as the principal cause of regret is, not that it was severely criticised, but that it was ever written, far less printed. In the controversy which thus arose, however, Sir William was overmatched, both in science and in Hebrew, with which D'Oyly and the Reviewer evinced a most intimate acquaintance; and although his reply displayed much ingenuity, no skill could evade, far less destroy, the force of some of the criticisms. The truth is, the allegorical theory which he undertook to establish was taken at second hand from the work of Dupuis; and although the author, notwithstanding all the errors charged against him, brought great stores of learning and erudition to bear upon it, yet the absurdities to which it leads are so glaring, and the consequences which follow from it are so pernicious, that it is surprising Sir William Drummond should not have foreseen the one, or been prudent enough not to hazard the other. The preface, too, though beautifully written, contains observations which nothing can excuse, and irreverences so gross as even to shock persons the least scrupulous about subjects of religion. The profane joke about veal cutlets is worthy only of Mr Thomas Paine, and fit to appear in no work where the ordinary humanities of taste and reason are duly observed.

In 1818 Sir William Drummond published, experimentally we believe, the first part of a poem entitled *Odin*, 4to, the object of which was to embody in verse some of the more striking features of the Scandinavian mythology. The poem, however, did not succeed in attracting public attention, which was then almost exclusively fixed on some of the great masters of song, whose deep voice of inspiration filled the land; and although it contained passages of very considerable power and beauty, it fell into almost immediate oblivion.

But the work on which the reputation of Sir William Drummond as a scholar and antiquary must chiefly rest, is his *Origines, or Remarks on the Origin of several Empires, States, and Cities*, in 3 vols. 8vo. The first volume, embracing the origin of the Babylonian, the Assyrian, and the Iranian empires, appeared in 1824; the second, which is wholly devoted to the subject of Egypt, including the modern discoveries in hieroglyphics, came out in 1825; and the third, which treats of the Phœnicians and Arabia, was published in 1826. It would be exceedingly difficult, by a general statement, or by critical observations apart from details, to convey an accurate idea of the real character and merits of this work; which, with much that is strained, exaggerated, or defective, to say nothing of errors into which the author is sometimes betrayed by the excessive refinements of an ever active ingenuity, is in several respects one of the most remarkable productions of modern times. A principal feature of the *Origines*, though certainly the least obtrusive, is, that here the author labours quietly to build up and fortify the authority of the historical books of the Old Testament, which, in the *Œdipus Judaicus*, he had (probably without intending it) contributed to impair, if not to pull down: whilst by concentrating, as it were, into one focus the various scattered lights of tradition, history, philosophy, science, etymology, and archæology; he has contrived to illuminate many of the darkest passages in the records of the ancient world; to dispel no inconsiderable portion of the obscurity which overshadowed the origin and annals of the great empires of antiquity; and, even in the merest archæological discussions, to interweave incidental illustrations, alike curious in themselves, and valuable to the scholar, the theologian, and the antiquary. Upon this work, therefore, as on a fixed and enduring pedestal, the fame of Drummond as a scholar must in a great measure rest. Besides its other great and singular merits, it has that which indeed is peculiar to almost all Drummond's works, of being written in a pure, chaste, classical style, full of vivacity and vigour, and sometimes even rising into a rich and lofty strain of eloquence. The dialogue between Neomathes and Philothoth, in the second volume, where the one impugns and the other defends the astronomical and mathematical skill of the ancient Egyptians, may be instanced as a specimen of the grace, elegance, and force of Drummond's style, when it flows in a continuous stream, unbroken by the projecting corners and edges of a hard and rugged erudition.

Sir William Drummond's appreciation of the modern discoveries in hieroglyphics (a subject to which three consecutive chapters of the second volume are devoted)

Drummond. Druses.

is, in general, sound and discriminating; and he foresaw sooner than almost any one else, that the powers of the phonetic alphabet, as an instrument of discovery, would be found to have been greatly over-rated. In a letter, dated Naples, 27th April 1827, and addressed to the author of this imperfect notice, he very distinctly shows how fully he had estimated the difficulty which M. Champollion had overlooked, and which now appears to be nearly, if not altogether insuperable. "That M. Champollion's system is accurate to a certain extent," says he, "I admit; and his discoveries do him great honour. Whether he be right in all the details of his system is another question. He establishes the existence of a very great number (I forget the precise number) of phonetic hieroglyphs;[1] and to these, he says, are to be traced all the characters of the running hand, which he reads with so much ease. Now I cannot help observing, that where there are so many signs to represent each alphabetical letter, and where consequently there must have been various contractions for each of these signs in the running hand, the task of learning all these contractions without the aid of a master, and of accurately referring them to their prototypes, must be immense. In Sanscrit there are fifty-two letters, and yet there are above eight hundred contractions. To refer these Sanscrit contractions to their original letters is not always very easy; but the difficulty in Egyptian must have been much greater, in which language the phonetic characters, and consequently the contractions, are far more numerous." Here we have the germ of those principles which, developed and applied by Klaproth to the values of characters as set down by M. Champollion, have made terrible havoc of his discoveries, and left him at last little more than what he took without acknowledgment from Dr Young.

Of Sir William Drummond in his public capacity we are not prepared to speak with any degree of confidence, having little knowledge of his services as a diplomatist, or of his capabilities for acting in that character. The habit of his mind was a cautious or rather tentative boldness, accompanied with perseverance, yet tempered with a conciliating blandness of disposition, and an amenity of manners, native to his character; and it is to be presumed that this prevailing tendency showed itself in the conduct of affairs, as well as in abstract or speculative pursuits. In 1808, we find him, whilst resident at the court of Palermo, ostensibly embarked in a scheme for securing the regency of Spain, which had then just risen in arms to throw off the yoke of France, to Prince Leopold of Sicily. As might have been expected, the project misgave at the very commencement, and Sir William Drummond has not escaped censure for the part he had in it. "Sir William Drummond, the British envoy at Palermo, Mr Viale, and the Duke of Orleans," says Colonel Napier," were the ostensible contrivers of this notable scheme, by which, if it had succeeded, a small party in a local junta (that of Seville) would have appointed a regency for Spain, paved the way for altering the laws of succession in that country, established their own sway over the other juntas, and created interminable jealousy between England, Portugal, and Spain; but with whom the plan originated does not very clearly appear. Sir William Drummond's representations induced Sir Alexander Ball to provide the ship of war, nominally for the conveyance of the Duke of Orleans [since king of the French, who had made no secret of his intention to negociate for the regency of Spain], but in reality for Prince Leopold, with whose intended voyage Sir Alexander does not appear to have been made acquainted. That the prince should have desired to be regent of Spain was natural; but that he should have been conveyed to Gibraltar in a British ship of the line, when the English government disapproved of his pretensions, was really curious. Sir William Drummond could scarcely have proceeded such lengths in an affair of so great consequence, without secret instructions from some member of his own government; yet Lord Castlereagh expressed unqualified approbation of Sir Hew Dalrymple's decisive conduct upon the occasion." (Napier's *History of the Peninsular War*, vol. i. p. 177.) In politics Sir William Drummond appears to have known his ground well, and to have given entire satisfaction to the governments which employed him, at periods of no ordinary difficulty, in transacting affairs of the greatest importance.

Such is an imperfect outline of the literary and political character of this distinguished person. In private life he was a man of modest, retiring, unobtrusive manners, perfectly unconscious that he differed from or had any claims to distinction superior to the most ordinary and commonplace person who fell in his way. Throughout his whole life he was a close and assiduous student, often preferring the company of his books to the promiscuous and frivolous intercourse of company; and hence he was sometimes considered as eccentric, if not cold, distant, and haughty, by those who neither knew nor could sympathise with the habits which are gradually formed by a studious and contemplative life; habits which continue unconsciously to grow upon men whose days and nights are devoted to the pursuit of knowledge. But he was, nevertheless, one of the kindest, mildest, and most generous and humane men that ever existed. To his tenants and dependents he was indulgent even to the injury of his own private fortune; to his friends he was most stedfastly and fervently devoted. In him rising merit was always sure to find a ready and active patron; and not a few individuals have owed their establishment and success in life to the circumstance of having attracted his notice, or of being pointed out to him as deserving of support or encouragement. Latterly, owing to the precarious state of his health, which made it necessary for him to resort to a warmer climate, he resided almost constantly abroad; chiefly, we believe, at Naples, where he continued to indulge in those learned pursuits which formed the main solace and delight of his life. (J. B—E.)

DRUNKENNESS, or INTOXICATION, a well-known vice, the consequence of an excessive use of spirituous liquors, wines, or drugs. Drunkenness is gradually produced, and several distinct stages may be traced in its progress. The sensations experienced in the earlier stages, or the state of incipient intoxication, are peculiarly pleasurable. The mind becomes unusually excited; a soft serenity steals over it, inducing a spirit of universal contentment; gaiety and warmth kindle at the heart, and images of beauty expand before the imagination. In this state, before consciousness is attacked, or the sensorium affected, some of the faculties of the soul act with greater liveliness and vigour, and the feelings of strength and courage are increased. In a short while the sense of propriety is lost, the soul begins to open itself and pour forth its secrets, displaying all the peculiarities of temper, good or bad. Gradually the scene thickens, and consciousness becomes still more weakened. Reason vacates her throne, and grotesque conceptions crowd upon the fancy. Dizziness attacks the brain, and surrounding objects, seeming to lose their balance—

[1] About *a hundred and forty;* whilst, even by the lowest estimate, the total number of hieroglyphs on the monuments exceeds *eight hundred.*

Drunkenness.

Into strange vagaries fall,
As they would dance.

The drunkard begins to feel the earth unsteady beneath his feet, his sense of equilibrium gives way, and total insensibility succeeds, in which a state of stupor, wild dreams, and horror, strongly contrasts with that of previous excitement. Different individuals are differently affected by the inebriating liquid. The state of the passions at the period of indulging in strong liquors also operates powerfully in modifying its effects. Persons under sentence of death, and immediately before execution, have been known to swallow with impunity draughts of the strongest alcohol, which, under other circumstances, would have rendered them senseless. Hence the remarkable propriety of the language put into the mouth of Lady Macbeth previously to the contemplated murder, when, alluding to the manner in which she had "drugged the possets" of the grooms, she says, "that which hath made them drunk hath made me bold." In some persons constitutional moroseness and melancholy are dispelled; in others their habitual gloom is aggravated. Cases of the latter description, however, are by no means so numerous as those of the former, and the general effect of indulgence in "thick potations" is to dispel the clouds of care, at least for the time being. But the re-action which eventually follows over-excitement serves to deepen the darkness, and, by a dispensation of retributive justice, to inflict certain punishment for the previous delinquency. Drunkards who are of a sanguineous temperament are most intensely excited by the use of strong liquors.

It is unnecessary to enumerate the various inebriating agents, which, as well as temperament, influence the nature of the intoxication produced. Thus ebriety from ardent spirits differs from that generated by malt liquors. Besides alcohol, which is the intoxicating principle in all liquors, there are various substances taken, both in the solid and fluid state, which induce intoxication. The most remarkable are opium, bang, and nitrous oxide gas. The former, it is well known, is in extensive use for this purpose in the East, but the latter has not yet been employed out of the laboratory of the chemist. The effects produced by this gas are described by the discoverer, Sir Humphry Davy, and others who have experienced them, as very delightful, and similar to those felt during the earlier stages of intoxication from wine, but of a purer and more ethereal nature.

Amongst the physiological effects of drunkenness are vertigo, double vision, staggering and stammering, heat and flushing, ringing in the ears, and other analogous affections. Vertigo, though partly produced by the ocular delusions under which the drunkard labours, seems principally to arise from the close sympathy which subsists between the brain and the nerves of the stomach. Double vision is readily accounted for by the influence of increased circulation in the brain upon the nerves of sight. Staggering and stammering may likewise be explained by the disordered state of the nervous system. Heat and flushing result from the strong determination of blood to the surface of the body, and ringing in the ears particularly from the throbbing of the internal carotid arteries, which run in the immediate neighbourhood of the ear. The mental pleasure arising from intoxication is not so easily explained, though the primary cause no doubt is physical or rather nervous excitement gradually superinduced, and thus stimulating both the imagination and the passions. The evil consequences of drinking, both in a physical and moral point of view, are numerous and distressing. On the unhappy victim of this propensity a long train of bodily diseases and infirmities are entailed. The liver, stomach, brain, kidneys, indeed all the functions of the body, are seriously impaired by the practice; and in this state the frame is not only more liable to attacks of disease, but when they do come they are likely to exhibit tenfold inveteracy. Thus life is either suddenly shortened, or protracted into a long disease. Death itself is frequently an immediate consequence of over indulgence. We shall not attempt a classification of the bodily infirmities and pernicious effects which drunkenness produces; but we may mention madness, and spontaneous combustion of the body, as belonging to the number. The former is by no means a rare occurrence, and there are well authenticated cases of the latter. Drunkenness in a judicial point of view is not punishable by our laws; but acts of violence committed under its influence are held to be aggravated rather than otherwise; nor can the accused allege it as an extenuation of the crime of which he has been guilty. In proof of this it may be stated, that a bond signed in a fit of intoxication holds good in law, and is perfectly binding, unless it can be shown that the person who signed it was inebriated by the collusion or contrivance of those to whom the bond was given.

Drunkenness has been known from the earliest ages. Wherever the grape flourished inebriation soon made its appearance. It has greatly varied at different times and amongst different nations. There can be no doubt that in a rude, uncivilized state of society, it prevails to the greatest extent, and assumes the most revolting forms. It is also found to exist more extensively in northern than in southern latitudes, owing no doubt to the difference of climate. As society is refined, the vice certainly diminishes amongst the higher orders, although amongst those in the lower ranks it is still found to exist to a fearful extent. For checking this demoralizing practice various moral engines have been set to work, but without a success commensurate with the philanthropy of the design or the importance to society of the anticipated results. (J. F. S.)

Druses.

DRUSES, an independent people of Palestine, of warlike habits, who inhabit the mountains of Libanus, Anti-Libanus, and all the coast from Gibail to Saide, and east as far as Balbec. There are various conjectures concerning the origin of this singular race; the most rational of which is, that they were originally a persecuted sect of Mahommedans, who, flying from oppression, took refuge, about the commencement of the eleventh century, amongst the mountains of Lebanon, and there formed an independent society.

The unity of the Mahommedan faith was at a very early period broken by contending sectaries; and, according to the full and accurate details of Volney, from whom the following account is chiefly compiled, Egypt, under the influence of these delusions, became, in the reign of the third caliph of the race of the Fatimites, and in the year of the Hegira 386 (A. D. 996), the theatre of the most extravagant enthusiasm and absurdity ever perhaps recorded in history. This prince, called Hakem-b'amr-ellah, was remarkable for his heresies and fanatical zeal. He caused the first caliphs, the companions of Mahommed, to be cursed in the mosques, and afterwards revoked the anathema; he compelled the Jews and Christians to abjure their religion, and then permitted them to resume it; he forbade the pilgrimage to Mecca, fasting, and the five prayers; and at length carried his madness so far as to desire to pass for God himself. This impious pretension was supported by a false prophet, who came from Persia into Egypt, and who, to ingratiate himself with Hakem, maintained that this caliph was God himself incarnate. But unluckily for the prophet, his new god had not the power to protect him from the fury of his enemies, who slew him in a tumult almost in the arms of the caliph, who was himself massacred soon afterwards on Mount

Mokhattam, where, as he said, he had held conversation with angels.

The death of these two chiefs did not stop the progress of their opinions. A disciple of Mohammed-ben-Ismael, named Hamzu-ben-Ahmud, propagated them with indefatigable zeal in Egypt, in Palestine, and along the coast of Syria, as far as Sidon and Berytus. But his proselytes being persecuted by the sect in power, took refuge in the mountains of Lebanon, where they were better able to defend themselves; and shortly after this era we find them established there, and forming an independent society.

The difference of their opinions naturally disposes them to be enemies, but the urgent interest of their common safety forces them to allow mutual toleration; and they have always appeared united, and have jointly opposed, at different times, the Crusaders, the sultans of Aleppo, the Mamelukes, and the Ottomans. The conquest of Syria by the latter made no change in their situation. Selim I. on his return from Egypt, meditating no less than the conquest of Europe, disdained to waste his time before the rocks of Lebanon. Soliman II. his successor, incessantly engaged in important wars, either with the knights of Rhodes, the Persians, the kingdom of Yemen, the Hungarians, the Germans, or the emperor Charles V. had no time to think of the Druses. Emboldened by this inattention, and not content with their own independence, they frequently descended from their mountains to pillage the Turks. The pashas in vain attempted to repel these inroads; for their troops were invariably routed or repulsed. But about the year 1588 they were at last subdued by Amurath III., to whom they became tributary, and under whose powerful sway the anarchy by which the country was distracted under its different chiefs was put an end to; and one head or chief was established, who was invested with the executive power, and who was made liable to the sultan for the stipulated tribute, which he was to collect as he best could from the people. The whole power and resources of the country being by this conquest or revolution concentrated under one head, the Druses were engaged in continual warfare and in marauding hostilities with the Turks; and towards the middle of the seventeenth century they had attained to the height of their power under the celebrated emir Fakir-el-din or Fakardin. This chief extended his conquests, and at length became so formidable that he excited the terror of the sultan, who resolved to make an effort for his destruction. To avert the threatening storm he embarked for Italy to solicit succours from the court of the Medici, at Florence, where he remained for nine years. On his return he found every thing prosperous under the wise government of his son Ali. But this prince was afterwards defeated in a battle with the Turks; and Fakir-el-din himself being compelled to take refuge in the mountains, was betrayed into the hands of the Turks by his companions, and by the orders of Amurath he was strangled at Constantinople in the year 1631.

After the death of Fakir-el-din, the posterity of that prince still continued in possession of the government, though at the pleasure, and as vassals, of the Porte. But as this family failed in the male line at the beginning of the last century, the authority devolved, by the election of the scheiks, on the house of Shelah. The only emir of that house whose name deserves to be preserved, is Melhem, who reigned from 1740 to 1759; in which interval he retrieved the losses of the Druses, and restored them to that consequence which they had lost by the defeat of Fakir-el-din. Towards the end of his life, about the year 1754, Melhem, wearied with the cares of government, abdicated his authority, to live in religious retirement, after the manner of the Okkals; but the troubles which succeeded forced him once more to resume the reins of government, which he held till 1759, when he died universally regretted.

He left three sons, minors, the eldest of whom ought, according to the custom of the country, to have succeeded him; but being only eleven years of age, the authority devolved on his uncle Mansour, agreeably to a law very general in Asia, which provides that the people shall be governed by a sovereign who has arrived at years of maturity. The young prince was but little fitted to maintain his pretensions; but a Maronite, named Sad-el-kouri, to whom Melhem had intrusted his education, took this upon himself. Aspiring to see his pupil a powerful prince, that he might himself become a powerful vizir, he made every exertion to advance his fortune; and accordingly entered into a great many plots and intrigues, in which he succeeded by means of an emir of the name of Yussuf in subverting his authority. We have no exact or accurate information of the internal state of this country, or of the domestic agitations and wars by which it has since been distracted. Nor would the detail of these petty wars, however ample or correct, possess any peculiar interest. The country is ruled by an emir, who is considered as the vassal of the Turks.

In their religion the Druses have very peculiar tenets and observances. They practise neither circumcision, nor prayers, nor fasting; they observe neither festivals nor prohibitions. They drink wine, eat pork, and allow marriage between brothers and sisters, though not between fathers and children. From this we may conclude, with reason, that the Druses have no religion; yet one class of them must be excepted, whose religious customs are very peculiar. Those who compose it are to the rest of the nation what the initiated were to the profane. They assume the name of *Okkals*, or spiritualists, and bestow on the vulgar the epithet of *Djahel*, or ignorant. They have various degrees of initiation, the highest orders of which require celibacy. These are distinguished by the white turban, which they affect to wear as a symbol of their purity; and so proud are they of this supposed purity, that they think themselves sullied by even touching a profane person. If you eat out of their plate, or drink out of their cup, they break them; and hence the custom, so general in this country, of using vases with a sort of cock, which may be drank out of without touching them with the lips. All their practices are enveloped in mysteries. Their oratories stand alone or detached, and are constantly situated on eminences; in these they hold their secret assemblies, to which women are admitted. It is believed that they perform ceremonies there in presence of a small statue resembling an ox or a calf; and hence some have pretended to prove that they are descended from the Samaritans. But besides that the fact is not well ascertained, the worship of the ox may be deduced from other sources.

The rest of the Druses, strangers to this spirit, are wholly indifferent about religious matters. The Christians who live in their country pretend that several of them believe in the metempsychosis, and that others worship the sun, moon, and stars. All this is possible; for every one, left to his own fancy, follows the opinion which pleases him most; and these opinions are those which present themselves most naturally to unenlightened minds. When among the Turks, they affect the exterior of Mahommedans, frequent the mosques, and perform their ablutions and prayers. Among the Maronites, they accompany them to church, and, like them, make use of holy water. Many of them, importuned by the missionaries, suffer themselves to be baptized; and if solicited by the

 Turks, receive circumcision, and conclude by dying neither Christians nor Mahommedans. But they are not so indifferent in matters of civil policy.

The Druses may be divided into two classes: the common people; and the people of eminence and property, distinguished by the title of scheiks and emirs, or descendants of princes. The greater part are cultivators, either as farmers or proprietors; and every man lives on his inheritance, improving his mulberry trees and vineyards. In some districts they grow tobacco, cotton, and some grain; but the quantity of these is inconsiderable. It appears that at first all the lands were, as formerly in Europe, in the hands of a small number of families. But in order to render them productive, the great proprietors were forced to sell part of them, and let leases; which subdivision has become the chief source of the power of the state, by multiplying the number of persons interested in the public welfare. There still exist, however, some traces of the original inequality, which even at this day produces pernicious effects. The great property possessed by some families gives them too much influence in all the measures of the nation; and their private interests have too great weight in every public transaction. Their recent history affords sufficient proofs of this, since all the civil or foreign wars in which they have been engaged have originated in the ambition and personal views of some of the principal families, such as the Lesbeks, the Djambelats, and the Ismaels of Solyma. The scheiks of these houses, who alone possess one tenth part of the country, procured retainers by means of their money, and at last involved all the Druses in their dissensions. It must be owned, however, that possibly to this conflict between contending parties the whole nation owes the good fortune of never having been enslaved by its chief.

This chief, called *Hakem* or governor, and also *Emir* or prince, is a sort of king or general, who unites in his own person the civil and military powers. His dignity is sometimes transmitted from father to son, sometimes from one brother to another; and the succession is determined rather by force than by any certain laws. Females can in no case pretend to this inheritance. They are already excluded from succession in civil affairs, and consequently can still less expect it in political. In general the Asiatic governments are too turbulent, and their administration renders military talents too necessary, to admit of the sovereignty of women. Among the Druses, the male line of any family being extinguished, the government devolves to him who is in possession of the greatest number of suffrages and resources. But the first step used to be to obtain the approbation of the Porte, of whom he became the vassal and tributary. It even happens, that, not unfrequently, to assert its supremacy, it names the Hakem, contrary to the wishes of the nation, as in the case of Ismael Hasbeya, raised to that dignity by Djezzar; but this constraint lasts no longer than it is maintained by the violence which gave it birth. The office of the governor is to watch over the good order of the state, and to prevent the emirs, scheiks, and villages, from making war on each other; and in case of disobedience, he may employ force. He is also at the head of the civil power, and he names the cadis, reserving to himself the power of life and death. He collects the tribute, from which he annually pays to the pasha a stated sum. This tribute, which is called *miri*, is imposed on the mulberry trees, vineyards, cotton, and grain. All sown land pays in proportion to its extent; every foot of mulberries is taxed at three medins, or three sols nine deniers (not quite twopence). A hundred feet of vineyard pays a piastre, or forty medins; and fresh measurements are often made to preserve a just proportion. The scheiks and emirs have no exemption in this respect; and it may truly be said that they contribute to the public stock in proportion to their fortune. The collection is made almost without expense. Each man pays his contingent at Dair-el-kamar, if he pleases, or to the collectors of the prince, who make a circuit round the country after the crop of silks. The surplus of this tribute is for the prince; so that it is his interest to reduce the demands of the Turks, as it would likewise be to augment the impost. But this measure requires the sanction of the scheiks, who have the privilege of opposing it. Their consent is necessary, likewise, for peace and war. In these cases, the emir must convoke general assemblies, and lay before them the state of his affairs. There every scheik, and every peasant who has any reputation for courage or understanding, is entitled to give his suffrage; so that this government may be considered as a mixture of monarchy, aristocracy, and democracy. Every thing indeed depends on circumstances. If the governor be a man of ability, he is absolute; if he be weak, he is a cipher. This proceeds from the want of fixed laws; a want common to all Asia, and the radical cause of all the disorders in the governments of the Asiatic nations.

Neither the chief nor the individual emirs maintain troops; they have only persons attached to the domestic service of their houses, and a few black slaves. When the nation makes war, every man, whether scheik or peasant, able to bear arms, is called upon to march. He takes with him a little bag of flour, a musket, some bullets, a small quantity of powder made in his village, and repairs to the rendezvous appointed by the governor. If it be a civil war, as sometimes happens, the servants, the farmers, and their friends, take up arms for their patron, or the chief of their family, and repair to his standard. In such cases, the parties irritated frequently seem on the point of proceeding to the last extremities; but they seldom have recourse to acts of violence, or attempt the death of each other. Mediators always interpose, and the quarrel is appeased the more readily, as each patron is obliged to provide his followers with provisions and ammunition.

The Druses are noted for their hospitality. Whoever presents himself at their door in the quality of a suppliant or passenger, is sure of being entertained with lodging and food in the most generous and unaffected manner. Volney often saw the lowest peasants give the last morsel of bread they had in their houses to the hungry traveller; and when it was observed to them that they wanted prudence, their answer was, "God is liberal and great, and all men are brethren." There are, therefore, no inns in their country any more than in the rest of Turkey. When they have once contracted with their guest the sacred engagement of bread and salt, no subsequent event can make them violate it. Various instances of this are related which do honour to their character. A few years ago an aga of the janissaries having been engaged in a rebellion, fled from Damascus and retired among the Druses. The pasha was informed of this, and demanded him of the emir, threatening to make war on him in case of refusal. The emir demanded him of the scheik Talhouk, who had received him; but the indignant scheik replied, "When have you known the Druses deliver up their guests? Tell the emir, that as long as Talhouk shall preserve his beard, not a hair of the head of his suppliant shall fall."

In consequence, says Volney, of their prejudices, the Druses do not choose to make alliances out of their own families. They invariably prefer their relation, though poor, to a rich stranger; and poor peasants have been known to refuse their daughters to merchants of Saide and Bairout, who possessed from twelve to fifteen thousand piastres. They

observe also, to a certain degree, the custom of the Hebrews, which directed that a brother should espouse his brother's widow.

In short, the proper and distinctive character of the Druses is a sort of republican spirit, which gives them more energy than any other subjects of the Turkish government, and an indifference for religion, which forms a striking contrast with the zeal of the Mahommedans and Christians. In other respects, their private life, their customs and prejudices, are the same with those of other orientals. They may marry several wives, and repudiate them when they choose; but, except by the emir and a few men of eminence, that is rarely practised. The women are all veiled, so that no man knows the face of any other woman than his wife, his mother, his sister, and sisters-in-law. Every man lives in the bosom of his own family, and goes little abroad. The women, those even of the scheiks, make the bread, roast the coffee, wash the linen, cook the victuals, and perform all domestic offices. The men cultivate their lands and vineyards, and dig canals for watering them. In the evening they sometimes assemble in the court, the area, or house of the chief of the village or family. There, seated in a circle, with legs crossed, pipes in their mouths, and poniards at their belts, they discourse of their various labours, the scarcity or plenty of their harvests, peace or war, the conduct of the emir, or the amount of the taxes; they relate past transactions, discuss present interests, and form conjectures on the future. Their children, tired with play, come frequently to listen. This is the only education of those who are termed the Ignorant.

This account of the character, manners, and religious tenets of the Druses has been corroborated by modern travellers. The reverend Mr Connor, a missionary and travelling agent of the British and Foreign Bible Society, mentions that there are many sects among them; but that they are divided into two great classes, that of the Okkals or the Intelligent, who to the number of 10,000 form the sacred order; and the Djahels or Ignorant. It is stated to be extremely difficult to learn any thing satisfactory respecting the religious creed of this people. It is generally agreed that they believe in the transmigration of souls; and according to the character of the individual in his journey through life, will be the nature of the body which his soul will animate in a future state of existence. If his conduct has been fair and honourable, his soul will vivify the body of some respectable character in life. But if his conduct has been evil, his soul will enter the body of a horse, a mule, or an ass. In like manner it is believed that persons of eminent and conspicuous virtue will, as the highest recompense of their merit, pass after death into the bodies of Chinese Druses. In the schools, which are frequent among the Druses, the Okkals are generally the masters, and are paid by the pupils. They teach reading and writing, and the book generally used is the Koran. In some villages where there are Christian schools, the Druses send their children thither, where they are taught to read the Psalms of David. There are no Christians among the Druses, though the emir with his family and some of the other nobles have their children baptized, have chapels in their houses, and hear mass on Sunday, not from any rational belief in the truths of Christianity, but for the same reason that, though they dislike the Mahommedans generally, and entertain no tenet in common with their faith, yet many of them, as we learn from Buckingham, are infected with their customs, and keep the feast of Ramadan with as much rigour as the most orthodox follower of the Arabian prophet; just as the Mussulmans of India, though they despise and hate the Hindus, have nevertheless adopted many of their superstitions and ceremonies.

The Djahels or the Ignorant, who form by far the most numerous class, perform no religious rites whatever, unless when they are obliged by circumstances to assume the appearance of Mahommedans. They cherish an equal dislike to the Christians and Turks; and believe that the deity was incarnated in the person of Hakem, caliph of Egypt, and that he will shortly appear again and utterly destroy all his enemies.

The Druses are a restless and enterprising people; they are formidable in irregular war, being brave even to temerity; excellent marksmen, and noted for sudden surprises. The passion of all classes for arms is remarked by every traveller; and Buckingham mentions a keen dispute at which he was present relative to the value of different weapons, in which the sabres of Ispahan and Damascus, and the muskets and pistols of England, were unanimously preferred. They are of industrious habits, devoting their attention to the cultivation of the soil; and the same traveller, who was over all this country, on quitting a Mahommedan village and entering one inhabited by Druses, was struck with the contrast of the superior order and neatness everywhere conspicuous, as well as in the more cultivated state of the land. No great distinction of ranks is preserved among them, scheiks and peasants treating each other with the greatest familiarity. They speak pure Arabic. Soeda, which is the capital of the Eastern Druses, and the residence of their emir or prince, is about two miles westward of the summit of that range of hills which forms the eastern boundary of the plains of the Hauran.

DRUSIUS, or VAN DEN DRIECHE, JOHN, a learned Protestant and eminent critic, was born at Oudenarde, in Flanders, on the 28th June 1550. Being designed for the church, he learned Greek and Latin at Ghent, and philosophy at Louvain; but his father having been outlawed for his religion, and deprived of his estate, they both retired to England, where the son became professor of oriental languages at Oxford. Upon the pacification of Ghent, however, they returned to their own country, and Drusius was appointed professor of the oriental languages at Leyden. From this place he removed to Friesland, and was admitted professor of Hebrew in the university of Franeker; an office which he discharged with great honour till his death, which happened in 1616. His works prove him to have been well skilled in Hebrew and in Jewish antiquities; and in 1600 the states-general employed him, at a salary of four hundred florins a year, to write notes on the most difficult passages in the Old Testament; but being frequently interrupted in prosecuting this undertaking, it was not published until after his death. He carried on an extensive correspondence with the learned in different countries; for, besides letters in Hebrew, Greek, and other languages, there were found amongst his papers upwards of two thousand written in Latin. He had a son, John, who died in England at the age of twenty-one, and was accounted a prodigy of learning.

Drusius, who was a man of real learning, and deserves the encomiums which Simon has bestowed on him, is also favourably mentioned by Bayle, Freher, Meursius, Foppens, Paquot, and others. Paquot states the number of the printed works and treatises of Drusius at forty-eight, and of the unprinted at upwards of twenty. Of the former more than two thirds were inserted in the collection entitled *Critici Sacri, sive Annotata doctissimorum Virorum in vetus et novum Testamentum*, Amsterdam, 1698, in 9 vols. folio, or London, 1660, in 10 vols. folio. Amongst the works of Drusius not to be found in this collection may be mentioned, 1. *Alphabetum Hebraicum vetus*, 1584, 4to; 2. *Tabulæ in Grammaticam Chaldaicam ad usum Juventutis*, 1602, 8vo; 3. An edition of *Sulpitius Severus*, Franeker,

1607, 12mo; 4. *Opuscula quæ ad Grammaticam spectant omnia*, 1609, 4to; 5. *Lacrymæ in obitum J. Scaligeri*, 1609, 4to; and 6. *Grammatica Linguæ Sanctæ nova*, 1612, 4to.

DRYADES, in *Ancient Mythology*, a kind of inferior deities or nymphs who were believed to inhabit groves and woods. They differed from the Hamadryades, the latter being attached to some particular tree, with which they were born, and with which also they died; whereas the former were goddesses of trees and woods in general.

DRYANDER, JONAS, a Swedish naturalist of eminent talents, and a distinguished pupil of the great Linnæus, was born in 1748. His father, a clergyman near Gottenburg, died during the minority, if not the infancy, of his son; in consequence of which the care of the education of the latter devolved on a maternal uncle. This was Dr Lars Montin, a member of the Stockholm Academy, known to the world by several botanical writings, and, amongst others, by an inaugural dissertation on the genus *Splachnum*, published under the presidency of Linnæus, 28th March 1750; and reprinted in the *Amœnitates Academicæ*, vol. ii. 263. The early education of young Dryander, as far as we can learn, was chiefly in the University of Gottenburg; but he afterwards removed to Lund, where he took his degree of master of arts, or doctor in philosophy, under the presidency of Lidbeck, in 1776; on which occasion he published a dissertation, *fungos regno vegetabili vindicans.* He combated the ideas of certain philosophers, who, led by analogy rather than observation and judgment, were disposed to believe that *fungi* might, like corals and corallines, be the production of animals. But though Mr Dryander thus asserted the vegetable nature of these bodies, he subsequently imbibed, from his friend and preceptor Linnæus, an insuperable dislike to their use as food; nor could the most delicate mushrooms of the most luxurious table ever tempt him to overcome this prejudice. We know not at what period he went to study at Upsal, nor how long he remained there. He became for some time domestic tutor to a young Swedish nobleman, after which he visited England, under the patronage of his countryman the well-known Dr Solander, who introduced him to the acquaintance of Sir Joseph Banks; and on the sudden death of Solander in 1782, he succeeded to the place of that eminent man, in the confidence and friendship of his distinguished patron. He was, in like manner, domesticated under the roof of Sir Joseph as his librarian, and continued in that situation as long as he lived. Mr Dryander also held the offices of librarian to the Royal and the Linnæan Societies. He was one of the first founders of the latter in 1788; and took a principal interest in all its concerns, especially in drawing up its laws and regulations, when this society was incorporated by royal charter in 1802. He, moreover, fulfilled the duties of a very active vice-president, till the time of his decease, which happened towards the end of October 1810, in the sixty-third year of his age. His remains were deposited in the vault of St Ann's Church, Soho, the funeral being attended by a number of his friends, principally members of the Linnæan Society.

The acknowledged publications of Mr Dryander on the subject of botany consist of the following dissertations: 1. *An Account of the Genus Albuca*, in the Stockholm *Transactions* for 1784, in Swedish; 2. *Observations on the Genus Begonia*, in the *Transactions of the Linnæan Society*, vol. i. In this essay twenty-one species are determined, with an indication of nine doubtful ones, though the genus was previously supposed to consist of a solitary species only. 3. *On Genera and Species of Plants* which occur twice or three times in Professor Gmelin's edition of Linnæus's *Systema Naturæ; Trans. of Linn. Soc.* vol. ii. These corrections unfortunately extend no farther than the class *Octandria.* Their author intended to have completed them, but other occupations intervened; and the book which was the object of his correction soon fell into absolute neglect, as far as regards botany; insomuch that its errors, however great and numerous, became harmless. 4. *Lindsea, a new Genus of Ferns; Trans. of Linn. Soc.* vol. iii. This genus is distinguished from *Pteris*, by the *involucrum* opening outward. 5. *Botanical Description of the Benjamin Tree of Sumatra*, in the *Phil. Trans.* vol. lxxvii. The tree in question, about which great mistakes had arisen, is here shown to be a species of *Styrax.* This paper has been republished and translated.

The principal works published under the superintendence and correction of the subject of this memoir, were, the *Hortus Kewensis* of Mr Aiton, printed in 1789, and about half the second edition of the same work, interrupted by his death; as well as Dr Roxburgh's *Plants of the Coast of Coromandel*, a splendid and highly valuable publication, for which the world is indebted to the munificence of the East India Company. To both these the critical learning and accuracy of Mr Dryander were most usefully applied, especially in the typographical department. It would be vain to seek for an error in the printing of any thing which had passed through his hands. We have only to regret that the same critical correctness was not extended as a principle to every other department of the works in which he took a part. Had this been the case, the erroneous essential character of *Oldenlandia*, copied in *Hortus Kewensis* from Linnæus and Willdenow, would not have been allowed to contradict the plate and description of Roxburgh, cited underneath. But, above all, various inaccuracies and faults in nomenclature are propagated and confirmed by an authority which Mr Dryander himself never intended to give. He has often assured the writer of this notice, that, had he published in his own name, he would not have adopted such inaccuracies; which is mentioned here to prevent the errors of others being laid to his charge. The popular *Species Plantarum* of Willdenow being the avowed guide, the author of that work must be responsible for matters which it did not come within the scope of the author or editor of the *Hortus Kewensis* to correct. Many subjects, however, are most skilfully elucidated in this publication, as well as in the sequel of its second edition by Mr Brown, and these cannot escape the discrimination of an intelligent reader. Practical botany was but a secondary or occasional pursuit of Mr Dryander, and he had a diffidence of his powers, and a consequent distaste for the technical and descriptive parts of the science. The descriptions he had prepared for Mr Bauer's splendid figures of *Ericæ*, published by Mr Aiton, were readily and even gladly thrown into the fire, on occasion of a difference of opinion respecting the intended title of the work.

The study in which this most acute and correct man found ample scope for the exercise of his talents was bibliography. His *Catalogus Bibliothecæ Historico-Naturalis Josephi Banks*, is a model for all future writers in this line; but a model rather calculated to check than to excite imitation. A work so ingenious in design, and so perfect in execution, can scarcely be produced in any science; so faultless a specimen of typography we have never elsewhere seen. The frank and unvarnished sincerity of Mr Dryander's character was secondary only to his universal and fastidious exactness upon every subject that came under his notice. He could not be a silent witness of the slightest injustice, misrepresentation, or misconception. His impatience of contradiction arose more from the quickness of his penetration into the confusion and inaccuracy of ordinary intellects and charac-

ters, than from any natural severity. All clearness, honesty, and precision himself, he had little indulgence for those who fell short of his standard, and these were the greater part of mankind. On being asked what share Dr Smith had in the composition of the *Flora Græca*, he replied, with a vehemence which startled the inquirer, "Every word!" When teazed, as was too often his lot, by the questions of the heedless and superficial, he never neglected the duties of the office he had undertaken, if he could not always conceal his impatience under their performance. But when the humblest cultivator of real science applied for his assistance, all his stores were laid open; the most condescending liberality graced his conversation; and he was careful that what he communicated should not only be heard but understood. The versatility of his genius and conversation was no less admirable than their exactness. Whether the subject were a question in science, or a point of history; the politics of Europe, or the tittle-tattle of an obscure German court; the literary talents and performances of any distinguished man, or his private transactions; the intrigues for a place at court, a professorship, or a domestic establishment; he was sure to throw some light upon it. Few men were more missed in the circle in which he moved, nor could his place in general society be readily supplied. (J. E. S.)

DRYDEN, JOHN, an illustrious English poet, descended of a respectable family in Huntingdonshire, was born at Aldwincle, in that county, on the 9th August 1631. He was educated under Dr Bushby at Westminster school, whence he removed to Cambridge in 1650, having been elected scholar of Trinity College, of which he appears to have been afterwards a fellow. In his earlier days he gave no extraordinary indications of genius; for even the year before he quitted the university, he wrote a poem on the death of Lord Hastings, which by no means exhibits a presage of that perfection in poetical composition which he was afterwards destined to attain.

On the death of Oliver Cromwell he wrote some "heroic stanzas" to the memory of the Lord Protector; but after the Restoration, being desirous of ingratiating himself with the new monarch, he wrote, first, a poem entitled *Astræa Redux*, and afterwards a panegyric on the king upon the occasion of his coronation. In 1662, he addressed a poem to the lord chancellor Hyde, presented on new year's day; and in the same year he published a satire on the Dutch. In 1668 appeared his *Annus Mirabilis*, or the Year of Wonders, an historical poem, intended to celebrate the Duke of York's victory over the Dutch. These pieces at length obtained him the favour of the crown; and Sir William Davenant having died the same year, 1668, Dryden was appointed to succeed him as poet-laureat and historiographer to Charles II.; and accordingly he entered upon the office, though his patent was not signed until the year 1670. The pension of the two offices was L.200 a year. About this time also his inclination to write for the stage seems first to have evinced itself. For besides his concern with Sir William Davenant in the alteration of Shakspeare's *Tempest*, he in 1669 produced his *Wild Gallants*, a comedy, which met with very indifferent success. Yet the author, not discouraged by its failure, soon published his *Indian Emperor*, which having experienced a more favourable reception, encouraged him to proceed. He did so, and that with so great rapidity, that in the key to the Duke of Buckingham's *Rehearsal* he is recorded to have engaged himself by contract to write four plays in the year; and, indeed, in the years 1679 and 1680 he appears to have fulfilled this obligation. To this unhappy necessity which he lay under are to be attributed all those irregular and bombastic flights, and sometimes even puerile exuberances, for which he has been so severely criticised, and which, in the unavoidable hurry he usually wrote in, it was impossible for him to find time either to lop off or to correct.

In 1675, the Earl of Rochester, whose envious disposition did not allow him patiently to see growing merit meet with its due reward, and who therefore felt chagrined at the just applause with which Dryden's dramatic pieces had been received, was determined if possible to shake his interest at court; and he succeeded so far as to recommend one Crowne, an obscure author, to write a mask for the court, a service which of course belonged to Dryden as poet-laureat. Nor was this the only attack, or indeed the most formidable one, which Dryden's fame drew upon him; for, some years before this, the Duke of Buckingham, a man of licentious character, but of great wit, had severely ridiculed several of our author's plays in his piece called the *Rehearsal*. But though the intrinsic wit which runs through this performance cannot, even at the present day, fail to excite our laughter, yet, as ridicule is not always the test of truth, it ought not to form the standard by which to fix Dryden's poetical reputation, more especially when we consider that the pieces therein ridiculed are not the masterpieces of Dryden; that the very passages burlesqued are frequently, in their original places, much less ridiculous than when thus detached, like a rotten limb, from the body of the work, exposed to view with additional distortions, and divested of that connection with the other parts which gave it not only symmetry, but beauty; and, lastly, that the beauties, which the critic has kept in the back-ground, are infinitely more numerous than the deformities which he has thus industriously brought forth into immediate view.[1]

Dryden, however, did not suffer these attacks to pass with impunity; for in 1679 there appeared an *Essay on Satire*, said to have been written jointly by himself and the Earl of Mulgrave, containing some very severe reflections on the Earl of Rochester and the Duchess of Portsmouth, who, it is not improbable, might have been instrumental in the affront shown to Dryden; and in 1681 he published his *Absalom and Achitophel*, in which the well-known character of Zimri, drawn for the Duke of Buckingham, is certainly severe enough to repay all the ridicule thrown on him by that nobleman in the character of Bayes.[2] The

[1] Dryden affected to despise the satire of the *Rehearsal*, which, however, he must have felt acutely. In the dedication prefixed to his translation of Juvenal and Persius, he observes, speaking of the many lampoons and libels which had been written against him, "I answered not the *Rehearsal*, because I knew the author sat to himself when he drew the picture, and was the very Bayes of his own farce; because also I knew, that my betters were more concerned than I was in that satire; and, lastly, because Mr Smith and Mr Johnson, the main pillars of it, were two such languishing gentlemen in their conversation, that I could liken them to nothing but their own relations, those noble characters of men of wit and pleasure about town." But notwithstanding this affected insensibility, Dryden did not fail to take his revenge, as will be seen in the succeeding paragraph of the text.

[2] Dryden left the story unfinished; and the reason he assigns for doing so is, because he could not prevail upon himself to exhibit Absalom as unfortunate. "Were I the inventor," says he, "who am only the historian, I should certainly conclude the piece with the reconcilement of Absalom to David. And who knows but this may come to pass? Things were not brought to extremity where I left the story; there seems to be yet room left for a composure: hereafter there may be only for pity. I have not so much as an uncharitable wish against Achitophel; but am content to be accused of good-natured error, and to hope, with Origen, that the devil himself may at last be saved. For which reason, in this poem, he is neither brought to set his house in order, nor to dispose o his person afterwards." Nevertheless, a second part of *Absalom and Achitophel* was undertaken and written by Tate, at the reques and under the direction of Dryden, who wrote nearly two hundred lines of it himself.

resentment shown by these peers was, however, different and characteristic. Lord Rochester, who was a coward as well as a man of the most depraved morals, basely hired three ruffians to cudgel Dryden in a coffeehouse; whilst the Duke of Buckingham, in a more open manner, took the task upon himself, and at the same time presented the poet with a purse containing no very trifling sum of money; telling him that he inflicted the beating as a punishment for his impudence, but bestowed the gold as a reward for his wit.

In 1680 was published a translation of Ovid's Epistles in English verse by several hands, two of which, together with the preface, were by Dryden; and in 1682 appeared his *Religio Laici*, designed as a defence of revealed religion, against deists, infidels, *et hoc genus omne.* Soon after the accession of King James II. our author changed his religion for that of the church of Rome, and wrote two pieces in vindication of the Catholic tenets; namely, *A Defence of the Papers written by the late King*, found in his strong box; and the celebrated poem, afterwards answered by Lord Halifax, entitled *The Hind and the Panther*. By this extraordinary step he not only engaged himself in controversy, and incurred much censure and ridicule from the contemporary wits, but on the accomplishment of the revolution, being, by reason of his new religion, disqualified from bearing any office under the government, he was stripped of the laurel, which, to his still greater mortification, was bestowed on Richard Flecknoe, a man for whom he had a most settled aversion. This circumstance occasioned his writing the severely satirical poem called *MacFlecknoe*.

Dryden's circumstances had never been affluent; but being now deprived of this little support, he found himself reduced to the necessity of writing for bread. We consequently find him from this period engaged in tasks of labour as well as genius, namely, in translating the works of others; and to this necessity perhaps our nation stands indebted for some of the best translations extant. In the year when he lost the laurel, he published the life of St Francis Xavier from the French. In 1693 appeared a translation of Juvenal and Persius; in the first of which he had a considerable hand, and of the latter the entire execution. In 1695 was published his prose version of Fresnoy's *Art of Painting;* and in the year 1697 he gave to the world that translation of Virgil's works which still does, and perhaps ever will, hold the first place amongst all attempts of the kind. The smaller pieces of this eminent writer, such as prologues, epilogues, epitaphs, elegies, songs, and the like, are too numerous to be specified here, though now all happily collected in Sir Walter Scott's edition of his works. His last work is what is called his *Fables*, consisting of many of the most interesting stories in Homer, Ovid, Bocaccio, and Chaucer, translated or modernized in the most elegant and poetical manner; together with some original pieces, among which is the Ode to St Cecilia's Day. This last composition, though written in the very decline of the author's life, and at a period when old age and distress had conspired to damp his poetic ardour, and enfeeble the wings of fancy, possesses nevertheless as much of both as would have been sufficient to render him immortal had he never written a single line besides.

Dryden married Lady Elizabeth Howard, the daughter of the Earl of Berkshire, who survived him about eight years, though for the last four of them she was a lunatic, having been deprived of her senses by a nervous fever. By this lady he had three sons; Charles, John, and Henry. After a long life, harassed with the most laborious of all fatigues, that of the mind, and continually rendered anxious by distress and difficulty, he expired on the 1st of May 1701. Dryden had no monument erected to him for several years; a circumstance to which Pope alludes in his epitaph intended for Rowe. Upon this hint Sheffield Duke of Buckingham erected a tomb, for which the following epitaph was originally intended:

> This Sheffield rais'd—the sacred dust below
> Was Dryden once; the rest, who does not know?

But this was afterwards changed into the plain inscription still to be seen on the monument, containing merely the dates of the poet's birth and death, together with the fact of the tomb having been erected by John Sheffield, duke of Buckingham.

Dryden's character has been variously estimated by different writers, some of whom have exalted it by the highest commendation, and others debased it by the severest censure. The latter, however, we must charge to that strong spirit of party which prevailed during the greater part of Dryden's lifetime, and which ought therefore to be taken with great allowances. From some parts of his history, however, he appears to have been unsteady, and to have too readily temporized with the several revolutions in church and state. But this might in some measure have been owing to that natural timidity and diffidence of disposition, which almost all writers seem agreed that he possessed. Congreve, whose authority cannot be suspected, has given us such an account of him as must make him appear no less amiable in his private character as a man, than he was illustrious in his public capacity as a poet. In the former capacity, according to Congreve, he was humane, compassionate, forgiving, and sincerely friendly; of extensive reading, tenacious memory, and ready communication; gentle in the correction of the writings of others, and patient under the reprehension of his own deficiencies; easy of access himself, but slow and diffident in his advances to others; and of all men the most modest and the most easy to be discountenanced in his approaches either to his superiors or to his equals. In the latter the highest testimonies have been borne to his merits by some of the greatest men.

Pope had a very high opinion of Dryden. In a letter to Wycherly he says, "It was certainly a great satisfaction to me to see and converse with a man whom in his writings I had so long known with pleasure; but it was a very high addition to it, to hear you at our very first meeting doing justice to your dead friend Mr Dryden. I was not so happy as to know him; *Virgilium tantum vidi.* Had I been born early enough, I must have known and loved him; for I have been assured, not only by yourself, but by Mr Congreve and Sir William Trumball, that his personal qualities were as amiable as his poetical, notwithstanding the many libellous misrepresentations of them; against which the former of these gentlemen has told me he will one day vindicate him." But what Congreve and Pope have said of Dryden is rather in the way of panegyric than as an exact and impartial character. Other writers, however, have spoken of him with greater moderation, yet probably without doing him any injustice. Thus, according to Felton, "he at once gave the best rules, and broke them, in spite of his own knowledge, and the *Rehearsal.* His prefaces are many of them admirable upon dramatic writings: he had some peculiar notions, which he maintains with great address; but his judgment in disputed points is of less weight and value, because the inconstancy of his temper did run into his thoughts, and mixed with the conduct of his writings, as well as his life." Voltaire describes him as "a writer whose genius was too exuberant, and not accompanied with judgment enough;" and he adds, that "if he, Dryden, had written only a tenth part of the works he left behind him, his character would

have been conspicuous in every part. But," says the philosopher of Ferney, "his great fault is his having endeavoured to be universal." "Perhaps no nation," says Dr Johnson, "ever produced a writer that enriched his language with such a variety of models. To him we owe the improvement, perhaps the completion, of our metre, the refinement of our language, and much of the correctness of our sentiments. By him we were taught 'sapere et fari,' to think naturally and express forcibly. Though Davies has reasoned in rhyme before him, it may be perhaps maintained that he was the first who joined argument with poetry. He showed us the true bounds of a translator's liberty. What was said of Rome adorned by Augustus, may be applied by an easy metaphor to English poetry embellished by Dryden, 'lateritiam invenit, marmoream reliquit;' he found it brick, and he left it marble." The public voice, indeed, has assigned to Dryden the first place in the second rank of our poets; no mean station in a table of intellectual precedency so rich in illustrious names: and it is allowed that, even of the few who were his superiors in genius, none has exercised a more extensive or permanent influence on the national habits of thought and expression. In the following noble passage from an article in the *Edinburgh Review* (vol. xlvii. p. 29), the great attributes of Dryden's character and genius are unfolded with striking vigour of diction and splendour of illustration.

"If Dryden had died before the expiration of the first of the periods into which we have divided his literary life, he would have left a reputation, at best, little higher than that of Lee or Davenant. He would have been known only to men of letters; and by them he would have been mentioned as a writer who threw away, on subjects which he was incompetent to treat, powers which, judiciously employed, might have raised him to eminence, whose diction and whose numbers had sometimes very high merit, but all whose works were blemished by a false taste, and by errors of gross negligence. A few of his prologues and epilogues might perhaps still have been remembered and quoted. In these little pieces, he early showed all the powers which afterwards rendered him the greatest of modern satirists. But during the latter part of his life he gradually abandoned the drama. His plays appeared at longer intervals. He renounced rhyme in tragedy. His language became less turgid, his characters less exaggerated. He did not indeed produce correct representations of human nature; but he ceased to daub such monstrous chimeras as those which abound in his earlier pieces. Here and there passages occur worthy of the best ages of the British stage. The style which the drama requires changes with every change of character and situation. He who can vary his manner to suit the variation, is the great dramatist; but he who excels in one manner only, will, when that manner happens to be appropriate, appear to be a great dramatist; as the hands of a watch which does not go point right once in the twelve hours. Sometimes there is a scene of solemn debate. This a mere rhetorician may write as well as the greatest tragedian that ever lived. We confess that to us the speech of Sempronius in Cato seems very nearly as good as Shakspeare could have made it. But when the senate breaks up, and we find that the lovers and their mistresses, the hero, the villain, and the deputy-villain, all continue to harangue in the same style, we perceive the difference between a man who can write a play and a man who can write a speech. In the same manner, wit, a talent for description, or a talent for narration, may, for a time, pass for dramatic genius. Dryden was an incomparable reasoner in verse. He was conscious of his power; he was proud of it; and the authors of the *Rehearsal* justly charged him with abusing it. His warriors and princesses are fond of discussing points of amorous casuistry, such as would have delighted a parliament of love. They frequently go still deeper, and speculate on philosophical necessity and the origin of evil.

"There were, however, some occasions which absolutely required this peculiar talent. Then Dryden was indeed at home. All his best scenes are of this description. They are all between men; for the heroes of Dryden, like many other gentlemen, can never talk sense when ladies are in company. They are all intended to exhibit the empire of reason over violent passion. We have two interlocutors, the one eager and impassioned, the other high, cool, and judicious. The composed and rational character gradually acquires the ascendency. His fierce companion is first inflamed to rage by his reproaches, then overawed by his equanimity, convinced by his arguments, and soothed by his persuasions. This is the case in the scene between Hector and Troilus, in that between Antony and Ventidius, and in that between Sebastian and Dorax. Nothing of the same kind in Shakspeare is equal to them, except the quarrel between Brutus and Cassius, which is worth them all three.

"Some years before his death, Dryden altogether ceased to write for the stage. He had turned his powers in a new direction, with success the most splendid and decisive. His taste had gradually awakened his creative faculties. The first rank in poetry was beyond his reach, but he challenged and secured the most honourable place in the second. His imagination resembled the wings of an ostrich. It enabled him to run, though not to soar. When he attempted the highest flights, he became ridiculous; but while he remained in a lower region, he outstripped all competitors.

"All his natural, and all his acquired powers, fitted him to found a good critical school of poetry. Indeed he carried his reforms too far for his age. After his death our literature retrograded; and a century was necessary to bring it back to the point at which he left it. The general soundness and healthfulness of his mental constitution, his information, of vast superficies though of small volume, his wit scarcely inferior to that of the most distinguished followers of Donne, his eloquence, grave, deliberate, and commanding, could not save him from disgraceful failure as a rival of Shakspeare, but raised him far above the level of Boileau. His command of language was immense. With him died the secret of the old poetical diction of England, the art of producing rich effects by familiar words. In the following century, it was as completely lost as the Gothic method of painting glass, and was but poorly supplied by the laborious and tesselated imitations of Mason and Gray. On the other hand, he was the first writer under whose skilful management the scientific vocabulary fell into natural and pleasing verse. In this department he succeeded as completely as his contemporary Gibbons succeeded in the similar enterprise of carving the most delicate flowers from heart of oak. The toughest and most knotty parts of language became ductile at his touch. His versification, in the same manner, while it gave the first model of that neatness and precision which the following generation esteemed so highly, exhibited, at the same time, the last examples of nobleness, freedom, variety of pause and cadence. His tragedies in rhyme, however worthless in themselves, had at least served the purpose of nonsense-verses: they had taught him all the arts of melody which the heroic couplet admits. For bombast, his prevailing vice, his new subjects gave little opportunity; his better taste gradually discarded it.

"He possessed, as we have said, in a pre-eminent de-

gree, the power of reasoning in verse; and this power was now peculiarly useful to him. His logic is by no means uniformly sound. On points of criticism he always reasons ingeniously, and, when he is disposed to be honest, correctly; but the theological and political questions which he undertook to treat in verse were precisely those which he understood least. His arguments, therefore, are often worthless; but the manner in which they are stated is beyond all praise. The style is transparent. The topics follow each other in the happiest order. The objections are drawn up in such a manner that the whole fire of the reply may be brought to bear on them. The circumlocutions which are substituted for technical phrases are clear, neat, and exact. The illustrations at once adorn and elucidate the reasoning. The sparkling epigrams of Cowley, and the simple garrulity of the burlesque poets of Italy, are alternately employed in the happiest manner, to give effect to what is obvious, or clearness to what is obscure.

"His literary creed was catholic, even to latitudinarianism, not from any want of acuteness, but from a disposition to be easily satisfied. He was quick to discern the smallest glimpse of merit; he was indulgent even to gross improprieties when accompanied by any redeeming talent. When he said a severe thing, it was to serve a temporary purpose, to support an argument or to tease a rival. Never was so able a critic so free from fastidiousness. He loved the old poets, especially Shakspeare. He admired the ingenuity which Donne and Cowley had so wildly abused. He did justice, amidst the general silence, to the memory of Milton. He praised to the skies the school-boy lines of Addison. Always looking on the fair side of every object, he admired extravagance, on account of the invention which he supposed it to indicate; he excused affectation in favour of wit; he tolerated even tameness for the sake of the correctness which was its concomitant.

"It was probably to this turn of mind, rather than to the more disgraceful causes which Johnson has assigned, that we are to attribute the exaggeration which disfigures the panegyrics of Dryden. No writer, it must be owned, has carried the flattery of dedication to a greater length; but this was not, we suspect, merely interested servility: it was the overflowing of a mind singularly disposed to admiration, of a mind which diminished vices, and magnified virtues and obligations. The most adulatory of his addresses is that in which he dedicates the State of Innocence to Mary of Modena. Johnson thinks it strange that any man should use such language without self-detestation; but he has not remarked, that to the very same work is prefixed an eulogium on Milton, which certainly could not have been acceptable to the court of Charles II. Many years later, when Whig principles were in a great measure triumphant, Sprat refused to admit a monument of John Philips into Westminster Abbey, because, in the epitaph, the name of Milton incidentally occurred. The walls of his church, he declared, should not be polluted by the name of a republican. Dryden was attached both by principle and interest to the court; but nothing could deaden his sensibility to excellence. We are unwilling to accuse him severely, because the same disposition which prompted him to pay so generous a tribute to the memory of a poet whom his patrons detested, hurried him into extravagance when he described a princess distinguished by the splendour of her beauty and the graciousness of her manners.

"This is an amiable temper, but it is not the temper of great men. Where there is elevation of character there will be fastidiousness. It is only in novels and on tombstones that we meet with people who are indulgent to the faults of others and unmerciful to their own, and Dryden at all events was not one of these paragons. His charity was extended most liberally to others, but it certainly began at home. In taste he was by no means deficient. His critical works are beyond all comparison superior to any which had till then appeared in England. They were generally intended as apologies for his own poems, rather than as expositions of general principles; he, therefore, often attempts to deceive the reader by sophistry, which could scarcely have deceived himself. His dicta are the dicta, not of a judge, but of an advocate, and often of an advocate in an unsound cause; yet in the very act of misrepresenting the laws of composition he shows how well he understands them; but he was perpetually acting against his better knowledge. His sins were sins against light: he trusted that what was bad would be pardoned for the sake of what was good; what was good he took no pains to make better. He was not, like most persons who rise to eminence, dissatisfied even with his worst productions. He had set up no unattainable standard of perfection, the contemplation of which might at once improve and mortify him. His path was not attended by an unapproachable mirage of excellence, for ever receding and for ever pursued. He was not disgusted by the negligence of others, and he extended the same toleration to himself. His mind was of a slovenly character; fond of splendour, but indifferent to neatness. Hence most of his writings exhibit the sluttish magnificence of a Russian noble, all vermin and diamonds, dirty linen and inestimable sables. Those faults which spring from affectation, time and thought in a great measure removed from his poems; but his carelessness he retained to the last. If towards the close of his life he less frequently went wrong from negligence, it was only because long habits of composition rendered it more easy to go right. In his best pieces we find false rhymes, triplets in which the third line appears to be a mere intruder, and while it breaks the music, adds nothing to the meaning; gigantic Alexandrines of fourteen and sixteen syllables, and truncated verses for which he never troubled himself to find a termination or a partner.

"Such are the beauties and the faults which may be found in profusion throughout the later works of Dryden. A more just and complete estimate of his natural and acquired powers, of the merits of his style and of its blemishes, may be formed from the *Hind and Panther*, than from any of his other writings. As a didactic poem, it is far superior to the *Religio Laici*. The satirical parts, particularly the character of Burnet, are scarcely inferior to the best passages in *Absalom and Achitophel*. There are, moreover, occasional touches of a tenderness, which affects us more, because it is decent, rational, and manly, and reminds us of the best scenes in his tragedies. His versification sinks and swells in happy unison with the subject, and his wealth of language seems to be unlimited. Yet the carelessness with which he has constructed his plot, and the innumerable inconsistencies into which he is every moment falling, detract much from the pleasure which such various excellence affords.

"In *Absalom and Achitophel* he hit upon a new and rich vein, which he worked with signal success. The ancient satirists were the subjects of a despotic government. They were compelled to abstain from political topics, and to confine their attention to the frailties of private life. They might, indeed, sometimes venture to take liberties with public men,

Quorum Flaminia tegitur cinis atque Latina.

Thus Juvenal immortalized the obsequious senators who met to decide the fate of the memorable turbot. His fourth satire frequently reminds us of the great political

poem of Dryden; but it was not written till Domitian had fallen, and it wants something of the peculiar flavour which belongs to contemporary invective alone. His anger has stood so long, that though the body is not impaired, the effervescence, the first cream, is gone. Boileau lay under similar restraints, and, if he had been free from all restraint, would have been no match for our countryman.

"The advantages which Dryden derived from the nature of his subject he improved to the very utmost. His manner is almost perfect. The style of Horace and Boileau is fit only for light subjects. The Frenchman did indeed attempt to turn the theological reasonings of the Provincial Letter into verse, but with very indifferent success. The glitter of Pope is cold: the ardour of Persius is without brilliancy. Magnificent versification and ingenious combinations rarely harmonize with the expression of deep feeling. In Juvenal and Dryden alone we have the sparkle and the heat together. Those great satirists succeeded in communicating the fervour of their feelings to materials the most incombustible, and kindled the whole mass into a blaze at once dazzling and destructive. We cannot indeed think, without regret, of the part which so eminent a writer as Dryden took in the disputes of that period. There was, no doubt, madness and wickedness on both sides; but there was liberty on the one and despotism on the other. On this point, however, we will not dwell. At Talavera the English and French troops for a moment suspended their conflict to drink of a stream which flowed between them. The shells were passed across from enemy to enemy without apprehension or molestation. We, in the same manner, would rather assist our political adversaries to drink with us of that fountain of intellectual pleasure which should be the common refreshment of both parties, than disturb and pollute it with the havoc of unseasonable hostilities.

"*MacFlecknoe* is inferior to *Absalom and Achitophel* only in the subject: in the execution it is even superior. But the greatest work of Dryden was the last, the Ode on St Cecilia's Day. It is the masterpiece of the second class of poetry, and ranks but just below the great models of the first. It reminds us of the Pedasus of Achilles—

ὅς, καὶ θνητὸς ἐὼν, ἕπεθ' ἵπποις ἀθανάτοισι.

By comparing it with the impotent ravings of the heroic tragedies, we may measure the progress which the mind of Dryden had made. He had learned to avoid a too audacious competition with higher natures, to keep at a distance from the verge of bombast or nonsense, to venture on no expression which did not convey a distinct idea to his own mind. There is none of that 'darkness visible' of style which he had formerly affected, and in which the greatest poets only can succeed. Every thing is definite, significant, and picturesque. His early writings resemble the gigantic works of those Chinese gardeners who attempt to rival nature herself, to form cataracts of terrific height and sound, to raise precipitous ridges of mountains, and to imitate in artificial plantations the vastness and the gloom of some primeval forest This manner he abandoned; nor did he ever adopt the Dutch taste which Pope affected, the trim parterres and the rectangular walks. He rather resembled our Kents and Browns, who, imitating the great features of landscape without emulating them, consulting the genius of the place, assisting nature, and carefully disguising their art, produced, not a Chamouni or a Niagara, but a Stowe or a Hagley.

"We are, on the whole, inclined to regret that Dryden did not accomplish his purpose of writing an epic poem. It certainly would not have been a work of the highest rank. It would not have rivalled the Iliad, the Odyssey, or the Paradise Lost; but it would have been superior to the productions of Apollonius, Lucan, or Statius, and not inferior to the Jerusalem Delivered. It would probably have been a vigorous narrative, animated with something of the spirit of the old romances, enriched with much splendid description, and interspersed with fine declamations and disquisitions. The danger of Dryden would have been from aiming too high; from dwelling too much, for example, on his kingdoms of angels, and attempting a competition with that great writer, who in his own time had so incomparably succeeded in representing to us the sights and sounds of another world. To Milton, and to Milton alone, belonged the secrets of the great deep, the beach of sulphur, the ocean of fire, the palaces of the fallen dominations glimmering through the everlasting shade, the silent wilderness of verdure and fragrance where armed angels kept watch over the sleep of the first lovers, the portico of diamond, the sea of jasper, the sapphire pavement empurpled with celestial roses, and the infinite ranks of the cherubim, blazing with adamant and gold. The council, the tournament, the procession, the crowded cathedral, the camp, the guard-room, the chase, were the proper scenes for Dryden.

"But we have not space to pass in review all the works which Dryden wrote. We, therefore, will not speculate longer on those which he might possibly have written. He may, on the whole, be pronounced to have been a man possessed of splendid talents, which he often abused, and of a sound judgment, the admonitions of which he often neglected; a man who succeeded only in an inferior department of his art, but who, in that department, succeeded pre-eminently; and who, with a more independent spirit, a more anxious desire of excellence, and more respect for himself, would, in his own walk, have attained to absolute perfection."

Among the various editions of Dryden's works may be mentioned, the Prose Works, by Malone, 1800, in 4 vols.; the Poetical Works, with notes by Warton, and edited by Todd, 1812, in 4 vols. 8vo; and the whole of his Works, with a Life by the late Sir Walter Scott, Edinburgh, 1808, in 18 vols. 8vo.

DRY ROT,

A MOST destructive, and apparently infectious disease in timber, which, by decomposing the fibres, deprives it of all strength, and in no great length of time reduces it to a mass of dry dust; a circumstance from which it seems to have derived its name, which, perhaps, would better be expressed by that of *sap rot.*

Though this disease must from its nature have been co-existent with timber-trees, it would not seem to have excited much attention, and perhaps was not known, certainly not by its present name, before the middle of the last century; at some period, we rather think, of Sir John Pringle's presidency of the Royal Society of London. But for a long time after this little notice appears to have been taken of it; its ravages being, in all probability, inconsiderable, in comparison with what they have been of late years. Even now, the disease is in fact chiefly confined to modern built houses and modern built ships, and more particularly to the ships of the royal navy. The proximate cause of it has, therefore, rightly enough, as it would seem, been ascribed to the unseasonable state of

Dry Rot.

the timber, when placed in certain situations, and under particular circumstances. It could not fail, in the course of the late long protracted war, to become a matter of general observation, that a more rapid decay than usual had become almost universal throughout the fleet, and especially amongst the newest and most recently repaired ships. Many anxious inquiries were instituted, and experiments made, with the view of ascertaining the real cause of a decay, the further prevention of which was so highly important to the national welfare and security. The alarm was greatly increased when, in 1810, the Queen Charlotte, a first-rate ship of war, shortly afterwards launched at Deptford, was discovered, after a close examination, to have all her upper works infected with the *dry rot;* or, in other words, the ends of most of the beams, carlings, and ledges, the joinings of the planks, &c. were observed to be covered with a mouldy, fibrous, and reticulated crust, and the parts of the timber so covered to be perfectly rotten. All the newspapers and journals of the day were filled with this alarming fact, and in consequence thereof a multitude of *dry rot* doctors proffered their assistance; one having a nostrum for eradicating the disease where it had made its appearance, and another for preventing its further approach. Some of these specifics were expensive and inconvenient, many of them impracticable of application, and most of them futile and objectionable in one way or another. These doctors, in fact, like the physicians for the human body when the seat of the disease is unknown, were labouring altogether in the dark, having no other guide to direct them than their own whims and fancies, each being ignorant of the effect of the respective experiments which they wished to try on this diseased machine.

Alarming progress of.

Treatises on the dry rot.

Since the period in question a number of treatises have been written on the subject, for the prevention and cure of the dry rot in ships and houses; some wild and visionary enough, and others exhibiting the proofs of plain practical good sense, deduced from long observation, or the result of judicious experiment. Of the latter description may safely be mentioned *A Treatise on the Dry Rot in Timber*, written in 1815 by the late Mr Thomas Wade, who died previous to its publication, and whilst employed in making experiments in the dock-yards; and also another *On the Prevention of Timber from Premature Decay*, by Mr Chapman, 1817. *A Treatise on the Dry Rot*, by Mr Bowden of the Navy Office, is in many respects deserving of notice, in as far as the facts and his observations on the management of timber are carried; but he unluckily sets out with a fanciful theory, which, however, is not his own, concerning the generation of *fungi*, and their connection with the dry rot, to which, like most theorists, he endeavours to make all his facts subservient. In Mr M'William's *Essay on the Origin and Operation of the Dry Rot*, published in 1818, we find stuffed into a large quarto almost every theory and every fact gathered from preceding writers, from Aristotle down to Mr Ralph Dodd, civil engineer, who has also published his *Practical Observations on the Dry Rot in Timber;* which work appears to be little more than an advertisement of *A Dry Rot Preventive*, a nostrum which, it would seem, is too valuable to be disclosed, without calling in the doctor that he may get his fee. We have also in print the opinions and the specifics of Mr Gregory, Mr Ogg, and many others of minor note, all of whom profess to explain the cause, to secure the prevention, and to effect the cure of the *dry rot.*

Process of the common rot.

These authors are at variance amongst themselves, whether the *common rot* in timber, and the *dry rot*, be not one and the same disease. A little reflection, however, will, we conceive, lead us to consider them as essentially different, both in the symptoms, the progress, and the causes, though the *effect* of destroying the fibre of the wood is pretty nearly the same. If a post of wood, for instance, be driven into the ground, seasoned or unseasoned, it will speedily begin to decay just at the surface of the ground, or, as it were, between the earth and the air; if driven into the earth through water, as in a pond, the decay will commence at the surface of the water, or, as it is technically expressed, between wind and water, whilst all above water, and all that is constantly immerged in the water, as well as the part in the earth, will remain sound. Thus also a beam of wood let into a damp wall will begin to rot just where it enters the wall; so will wooden bannisters when they are let through the top and foot rails. In these and similar cases the rot begins externally, and its progress is inwards, and is more or less accelerated by the alternate action of wind, heat, and moisture, being *greatest* when the alternatives of exposure to wet and drought are most frequent, and *least* when constantly immersed in water, or constantly preserved in a dry atmosphere. Such we conceive to be the usual process of the *common rot* in wood, and it is evidently occasioned by alternate exposure to the vicissitudes of the weather, to moisture and dryness, to heat and cold.

Process of the dry rot

If the same post be well charred or covered over with a thick coating of paint, or varnish, or tar, no such effect will be produced *externally*, the coating being sufficient to protect it against the action of the weather; but if it should happen to be a green or unseasoned piece of wood so tarred or painted, in no great length of time the wood will be found to have begun to decay *internally*, whilst the outer surface appears uninjured, but at length it will also yield to the disease. If this piece of wood had been placed in a warm cellar or close room where there is little or no circulation of air, and more particularly if the room or cellar were damp, there would be perceived, in no great length of time, a fine mouldy coating spread over its surface, of a brownish yellow or dirty white; and shortly afterwards it would be found, on examination, to resemble in its form and structure some of the beautifully ramified *algæ* or sea weeds; which in process of time would become more compact, the interstices being so completely filled up as to give to the whole mass the appearance and consistence of leather. "At first," says one writer, "its appearance is that of fine fibres running on the surface in endless ramifications, resembling the nervous fibres of leaves; presently the interstices are filled up with a spongy or leather-like substance, assuming the character of that order of cryptogamous plants distinguished by the name of *fungus*."

By Mr Wade the general symptoms of *dry rot* are thus described: "The wood at first swells; after some time it changes its colour, then emits gases which have a mouldy or musty smell. In the more advanced stages of it the mass arises, and cracks in transverse directions. Lastly, it becomes pulverulent, and forms vegetable earth; and generally in some of these stages of decay the different species of fungus are found to vegetate on the mass." (*Treatise on the Dry Rot in Timber*. By Thomas Wade.)

These appearances do not invariably take place, the surface of the diseased timber sometimes remaining unchanged, while the process of rotting is going on within; they are, however, pretty constant. But however sound the surface may be, it will appear, on examining the piece of wood, placed in a situation similar to those above mentioned, that the whole of the interior fibres are decomposed, and become a mass of dust inclosed within a thin external shell. No charring of the surface, no paint, tar, or varnish, will prevent this process from taking place,

when the seeds of the dry rot exist, and are placed in a situation favourable for their growth, though they may prevent the external character of mouldiness from taking place on the surface.

Characteristic difference of the two rots.

The symptomatic difference, then, between the common rot and the dry rot may perhaps be thus defined. *Common rot* is a disease in timber, occasioned by the alternations of the weather acting on its surface, and destroying its fibres externally inwards. *Dry rot* is a disease in timber, occasioned by being shut up in warm, close, and moist situations, the effect of which is to destroy its fibres by a process acting internally outwards.

Causes of the dry rot.

Without stopping to inquire in what manner, and by what agency, chemical or mechanical, or both, the common rot acts on the external fibres of the wood, the effect of alternate exposure to the weather is too well known to require any further proof as to its being the immediate cause. The immediate cause of the dry rot is equally obvious; but the predisposing state of the timber to contract the disease is not so clear a problem. Accordingly, theories without end have been hatched to explain the phenomenon. A writer in a public journal, who has slightly touched on the subject, thus explains it. " It is well known," he observes, " that if a piece of green wood be laid across a fire, the air within, expanded by the heat, will drive out at each extremity a viscous fluid, possessing the property of disposing itself on the surface in reticulated filaments. The same appearance of nervous foliation is not uncommon in the intermediate spaces of the concentric layers of the *alburnum* of wood; and the core or heart of trees, and particularly of the pitch pine, after its passage in the heated hold of a ship, is often enveloped with a membranous corticle, like that which lies immediately beneath the bark. All these appearances are certain indications of the *dry rot;* and they point out, with sufficient clearness, that the *sap*, or principle of vegetation, brought into activity, is the *cause* of the disease; the *effect*, though infinitely more rapid, is the same as that of the common rot. It is still a problem in what manner this sap circulates; but there is no doubt that the tubes and cells of the alburnum, or sap-wood, are filled with it in the spring of the year, and that they are empty in the winter; that it is organized matter, developing itself by heat in all the various forms of new bark, leaves, and branches. The stem of a tree cut down will, on the return of summer, make an effort to push out leaves; a more feeble effort of this organized sap ends in the production of *fungus* only." (*Quarterly Review*, No. 15.)

It is now, we apprehend, pretty well decided, that, like other vegetables, the fungi or mushroom tribe are propagated by seed so minute and numerous as to float about invisibly in the air, and to be carried into all manner of situations. The fine impalpable powder that issues from the common puff-ball, like a column of smoke, will give some idea of the almost inconceivable myriads of minute seeds which it incloses. Of these seeds, though myriads perish, yet others, by a concurrence of accidents, being thrown into proper situations favourable for their growth, reproduce the species. It cannot be supposed that the fibres found in the dung of animals, and particularly of the horse, known by the name of mushroom spawn, and from which our gardeners construct their mushroom beds, are generated spontaneously in the belly of the animal, but that the seeds being devoured with his food, have found that degree of warmth, moisture, and soil, favourable to the development of the future plant; and this plant which the fibres exhibit, by care and cultivation increases and grows to the perfect state of all plants, and throws out above the surface the parts of fructification which we call the mushroom. If it be asked why the dung of a cow, which feeds on the same food with a horse, does not produce the spawn of mushrooms, the only answer to be given is, that it is not a proper nidus for the germination of the seed.

In the same manner may the perfect plant be produced from the seed, carried up into the longitudinal tubes of a growing tree, by the rising of the sap; though it would seem that the process of vegetation in the parasite thus lodged will not commence so long as the vital principle of the sap in the tree remains in activity. Indeed it is pretty evident, from numerous observations, that the process of fermentation is necessary to the growth of all fungi; and this may explain why in the diseased and decayed parts of a tree only are fungi found to grow whilst it is in a living state.

The sap, therefore, may be the *cause* of the *dry rot*, in as far as it is favourable to the growth of *fungi*, as it would seem to be when in a state of fermentation, though it never can by any process be convertible into this order of cryptogamous plants. But the appearance of fungi, though a frequent, is by no means a constant symptom of *dry rot;* and, therefore, Mr Bowden's definition of dry rot, with his whole doctrine, must fall to the ground. " The *nature* of *dry rot* is a *vegetable substance*," and this substance, he tells us, is fungus. Though not very happily expressed, his meaning is intelligible enough from what follows. " This secretion of nature (the juice of a tree) which was destined to appear in the form of leaves, branches, &c. being diverted from its original intention, assumes a new form from its own native energies. Vegetation commences in the various tubes of the wood, under the form of those fine fibrous shoots which have been already described (as mushroom spawn). It continues to increase in every direction, until, by an extraordinary manifestation, it happily averts the otherwise unforeseen but certain destruction of the vessel. It may confidently be asserted, therefore, that this is the primary, chief, and predisposing cause of *dry rot;* and this opinion may be further confirmed by an inquiry into the nature of the juices and fungi, and the manner in which the timber is affected." (*A Treatise on Dry Rot*, by A. Bowden.)

Mr Bowden having totally mistaken the nature of fungus, by adopting the erroneous principle of the writer in the *Quarterly Review*, labours hard to prove, and with considerable ingenuity, " that dry rot is caused by a vegetative substance, and that it is one of the species of *fungi;*" and this doctrine he illustrates in the case of *spent bark* from the tan-pits, of which he says, " when taken out and exposed to the heat of summer, the juices appear desirous of *obeying the laws of nature;* and being no longer capable of adding to the bulk of a tree, is satisfied with wearing the humble garb of a mushroom;" nay, so enamoured is he with the similarity of oak bark, and fungus, and *tannin*, that " an examination of the fungous coat taken from the end of a timber, would afford a strong presumption, from its exact resemblance to *leather*, that it owes its existence to no other cause than that which communicates such peculiar qualities." Into such absurdities will crude theories sometimes drive their authors.

Mr Wade has sounder notions on the nature of fungi; he knew they possessed the principle of reproduction, and that their seeds, under favourable circumstances, will vegetate; that the proper *nidus* for the reception of certain species of fungus appears to be wood in a state of progressive decomposition, or the remains of wood entirely decomposed; that, however, the effect produced by these plants and decaying timber is reciprocal, the latter furnishing food for the former, while the decomposition of the wood is accelerated by the growth of the fungus, the gaseous and soluble products being taken up by the

Dry Rot. plants, as quickly as these principles are disengaged. The whole tribe of parasitic fungi may, in fact, be considered as the wolves and tigers of the vegetable world, destroying ultimately every plant they fix upon, and most rapidly where the principle of vegetation has ceased to act, and the putrefactive fermentation of the juices has in consequence commenced.

The real efficient cause then of the dry rot, is that of the juices of the timber being brought into a state of putrefaction, occasioned generally by exposure to a moderate degree of heat and moisture in a stagnant atmosphere. "To favour this process," says Mr Wade, "as much as possible, the air and water should not be renewed, as they undergo a decomposition, which takes place very slowly." From the structure of timber being composed longitudinally of an assemblage of pipes or tubes, it is only necessary that one end of a log of wood should be placed in a damp or wet situation, to occasion the moisture to be conveyed to the opposite end by capillary attraction; and hence arises the infectious nature of the disease, which will always spread wherever the moisture finds its way; and even where there is no moisture, it will be created by the filaments of the fungi working their way through the tubes of the dry wood, and carrying it with them. Hence, also, the rapid decay in ships of war, from the great internal heat occasioned by the number of men, the moisture, and the close air. Hence, also, in houses, the *dry rot* always first appears in the lower apartments, where the floors, partitions, skirting-boards, &c. are supplied with moisture from the wet walls on the ground. In the London houses there is generally a room on the basement story, called the housekeeper's room, which is boarded, and carefully covered over with an oiled floor-cloth. In such a room the dry rot is sure to make its appearance. The wood absorbs the aqueous vapour which the oil-cloth will not allow to escape; and being assisted by the heat of the air in such apartments, the decay goes on most rapidly; and, as Mr Wade observes, "if the seed of fungus be present, the plant is developed in all the superfluity of vigour exhibited in a hot-house, where the same means are resorted to, namely, an atmosphere scientifically and artificially heated, and highly charged with aqueous vapour." Timber may, in fact, have the seeds of dry rot within it, and yet by proper treatment be kept sound for a great length of time. Thus ships laden with particular cargoes afford remarkable instances of the effects of such cargoes on their duration. The warm moisture created by a cargo of hemp is communicated to the timber, and promotes a rapid putrefaction. Mr Chapman says, that the ship Brothers, built at Whitby, of green timber, proceeded to Petersburg for a cargo of hemp. The next year it was found on examination that her timbers were rotten, and all the planking, excepting a thin external skin. A lading of cotton is always injurious to the ship, and even teak is affected by a cargo of pepper. The timber which is brought from America in the heated hold of a ship, is invariably covered over, on being landed, with a complete coating of fungus. It was the too general use of this timber in ships of the royal navy that at one time increased the disease to such an alarming degree. Those ships, on the contrary, which are employed constantly in the coal and lime trade, are very durable, and have been known to last for a century. These effects are obviously to be ascribed to the exclusion of air in the one case from, and the free admission of it in the other to, the interior surface of the ship, assisted, in the latter instance, by the absorption of moisture, by the coals and lime, from the timbers and planking.

Prevention of dry rot. If we are arrived at the right conclusion as to the *cause* of *dry rot* in timber, we can be at no loss with regard to the mode of treatment for the *prevention* of the disease. The experiments for this purpose have been very numerous, but may be classed under three general heads; desiccation or seasoning; immersion in earth, sand, or water; and impregnation with some foreign matter, which will resist putrefaction.

by desiccation or seasoning. The most simple and common mode of preventing the decomposition of vegetable matter, is by depriving it of moisture. Various schemes have been put in practice for drying the juices in large logs of timber. Time alone will do it when the wood is placed in favourable situations, that is to say, in a dry atmosphere, and constantly exposed to a free circulation of air; but time will also produce the rot in timber when piled up in stacks in the open air, imbibing moisture from the earth, and exposed to the vicissitudes of the seasons, and the alternatives of weather; scorched at one time by the heat of the sun, at another drenched with rain, and rent and split in every possible way by the freezing of the water which has insinuated itself into the pores and crevices of the wood. It was formerly, and, indeed, till very lately, the practice to let ships of war remain on the stocks *in frame* for two, three, or four years, to *season*, as it was called; but there never was so mistaken a notion. "When a ship," says Mr Wade, "is built, exposed to the weather, the lower part forms a grand reservoir for all the rain that falls; and as the timbers in that part are placed as close together as possible, the wet escapes very slowly. Those timbers are always soaked with moisture, and, to some distance from the keel, exhibit a green appearance; their green matter, when viewed through a microscope, is found to be a beautiful and completely formed moss, which vegetates at the expense of the timber. If to season timber be only to dry it, the sooner it is dried the better; and when completely dry, it cannot too soon be employed in ship-building, when it should be kept dry. It cannot answer any end to have seven years wear out of a ship on the stocks." At length our ship-wrights are convinced of this truth, and the plan now generally adopted in ship-building is to protect the vessel by a roofed structure, with the sides open to admit a free current of air, but to exclude all moisture, as well as the rays of the sun (See DOCK-YARDS); a practice which we have tardily adopted from the Swedes and the Venetians. A new system seems also to have been adopted on the piling the timber stacks. Instead of their being placed on old, useless, and often rotten logs of timber resting on the ground, they are now insulated from the earth on stone or iron pillars; and in place of their surfaces coming in contact with each other, pieces of wood are placed between them so as to admit of a circulation of air. Nothing further appears to be wanting but to protect the tops and the ends of the stocks or piles from the effects of the weather.

Of the various modes of artificial and rapid desiccation, that of charring is perhaps the best; but it is liable to two objections, the first is, that if the surface be completely charred, it diminishes very much the strength of the timber; and, secondly, it the more readily attracts moisture. The juices of timber may be drawn off or hardened by kiln-drying; but this also disturbs the arrangement of the fibres, and deprives the wood of a great part of its strength.

Mr Lukin's experiments for seasoning timber. The experiments made by Mr Lukin for the rapid seasoning of green oak timber, promised at one time much success, but ended in disappointment. He conceived, that if the acid and the watery particles were driven out of a piece of oak timber by some process which should prevent the surface from splitting, the fibres would be brought closer into contact, and whilst the log lost in weight it would gain in strength. With this view he

buried a piece of wood in pulverized charcoal in a heated oven. The log wore a promising appearance; the surface was close and compact; it had lost in its weight and dimensions; but when divided with the saw, the fibres were discovered to have started from each other, exhibiting a piece of fine net-work, resembling the inner bark of a tree.

His next contrivance was to supply the place of the fluids driven out by heat, with some other substance of an oily or resinous nature, which, while it destroyed the principle of vegetation, should preserve the timber in a compact state. For this purpose he erected a large kiln in Woolwich dock-yard, capable of containing from two to three hundred loads of timber. At each end, on the outside, was a retort in which the saw-dust of the pitch-pine was submitted to distillation. From the heads of these retorts were iron pipes, perforated with holes like a cylinder, continued along the upper part of the kiln the whole length in the inside. By this arrangement it was expected, that while the heat of the kiln drove off the aqueous matter of the timber, the product of the saw-dust, which resembled weak oil, or rather spirit of turpentine, would drop through the holes in the tubes upon the logs, and supply its place. But before the process of transfusion was judged to be complete, an explosion took place, which proved fatal to six of the workmen, and wounded fourteen, two of whom shortly afterwards died. The explosion was like the shock of an earthquake; it demolished the wall of the dock-yard, part of which was thrown to the distance of 250 feet; an iron door, weighing 280 pounds, was driven to the distance of 230 feet, and other parts of the building were borne in the air upwards of 300 feet. The experiment was not repeated.

The bad effects of applying artificial heat to the seasoning of green timber were strongly exemplified by a practice introduced very generally into our ships of war which had exhibited indications of the dry rot, particularly in the *Queen Charlotte*. Enormous fires were made in stoves placed in various parts of the ship, and the heat led in tubes to the cavities between the timbers, &c. The consequence of which was, as might be expected, an increase of the mischief they were intended to prevent. Every part of the ship was converted into a hot-house, and every part where the seeds of fungi had been deposited began to throw out a luxuriant crop of mushrooms; and where these did not appear, the juices of the wood were thrown into a state of fermentation, and, in the course of a twelvemonth, a great part of her upperworks became a mass of rottenness. After staving the powder magazines of some of the ships, there appeared under their floors, which are contiguous to much moisture, numbers of large excrescences of a leathery consistence, of the size and shape of a quart glass-decanter; and in all such parts where two surfaces of the wood were imperfectly brought into contact, were whole masses of fungi.

Winter-felled timber.

Another mode, of very ancient standing, was practised for getting rid of the juices of timber. This was supposed to be effected by felling the tree in the winter season, when the sap had descended and the vessels were empty. But by this practice the bark of the oak, so valuable in the process of tanning, was lost, as it will strip only from the wood in the spring of the year, when the sap is said to be rising. The supposed superior quality of the wood when winter-felled, and the general practice of felling oak timber at that season, may be inferred from a statute of James I. by which it is enacted, that no person or persons shall fell, or cause to be felled, any oaken trees meet to be barked, when bark is worth 2s. a cart-load (timber for the needful building and reparation of houses, ships, or mills, only excepted), but between the first day of April and last day of June, not even for the king's use, out of barking time, except for building or repairing his majesty's houses or ships.

The old Sovereign of the Seas is the standing example generally quoted to prove the beneficial effects of winter-felled timber. We are informed by one writer that, when taken in pieces, after forty-seven years' service, the old timber was still so hard that it was no easy matter to drive a nail into it, and all future writers have taken it for granted that this was owing to its being winter-felled. Mr Pett, however, who built her, takes no notice of any such circumstance. He merely says he was commanded by the king, on the 14th May 1635, to hasten into the north to procure the frame-timbers, plank, and trenails, for the great new ship at Woolwich. But he left his son behind to ship the moulds, provisions, and workmen, in a hired ship, to transport them to Newcastle; that the frame, as it was got ready, was sent in colliers from Newcastle and Sunderland; and that, on the 21st December, *in the same year*, the keel was laid in the dock; and in less than two years after this she was launched. Now, as it was the middle of May before Mr Pett received his majesty's commands to procure timber for this ship, and as she was on the stocks the same year, it is not very probable that the timber procured and sent in colliers from Newcastle to Woolwich was felled in the winter; much less could it have been "stripped of its bark in the spring, and felled the *second* succeeding autumn," as Mr Wade has it.

Neither is there the least proof of the old Royal William, recently broken up, when a century old, being built of winter-felled timber. The fact is, that she was rebuilt half a dozen times, and the only old and original timber remaining in her was in the lowest part of her hull, always immersed in the salt water externally, and washed with the bilge-water internally; and the wood from this part of her, when broken up, was perfectly sound, but quite black, having the appearance of being charred.

As far as experiments have been made, there is no reason to conclude that timber felled in the winter is at all more durable than that which is felled at the usual time. In the year 1793, the Hawke sloop of war was ordered to be built, one side being of timber that had been barked in the spring and felled in the winter, and the other side with timber felled at the usual time. In 1803 she was reported to be in so bad a state of rottenness, that she was ordered to be taken in pieces, when no difference whatever could be discovered in the state of the timbers of the two sides. It is said, however, in Derrak's *Memoirs of the Navy*, "that the timber had been stripped in the spring of 1787, and not felled until the autumn 1790," and this is given as an explanation of the failure. Why the barking in the spring should add to the durability of timber, is not easily conceived, if the object be to fell the timber when all the sap-vessels are empty, as, if the sap *descends* at all, which is doubtful, it might be expected to descend more freely when the bark is on than off the tree. This subject has not escaped the attention of the commissioners of the royal woods and forests, and various experiments have been made with a view to throw more light on a subject so vitally important to the British navy. In France, so long ago as 1669, a royal ordonnance limited the felling of timber from the 1st October to the 15th April; and the conservators of the forests directed that the trees should be felled when the "wind was at north," and "in the wane of the moon;" and we find an instruction of Bonaparte, that "as ships built of timber felled at the moment of vegetation must be liable to rapid decay, and require immediate repairs, from the effect of the *fermentation of the sap* in those pieces which had not been felled at the proper season;" the agents of the forests should abridge the time for felling naval timber, which should take place "in

Dry Rot.

the decrease of the moon, from the 1st November to the 15th March."

Immersion in earth, sand, or water.

The facts are so numerous and so strong in favour of the durability of timber when steeped in water or buried in earth or sand that no doubt whatever can be entertained of the efficacy of such a practice. At Brest all the timber used in ship-building is deposited in the narrow creek of the harbour which runs through the middle of the dock-yard, and it is said that the Brest built ships never had the dry rot. The same practice prevailed at Cadiz and Carthagena. Indeed there is reason to think that steeping in fresh water is a preventive of dry rot, probably by dissolving the juices of the timber. It was an ancient practice, and we believe is still followed in some parts of England, to place the timber intended for thrashing-floors in the midst of a stream of water, to *harden* it; and all the oak plants intended for the wainscotting of the old mansions were previously steeped in running water.

"I know it," says Mr Chapman, "to be the opinion of some well-informed men, whose sentiments are highly deserving of notice, that the sap of trees does not descend, but, like the arterial blood, is prevented by valves from returning; as a proof of which, it is asserted, that fresh-cut timber, if laid in a running stream, with the but-end towards the current, will have the water percolating through it, and carrying off the mucilaginous matter, but not otherwise." "There can be no doubt," he adds, "that the effect will be produced sooner in this direction than the other, and it should therefore be attended to." The reason is obvious; the extractive matter, which is the chief, though not the only, cause of putrefaction, is dissolved and driven off. The usual mode of preserving timber for masts, is to keep it immersed in water in what are called mast-locks. The mast of the Kangaroo sloop of war was dug out of the mud at the bottom of the mast-pond, at Deptford dock-yard, where it had been fifty years, and was one of the most serviceable masts in the navy. Burying timber in sand is a usual process for preserving it in warm climates. Yet, with all these facts and long experience, it was but very recently that the steeping of timber in salt water was practised in the king's dock-yards, and this originated in an accident. The Resistance frigate went down in Malta harbour. But as she had been reported in such a state of dry rot, or rather the surface of her timbers so covered with fungus, as to render it expedient to send her home, she was suffered to continue under water for many months. On her arrival in England it was observed that all appearance of fungus had vanished, and she remains a sound ship to this day. Yet even this fact does not seem to have attracted much attention. But when the dock-yard was removed from the northern to the southern side of Milford-haven, a few loads of timber that was covered with fungus were suffered to remain in the water for several months; and it was observed that, after being taken out and stacked in the new yard, the timber did not exhibit those appearances of dry rot which the same timber did most abundantly which had not been immersed in the salt water. This fact being reported to the navy board, it was proposed to sink one of two sister ships, the Mersey and the Eden, both alike infected with the dry rot, in Plymouth Sound. The Eden was the ship selected for this purpose. She remained under water for about eighteen months, and, on being raised, every trace of fungus had totally disappeared, whilst the Mersey was almost wholly covered with it. After remaining a year at home perfectly sound, she was sent out to the East Indies.

It is said, and there seems to be no reason for doubting the fact, that the planks of ships near the bows, which are obliged to be boiled in water or steam in order to bend them, are never infected with the dry rot: if the water in which they are boiled be strongly impregnated with salt, the effects would probably be more durable and decisive.

Dry Rot.

In a lecture read by Mr Ogg, a salt refiner, to the Plymouth Institution, on the prevention and cure of dry rot in ships of war, common salt is strongly recommended, for its cheapness, its wholesomeness, and its easy application; but he proposes a saturated solution of salt, in which he would steep not only single logs or planks, but the whole frame of a ship, or even the ship itself. "Let every ship in the navy," says the salt refiner, "be immersed a sufficient time in this fluid, and let every new ship be prepared in the same way, and dry rot would be heard of no more. But how is this to be accomplished? I answer, provide a dock or docks sufficiently capacious to receive five, ten, or twenty ships, and the work is done." As common sea-water will answer the purpose equally well, the apparatus of extensive docks and water saturated with salt are wholly unnecessary. But Mr Ogg, like Mr Bowden, appears to mistake the real cause of dry rot. "I affirm," says he, "that dry rot is occasioned by the vegetative principle; brine will destroy this principle; then sink the ship in brine." The experiments in the case of the Resistance and the Eden show that brine is not necessary.

The Dutch having observed that their busses, in which the herrings were caught and stowed away in pickle, lasted longer than any other craft, adopted the practice of filling up the vacancies between the timbers and planks of ships with salt, and of boring holes in the large timbers and cramming them full of salt. The Americans also found, that the ships employed in carrying out salt for their fisheries and domestic purposes were the most durable; and both they and the Dutch are glad to get a cargo of salt into a new ship, as the surest means of preserving her. The carpenter of the Franklin, an American seventy-four gun ship, when at Spithead, told some of her visitors, that at the junction of the beams, and at the butends of the timbers, pieces were cut, and the hollow part filled with salt, and covered over with felt, for the purpose of preserving those parts where two surfaces are imperfectly brought together, from the dry rot, where it is always most prevalent.

There are, however, very serious objections to the immersion of ships in a strong solution of salt, and the practice of inserting salt in the vacant space between the timbers, which may not, perhaps, apply with equal force to their immersion in sea-water. It is observed by a writer in the *Quarterly Review* for October 1814, that "the attraction for moisture which salts and acids possess, would keep the whole interior of the ship dripping wet; which would not only destroy the ship with the wet rot, but the ship's company also, whose health, experience has proved, is best preserved by keeping the ship as dry as possible; and thus the remedy would be worse than the disease." These bad effects have unquestionably been experienced, the muriate of magnesia, which exists in sea-water, being one of the most deliquescent salts; but whether the abstraction of moisture from the atmosphere be of long duration, is a fact which remains to be proved. In corroboration of the injurious effects above described, Mr Strange, in his *Evidences*, observes, "that the practice at Venice of the fresh cut timber being thrown into salt water prevents its ever becoming dry in the ships, and that the salt water rusted and corroded the iron bolts." Mr Chapman also observes that "the *Florida*, a twenty gun ship, taken from the Americans, and subsequently commissioned in the British service, had been salt-seasoned; and the result was, that in damp weather every thing be-

came moist, the iron work was rusted, and the health of the crew was impaired; in fine," he adds, "vessels so circumstanced are perfect hygrometers; being as sensible to changes of the moisture in the atmosphere as lumps of rock salt, or slips of fuci, or the plaster of inside walls where sea-sand has been used."

Mr Chapman, however, is of opinion, that vessels impregnated with bay-salt, or the large grained salt of Limington or of Liverpool (being pure muriate of soda, without admixture with the bitter deliquescent salts), will possess decided advantages, as would also vessels laden with saltpetre, if it has been dispersed among their timbers; and Mr Ogg sees no difficulty in refining salts so as to deprive it of its deliquescent quality. But if a very weak solution of salt, or even fresh water, shall be found to answer the purpose, the objection against immersing timber in sea-water seems to be got rid of. That it will immediately destroy all vegetable life in the delicate fibres of the fungus, and also prevent its future growth, is quite clear; and if it shall be found to prevent also the putrefactive process, it may be considered as the most advisable way to prepare timber for all purposes of house carpentry and ship-building.

Impregnation of timber with foreign substances.

A great variety of substances besides common salt, indeed almost any salt or acid, will destroy and prevent the growth of fungus. Sir Humphry Davy recommends a weak solution of the corrosive sublimate as the most efficient. A solution of sulphate of iron or copperas is much used in Sweden for hardening and preserving wood for wheel-carriages, &c. It is first boiled in this solution for three or four hours, and then kept in a warm place to dry, by which process it is said to become so hard and compact that moisture cannot penetrate it. "The wooden vessels," says Mr Chapman, "in which the sulpho-ferruginous solution is finally placed for the copperas to crystallize, become exceedingly hard, and not subject to decay." A solution of alum has been recommended; but Mr Chapman seems to think that its earthy basis would become a nidus of putrefaction. The wood, however, which is used about alum works, becomes hard and durable, and resists fire in an extraordinary manner. All timber, in fact, when completely saturated with saline matter, is more or less indestructible, and absolutely incombustible. A solution of arsenic has not been found to prevent the dry rot. With regard to the impregnation of oils there are various opinions, some thinking them beneficial and others injurious to the durability of timber. It is known, however, that ships in the Greenland trade have their timbers and planks preserved as high up as they are impregnated with whale oil from the blubber; and Mr Chapman says, that one of the masters of a Greenland ship having payed her upperworks with twelve or more successive coats with whale oil in hot weather, they became covered with a thin varnish, much harder and more compact than if filled with successive coats of turpentine. Resinous substances, however, are probably better than oil.

After a variety of experiments and sensible observations, Mr Chapman sums up the three great operations by which timber may be brought to resist the tendency to dry rot.

1. To deprive the timber of its mucilage, which is very liable to fermentation.

2. To impregnate timber with any strongly antiseptic and non-deliquescent matter.

3. To dry timber progressively by the sun and wind, or by the latter alone; and then to close its pores completely with any substance impervious to air and moisture, and at the same time highly repellant to putrescency.

Mr Wade recommends the impregnation of timber with sulphates of copper, zinc, or iron, rejecting deliquescent salts, as they corrode metals, and would destroy the bolts and metal fastenings of a ship. He observes, that timber impregnated with saline matter is no longer capable of fermentation, and that, of course, the gases necessary for the nutriment of fungi are not evolved. Selenite is recommended as being insoluble, or nearly so, and not liable to any alteration in the ordinary temperature of the atmosphere; but all salts, he observes, composed of barytes, should be rejected, because, though they are plentiful, cheap, and have some qualities eminently fitting them to be employed for this purpose, yet they are, without any exception, very poisonous.

From all experiments that have been made, it appears that the most effectual method of preventing the dry rot, and of giving durability to timber, is that of depriving the sap of its mucilage, more especially in the alburnum, where it most abounds; for though seasoning in the dry way will coagulate and harden the extractive matter of timber, yet when exposed to heat, moisture. and a stagnant air, the process of putrefaction will commence, and all the symptoms of dry rot will speedily make their appearance. It will be preferable, therefore, that such timber as is likely to be exposed to the vicissitudes of weather, should be seasoned by immersion or impregnation, rather than by the dry way.

Cure of the dry rot.

In this disease, as in those incident to animal life, prevention is much easier than cure. In fact, there is no other cure for the part affected than excision, and the sooner it is done the better, as the disease spreads most rapidly when fungi are propagated, throwing their minute fibres into the tubes of the contiguous sound wood, and producing that moisture which is a condition absolutely necessary to the putrefactive process. If, however, the fibre of the wood is still sound, and the roots of the fungi extend not beyond the alburnum near to the surface, immersion in sea water, as in cases of the Resistance and the Eden, or impregnation with some of the solutions above mentioned, may stop the progress of the disease; but the only safe cure, we apprehend, is that of cutting out the infected part. The sinking of the Royal George at her moorings has not been the means of preserving her timbers. On being visited in the diving-bell, her oaken sides were broken down into a confused mass of timber and black mud; having, no doubt, been too far gone in decay when the fatal accident happened; but her fir deck appeared as sound as the day when she sunk.

Miscellaneous observations.

It is a great mistake to suppose that the ancients were unacquainted with the dry rot, or premature decay of timber. Pliny has a number of valuable observations on the preservation of timber, and on its decay occasioned by the juices; and, among other things, recommends that a tree should be cut to the heart all round, in order to let the juices escape, and that it should not be felled until the whole had run out. He knew that the sappy part of oak was more subject to rot, and advised that it should be cut away in squaring. He knew, too, that resinous and oleaginous matter in wood preserved it; observing, that the more odoriferous a piece of timber is, the more durable. He knew that much depended on the close texture of timber, and that box, ebony, cypress, and cedar, might almost be considered as indestructible. We also know that cedar teak, and mahogany, are very durable woods.

The felling of timber while young and full of vigour, making use of the sap-wood or alburnum, and applying it to ships and buildings in an unseasoned state, have no doubt contributed to make the disease of dry rot infinitely more common and extensive than it was in former times, when our ships were "hearts of oak," and when in our large mansions the wind was suffered to blow freely through them, and a current of air to circulate through the wide space left between the pannelled wainscot and the wall.

In those old mansions which yet remain, and in the ancient cathedrals and churches, we find nothing like the dry-rot, though perhaps

> ———————— perforated sore
> And drill'd in holes, the solid oak is found
> By worms voracious eaten through and through.

Numerous examples of the extraordinary duration of timber may be produced, both from complete desiccation and exposure to the air, and from the complete exclusion of air and immersion in earth or water. Without adducing the surturbrandt of Iceland, covered with several strata of solid rock, or the logs of wood dug out of peat-moss, the antiquity of which is mere conjecture, we may instance the mummy cases of Egypt as being in all probability the most ancient timber in existence that has been worked by the hand of man. When Belzoni entered the splendid tomb of the kings of Thebes, in which was the transparent sarcophagus of gypsum, he found two human figures larger than life sculptured in wood, in as good preservation as if it had been worked in his own time; but the sockets of the eye, which had been copper, were entirely wasted away. We are told by Pliny, that the image of Diana at Ephesus, supposed to be of ebony, remained entire and unchanged, though the temple itself was ruined and rebuilt seven times. He adds that, in his own time, the image of Jupiter in the capitol, made of cypress wood, was still fresh and beautiful, though set up in the year after the foundation of Rome 551, nearly three hundred years before. He further says that there was a temple of Apollo at Utica, the timbers of which, being of Numidian cedar, are said to have stood 1188 years. The roof of Westminster Hall, which is constructed of oak, has stood for more than three hundred years, and is probably better now than when newly erected. Similar instances of the long duration of timber have occurred in situations where the atmospheric air has been excluded. In the Leverian Museum was a post said to be dug out of Fleet Ditch, charred at the lower end, having the name of Julius Cæsar cut into it. The foundation on which the stone piers of London Bridge are laid consist of huge piles of timber driven close to one another, on the top of which is a floor of planks ten inches thick, strongly bolted together; on these the stone piers rest, at above nine feet above the bed of the river, and, at low water, may be seen or felt at a very few inches below the surface. These piles have been driven upwards of six hundred years, and, from the solidity of the superincumbent weight, it may be concluded that they are perfectly sound. In the old city wall of London, timber is frequently dug out as sound and perfect as when first deposited there. As the last instance of the extraordinary preservation of timber, we may mention that in digging away the foundation of the Old Savoy Palace, which was built about six hundred and fifty years ago, the whole of the piles, consisting of oak, elm, beech, and chestnut, were found in a state of perfect soundness, without the least appearance of rottenness in any part of them, and the plank which covered the pile-heads was equally sound. Some of the beech, however, after being exposed a few weeks to the air, but under cover, had a coating of fungus spread over the surface; which affords a striking proof of the immense length of time that the seeds of this parasite will remain dormant, without parting with the principle of vegetable life, which is called into activity from the moment that they are deposited in a situation favourable to their growth. In this instance we have only to suppose that the indurated juices of the wood became dissolved by its exposure to the moist atmosphere, and the phenomenon of fungous vegetation is capable of receiving a satisfactory explanation.[1]

(J. B—W.)

DRYSALTER properly signifies one who deals in dried or salted meats, pickles, sauces, &c.; but it is also used for a dealer in dye-stuffs, paints, chemical products, &c.

DUAL (*dualis*, from *duo*, *two*), in *Grammar*, a form of the verb and noun in the ancient Greek, Sanscrit, and Gothic, and the modern Lithuanian languages, in which two persons or things are indicated, in contradistinction to *plural*, which expresses an indefinite number.

DUALISM, the name given to that philosophical scheme which endeavours to explain the phenomena of existence by the hypothesis of two principles equally necessary, equally eternal, and therefore independent of each other. Cosmological or metaphysical dualism has reference to the distinct existence of God and nature; theological or mythological dualism to that of good and evil; and psychological dualism to that of soul and body.

DUBLIN,

County.

A MARITIME county containing the metropolis of Ireland, in the province of Leinster, bounded N. by the county of Meath, E. by the Irish sea, S. by the county of Wicklow, W. by the counties of Kildare and Meath. Excepting Louth and Carlow, it is the smallest county in Ireland,—comprising, according to the ordnance survey, an area of 354 square miles, or 229,709 acres, of which 196,063 are arable, 19,312 uncultivated, 5519 in plantations, 170 under water, and, exclusive of the city of Dublin, 1820 in towns.

Ptolemy, the geographer, marks the district as being inhabited by the tribe of the Eblani; and owing to its situation, it was at an early period much exposed to the incursions of the Danes and Northmen, who, having taken possession of the Isle of Man, after their defeat at Stainford Bridge in England, subsequently established themselves in this neighbourhood. At the period of the English invasion, the city of Dublin and the adjoining districts were in the possession of those active and warlike seamen, from whom the tract of country north of the city was named Fingal, or the country of the White Strangers, a name given by the natives to the invaders on account of their fair hair and complexion. The inhabitants of this locality are chiefly of Danish or Anglo-Norman origin, and are described by the Rev. Cæsar Otway, as "still a taller and fairer race than is seen in almost any other part of Ireland; and as you enter Lusk, Skerries, or Rush, you observe the men more athletic,

---

[1] The process termed *kyanizing* is similar to that already noticed, as proposed by Sir Humphry Davy,—namely, steeping the timber in a solution of corrosive sublimate. This appears to be one of the best preservatives of wood in so far as dry-rot is produced by a fungus.

Mr Bethell's method of preparing wood for fences, railway-sleepers, piles and other wood-work submerged in water, and for various similar purposes, is said to render timber of any description much tougher, and greatly to promote its durability. The process is as follows: The timber is placed in a strong close iron tank, which is filled with oil of tar and other bituminous matters containing creasote, and with pyrolignite of iron; the air is then exhausted by powerful air-pumps; after which more of the saturating fluid is forced in by hydrostatic pumps. When the wood has been subjected for six or seven hours to a pressure of from 100 to 150 pounds on the square inch, the process is complete, and the wood is found to weigh from 8 to 12 pounds per cubic foot heavier than before. It also preserves iron bolts driven into it from corrosion. Wood thus prepared has been used for sleepers on several of the great English railways, and is said to have proved extremely durable. (See Ure's *Dict. of Arts*, &c., vol. ii, p. 963.)

the women better favoured, than the natives of the adjoining districts." Their descent from the Northmen is further exhibited by the character they have maintained, as being the hardiest and best sailors on the eastern coast of Ireland. The district S. of the city was denominated Harold's country, a name which it long retained. After the arrival of the Anglo-Norman invaders, grants of land, confirmed by Henry II., were made by Strongbow to his followers, who introduced the feudal system into Ireland without those checks, which would have rendered it in those early times beneficial, or at least tolerable, and without having acquired that influence over the native population which was necessary to cement the power of the owners of the soil, and admit of some identity of interest. These extensive grants laid the foundations of the wealth of the chief families and religious houses in the county; and the possession of "these large scopes of land and great liberties, with the absolute power to make war and peace, did raise the English lords to that height of pride and ambition, as that they could not endure one another."

In 1210, King John formed this district and some of the adjoining neighbourhood into a county, comprising the chief portion of country within the English pale. The limits of the county were very uncertain, and have undergone many changes before they were fixed within the present boundaries. Although so near the seat of government, 67,142 acres of profitable land were forfeited in the Rebellion of 1641, and 34,536 acres in the Revolution of 1688.

The county of Dublin is now divided into nine baronies. Balrothery East and West, in the northern part of the county, are of level surface and productive soil, resting almost wholly upon a limestone foundation, and are principally used in tillage; within their limits are the village of Lusk, with its ancient round tower, the maritime village of Rush, enumerated by Holinshed among the chief haven towns of Ireland, but now decayed; the considerable fishing village and harbour of Skerries and Balbriggan, previous to 1700 a small fishing village, but raised by the late Baron Hamilton and his descendants to the position of a town of some importance with a harbour, which is the only place of shelter for vessels exposed to severe weather, between the bays of Dublin and Carlingford. Coolock barony, to the north of the city of Dublin, also rests upon limestone, excepting the remarkable promontory of Howth, which, like Bray Head in the adjoining county of Wicklow, is formed of quartz rock; within this barony are the sea-bathing villages of Clontarf, Howth, and Malahide, the islands of Lambay and Ireland's Eye, and the suburban villages of Artane, Coolock, Raheny, and Santry, &c. Nethercross, another northern barony, with a level surface resting entirely upon limestone, contains the ancient parliamentary borough of Swords, once a corporate town, and the most ancient place in the county, with a round tower, and the ruins of an archiepiscopal palace, the once classic village of Glasnevin, the residence of Dr Delany and Tickell the poet, and occasionally of Swift, Addison, Sheridan, Parnell, &c. It is now decayed, and chiefly known as giving name to the neighbouring Roman Catholic cemetery, and the Botanic Gardens of the Royal Dublin Society. Newcastle barony is an undulating limestone district lying west of the city, watered by the Liffey and Dodder; comprising the western suburbs of the city of Dublin, the pleasantly situated and once frequented village of Lucan, and the small village of Newcastle, which formerly had a portrieve and burgesses under a charter of James I., and previous to the Union sent two members to the Irish parliament. Uppercross is a barony situated S. and S.W. of the city, extending from Dublin to the N.W. borders of the county of Wicklow, and containing Clondalkin, with its well-preserved and elegant round tower, and a large portion of the most frequented suburbs of the city. The half barony of Rathdown is bounded by the sea, and comprises the most picturesque and ornamented portion of the county S. of the city, including Dundrum, Blackrock, Kingstown, Dalkey, and Killiney. Castleknock barony, which includes the Phœnix Park, rests on a limestone foundation, and extends to the county of Meath. The barony of Dublin, erected by the act 5th and 6th Vict., cap. 96, consists entirely of the rural portions of the former county of the city of Dublin, comprising Ball's Bridge, with the botanic garden of the university, a portion of the parish of Monkstown, Sandymount, and the village of Donnybrook, remarkable only for its fair, originally granted by King John to be held for fifteen days, but now limited to one week in duration; and although still much frequented, gradually falling into decay as a pleasure fair.

These nine baronies, together with the city of Dublin, are subdivided into 83 parishes, comprised within the archdiocese of Dublin. The amount of property valued in the county, under the act 6th and 7th Vict., cap. 84 (Griffith's Valuation) is L.533,616, and the net annual value of property rated to the poor in the county is L.502,873. The only union workhouses, besides those in the city of Dublin, are those of Rathdown and Balrothery; but portions of the county are within the neighbouring unions of Celbridge, Naas, and Dunshaughlin. The county is the headquarters of the military district of Dublin, as well as of the commander-in-chief and staff of Ireland. The headquarters of the county militia are stationed at Lucan. The constabulary force, consisting of about 250 men and officers, has its headquarters at Ballybough, and district stations at Clontarf, Lucan, Swords, Rathfarnham, and Balbriggan. Excepting the metropolis, with its populous suburbs, and Kingstown, there are no places of magnitude within the county, the largest being the maritime town of Balbriggan, with 2310 inhabitants.

Previous to the union with Great Britain, this county returned ten representatives to the Irish parliament; two for the county, two for the city, two for the university, and two for each of the insignificant boroughs of Swords and Newcastle. The number of representatives was reduced to five by the act of Union, one member being withdrawn from the university, and the boroughs of Swords and Newcastle disfranchised. The Reform act restored the second member to the university, leaving the representation in other respects unchanged. The constituency of the county in 1852, under the act 13th and 14th Vict., cap. 69, was 6657, being a much larger number than during the existence of the forty-shilling freeholders before the Reform act.

The northern coast of the county from Drogheda to Howth has generally a sandy shore, and affords only the harbour of Balbriggan, which has been much improved of late years, and the small fishing harbour of Skerries. In the promontory of Howth, the coast suddenly assumes a bolder aspect; and between the town of Howth and the picturesque rocky islet of Ireland's Eye, is the artifical harbour constructed in an injudicious locality, at an expense of above one-third of a million sterling, but now almost choked up with sand, and useful only to vessels of small burthen, fishing vessels, and to a few boats belonging to the place. Dublin Bay, which extends from the peninsula of Howth to Dalkey Island, is five miles in width at its entrance, and although eminently beautiful among the marine inlets of the United Kingdom, the attempt to place it in competition as regards scenic grandeur with the Bay of Naples, to which it bears little resemblance, and by comparison with which it suffers at every point, is very injudicious. On the southern shore of the bay is the harbour of Kingstown, one of the most splendid artificial ports in the United Kingdom, commenced in 1816, from designs by the late Mr Rennie, at an estimated cost of L.801,159, nearly the entire of which amount has been expended in its construction. The eastern pier is 3500 feet in length, and the western pier extends

4950 feet from the shore, leaving an opening of 850 feet at the mouth of the harbour, the whole comprising an area of 250 acres, and varying in depth from 15 to 27 feet. Owing, however, to the width and erroneous position of its entrance, the anchorage within is so much exposed, that it has somewhat disappointed expectation, and requires an exterior breakwater to render it a secure anchorage at all times.

At the southern extremity of Dublin Bay is Dalkey Island, the channel between which and the mainland occasionally affords a good roadstead for shipping, and was considered by some engineers as the most appropriate situation on which the public money could have been expended on a harbour of refuge. The beautiful bay of Killiney, which is much exposed, extends from near Dalkey to the southern extremity of the county.

The largest island off the coast is the hilly cultivated island of Lambay, the property of Lord Talbot de Malahide, to the north of Howth, comprehending about 600 acres. Shell-fish, especially lobsters and crabs, are taken in abundance on the shore. In the reign of Queen Elizabeth it was granted to Archbishop Usher, and was his favourite residence during the composition of a considerable portion of his writings. To the north of Lambay are the Skerries, consisting of the islets of Innispatrick, Colt, Shenex, and Red Island, the latter of which is connected with the mainland by the pier of Skerries. Innispatrick is noted in the ecclesiastical annals of the country as being the place on which it is supposed St Patrick first landed in Ireland, and where he built a church. Between Lambay and Howth is the picturesque islet called Ireland's Eye, a craggy rock, comprehending about 54 acres, and supposed by geologists to be an insulated portion of the neighbouring peninsula. At the southern extremity of Dublin Bay is Dalkey Island with an area of 22 acres, affording good pasturage.

The only stream deserving the name of river is the Liffey, which, rising in the table-land of Wicklow, and precipitating itself over a ledge of rocks, forms the fine cataract of Polaphuca, near which it is joined by the mountain rivulet called the King's River, and traverses the level county of Kildare; on leaving which it intersects the county Dublin, and after falling over another elevated ledge of rocks, called the Salmon-leap, at Leixlip, the Liffey resumes its tranquil character, and, passing through the centre of the city, discharges its waters into the Bay of Dublin. It is joined at its mouth by the Dodder, a mountain stream which, though too insignificant to afford depth sufficient for the smallest boat, supplies water for several mills of various description during its short course from Kippure Hill to its junction with the Liffey. The other streams which are numerous and very small, have all an eastern course.

The county is intersected in various parts by the Grand Royal canals running injudiciously parallel to each other; the Dublin and Drogheda, Midland, Great Western, Great Southern and Western, Dublin and Kingstown, and Dublin and Wicklow railways, affording great facilities for communication between different portions of the county, and with the interior and more distant ports of Ireland.

The population of the county, apart from that of the city of Dublin, and which had not previously been ascertained with any approach to accuracy, was returned in 1812 as amounting to 132,000; and subsequent parliamentary returns with greater accuracy have stated it as follows:—In 1821, 150,011; in 1831, 176,012; in 1841, 140,047, and in 1851, 146,731.

If these returns relate to the same area, it would appear that Dublin is the only county in Ireland the population of which decreased between 1831 and 1841, or increased in the subsequent decennial period.

The total number of children receiving education in 1824–26 was reported in a parliamentary return to be 33,008, of which number 20,440 were Roman Catholics, 10,372 belonged to the Established Church, 465 were Dissenters, and the persuasion of the remaining 1731 was not ascertained. In 1853, there were 159 national schools in operation, attended by 28,799 children, 13,321 males and 15,478 females.

The manners, appearance, and dress of the lower classes differ less from what may be considered as being peculiarly characteristic of the rural population of remoter districts, than might be expected in the vicinity of a large metropolis. Even in the immediate neighbourhood of the city are to be seen groups of cabins, exhibiting, both in their external appearance and in the dress and manners of their inmates, much to remind the observer of the peasantry of the interior.

The greater part of this county, which presents various features of peculiar interest to the geologist, rests on the eastern extremity of the great bed of floetz limestone that extends over the middle of the island, widening as it spreads westward. It rises in its southern part into a range of mountains, which forms the verge of an elevated district, extending thence for more than thirty miles to the south through the county of Wicklow. Through this tract a large body of granite passes in a south-western direction, commencing at Blackrock and passing by Dundrum and Rathfarnham, and forming the loftiest summit in this county; bounded on its eastern and western sides by incumbent rocks of great variety of structure and relations; the micaceous schist at Killiney and Rathfarnham; argillaceous schist, on both sides of the granite and quartz rock, in the eastern side alone, forming the promontory of Bray Head, and reappearing in the more northern part of the county, where it forms the picturesque peninsula of Howth, and rises to the height of 567 feet above the level of the sea. Within the portion of this district included in the county of Dublin, and distinguished by its beautiful scenery, are veins of lead ore at Dalkey and near the Scalp. The country near Bray presents, within a small space, an instructive series of rocks; and at Killiney schistose beds are to be seen, of considerable extent, reposing on granite. Near Booterstown, in Dublin Bay, a mass of compact limestone is visible, within a few fathoms of the granite. The calp of Kirwan, a variety of limestone, is the prevailing rock in the immediate vicinity of Dublin, and is much used for building; and the granite of Dalkey and the neighbourhood is also much used for architectural purposes in the city and environs; quantities of it are even exported to England. Petrifactions abound in many parts of the limestone country. In the peninsula of Howth gray ore of manganese, with brown ironstone, and brown iron-ore, have been obtained in abundance.

The northern portion of the county is flat, and the soil good, particularly in the parts bordering on Meath; but on the southern side, the land rises into elevations of considerable height, which extend into the adjoining county of Wicklow. The highest of these, Kippure Head, on the border of Wicklow, is 2473 feet above the level of the sea, and the Three Rock Mountain 1763 feet. The soil in these mountains is poor, affording no encouragement for tillage, chiefly covered with heath, except where a subsidence in the ground affords a nucleus for the formation of bog, with which about two thousand acres are covered. There are also a few small tracts of bog in the northern part of the county. The mountain district is well adapted for timber, to the growth of which much attention has lately been paid, and the labours of the improvers are already rewarded by some fine plantations equally ornamental and profitable. This range of mountain ground produces a very striking effect on the traveller proceeding to the metropolis from Wicklow county. On arriving at its brow, the whole of the plain watered by the Liffey spreads itself out before him, studded with villas, enriched with groups of trees, in the midst of which may be seen the few elevated buildings, spires, and domes of the city rising through the dusky canopy of smoke that envelopes them; whilst beyond, the beautiful

County.

expanse of Dublin Bay, backed by the Hill of Howth, the island of Lambay, and Ireland's Eye, and, in clear weather, still more remote, the Mourne Mountains in the county of Down, towering above them all on the horizon's verge, present a view of highly cultivated nature seldom surpassed.

Though by much the greater part of the soil is inclined to clay, it is not of the deep and tenacious character so common in England; scarcely any part being without a mixture of gravel. Due search will generally discover limestone or other beneficial substrata at no great depth, and the operation of draining generally raises a sufficiency of gravel to manure the whole surface. The position of the ground, usually more or less undulating, affords peculiar facilities for drainage; and the circumstance of a great city being placed in a central position in the county, furnishes large quantities of ashes and other manure well calculated to conquer the natural stubbornness of such soils. Along the coast between Howth and Balbriggan are salt marshes, of small extent.

The farms are in general small. Near Dublin, particularly on the southern side of the city, a very considerable portion of the county is appropriated to the ornamental grounds of the gentry, and used more for convenience and enjoyment than with a view to agricultural profit. The rents are proportionately high, being calculated more with reference to these circumstances than the quality of the land. Although in comparison with other counties in Ireland tillage is not in a backward state, there is in some parts of the county more appearance of neglect than might have been expected so near the metropolis.

The number of holdings in 1853 amounted to 6741, viz.,

Not exceeding 1 Acre.	Between 1 and 5 Acres.	Between 5 and 15 Acres.	Between 15 and 20 Acres.	Between 30 and 50 Acres.	Between 50 and 100 Acres.	Between 100 and 200 Acres.	Between 200 and 500 Acres.	Above 500 Acres.
2275	2084	1870	1028	623	622	376	125	13

The extent of land under crops in 1853 was 101·999 acres, divided as follows:—

Corn, Beans, and Peas.	Potatoes.	Turnips, Parsnips, Mangold-Wurzel, &c.	Cabbage and other Green Crops.	Flax.	Meadow Clover, & Rape.
41,309	7465	6009	3327	2	43,887

The produce of the crops in the county of Dublin is in every instance above the average production of all Ireland, and generally greater than in any other county; not so much on account of any natural superiority in the soil, as by reason of the facilities afforded by the neighbourhood of a large city, and the consequent greater expenditure of capital on the land. The result of an inquiry recently undertaken into the state of farm cultivation, and the condition of road-sides, &c., as to the growth of weeds, places the county of Dublin at the head of the list, and therefore exhibits it as the most highly cultivated county in Ireland.

The live stock of the county in 1853 consisted of 19,448 horses, 3167 mules and asses, 44,063 cattle, 43,007 sheep, 19,041 pigs, 5229 goats, and 158,135 head of poultry. And the total value of stock was, in 1849, L.484,078; in 1850, L.520,720; in 1851, L.503,904; in 1852, L.518,857; and in 1853, L.525,586, being an increase in value of L.6729 over the previous year.

The fishery districts are Dublin and Malahide, together comprising 85 miles of maritime boundaries, with about 500 registered fishing vessels, employing 3000 men and boys. The chief stations are Howth and Skerries, the former of which is much used by the Manx and Cornish fishermen, who resort in considerable numbers to the harbour of Howth during the fishing season. Dublin Bay haddock and herrings have long been esteemed, and justly so, for their superior quality and flavour.

The manufactures of the county are mainly confined to the city of Dublin and its immediate neighbourhood. There is also at Balbriggan a manufactory of cotton hosiery in much repute.

Without leaving the county of Dublin, the antiquary would have no difficulty in finding numerous objects of interest and instruction, casting light upon the early history of the country. Among the ancient raths, duns, or forts constructed by the native Irish or the Danes, and more probably by both people, for defence or security in positions of natural strength, improved by art and labour, several remain in this county. One at Ratheny, although much reduced in its proportions, is still traceable; several yet more imperfect are faintly visible at Coolock; one near Lucan is furnished with the subterranean vaults and passages not unusually found in connection with the larger specimens; and another at Shankhill or Rathmichael, near the remarkable natural pass through the mountain called the Scalp, is of greater extent than the others, more commanding in position, and in close proximity to the ancient church, and supposed fragment of a round tower. Numerous sepulchral mounds of the same period also exist scattered throughout the county, occasionally somewhat similar in appearance to the raths, but generally smaller in extent, altogether artificial and of conical form. Among its most interesting antiquities this county reckons three of the ancient round towers almost peculiar to Ireland; one at Swords; another at Lusk, forming one of the angles of the church steeple; and a third in the highest state of preservation at Clondalkin. "No one who sees but once their beautiful, lofty, and slender shafts shooting up into the sky, and dominating in solemn grandeur the surrounding landscape—all strikingly resembling one another, and resembling nothing else—but must be struck with admiration and curiosity of the liveliest kind; and yet these primary feelings are but slight in degree when compared with those which are excited by the consideration of all the extraordinary circumstances involved in their history. That these towers have existed, or, at least, the majority of them, for upwards of 1000 years, is certain; that they may have existed twice or thrice this period is far from improbable; but that the era of their origin, and the object of their erection remain as secrets yet to be unfolded, are circumstances which only add to the mysterious interest which attaches to them."—(*Memorandums made in Ireland by Sir John Forbes.*) They however are probably not older than the introduction of Christianity; and seem of the same origin as the detached round towers of Abernethy in Perthshire, and of Egilsey in Orkney.

The little church of St Douloughs is worthy of note for the extreme antiquity of its architecture. It is 48 feet in length by 18 in width, and is covered by a double stone roof; and Dr Ledwick ascribes its construction to the Danes in the eleventh century, while other antiquaries suppose it to be of earlier date. A fine cromlech of six upright stones, supporting one of 18 feet by 15, and estimated to weigh above 25 tons, is still preserved near Cabinteely. The remains of a stone chair, and a rudely sculptured piece of granite, mark the former existence of an ancient temple near Killiney. At Old Connaught is a cross of considerable antiquity formed of granite, its shaft surmounted by a circle, on which the Crucifixion is rudely sculptured; and close by the church of St Douloughs are the remains of one of the crosses which once marked the croceæ or lands of the cross, dedicated to and under the jurisdiction of the church. There are also the remains of many castles and fortified houses, and, as throughout the whole of Ireland, numerous ruins of the ancient parochial churches without architectural pretension, but picturesque in their decay. The adjoining ground is still used as a place of sepulture by the peasantry, the locality being otherwise entirely neglected; and even in the vicinity of the metropolis neither wall nor fence protects these burial-grounds from intrusion.—(Thom's *Irish Almanac;* D'Alton's *History of the County of Dublin;* Archer's *Survey of the County of Dublin.*)

City.

Dublin, the metropolis of Ireland, in the county to which it gives name, and province of Leinster, ranking in importance as the second city in the United Kingdom. It is distant 292 miles W.N.W. from London, 138 miles west from Liverpool, and 60 miles west from Holyhead, in Lat. 58. 20. 38. N., and Long. 6. 7. 13. W., agreeably situate in the great central limestone district which reaches across the island from the Irish Sea to the Atlantic Ocean, on the river Liffey, and extending to the junction of that river with the Bay of Dublin, the waters of which wash its suburban shores.

Like almost every city of importance in the Old World, it is of very ancient origin; but of its first establishment no records exist, neither do any very ancient structures remain

City.

which could assist the researches of the antiquary. In the absence of tangible proof, conjecture has been busy at work, ingeniously constructing baseless stories of ancient grandeur belonging to the regions of pure romance, without a particle of historical foundation. Dublin is supposed to have been mentioned by Ptolemy the geographer, in the second century of the Christian era, as one of the chief places in Ireland, under the name Eblana; from a corruption of which word, or from the Irish Duiblinn, *the black or dark water*, the present name of the city is conjectured to have derived its origin.

At the earliest period of which any records remain, Ireland was governed by numerous petty princes or chieftains constantly at strife with each other for the mastery, which none obtained. As a natural result of this state of affairs, the population must have been thinly scattered over the country, and the power of each prince of small extent. At the close of the fifth century and subsequently, the Danes, or Northmen, called in Ireland Ostmen, from their eastern origin as compared with that country, were enabled, with various success, to maintain themselves in the city and adjoining neighbourhood, occasionally making inroads into the interior, committing great ravages, more especially (as they were heathens) against the religious establishments. In the middle of the tenth century, the Danes had become converted to Christianity, but being always exposed to attack in retaliation of their former outrages, fortified the city of Dublin, and the oldest remains of building were of their construction. About the year 1014 the Danes were defeated by the united Irish forces under Brien Boroihme, at the memorable battle of Clontarf, and were driven into the promontory of Howth, of which they retained possession until defeated by Sir Amoric Tristram, ancestor of the Earls of Howth, and Sir John de Courcy in 1177. They also, in diminished force, reoccupied the city, which was in their possession in 1170, when Dermod MacMorrough and his English allies who had landed at Bannon in 1169 and reduced the Danish cities of Wexford and Waterford, marching their forces from the south of Ireland under the leadership of the Anglo-Normans Milo de Cogan, Raymond le Gros, and Strongbow Earl of Pembroke, besieged and took the city, or rather the government of the city, from them. The Hiberno-Danish king escaped, collected forces in the Orkneys, Hebrides, and Isle of Man, and in the following year made an attempt to recover possession of Dublin, but was taken prisoner and put to death by order of Milo de Cogan, the first Anglo-Norman governor of the city; and thus terminated the last of the persevering attempts made by the enterprising Northmen to establish themselves in a position of which they instinctively appreciated the commercial value. In succession to that rude, hardy, and maritime people came the more warlike yet polished Anglo-Normans. Soon after his landing in 1172 at Waterford, Henry II. arrived in Dublin, and held his court there in a pavilion of wicker-work made "after the country manner," where the Irish chiefs were entertained with great pomp, and alliances entered into with them; "the plenty of the English table and the goodly courtesy of the attendants" having done much to reconcile them to their new allies. Previous to his departure for England, Henry bestowed the government on Hugh de Lacy, having granted by charter "to his subjects of Bristol his city of Dublin to inhabit, and to hold of him and his heirs for ever, with all the liberties and free customs which his subjects of Bristol then enjoyed at Bristol and through all England." In 1177 Strongbow, Earl of Pembroke, and the chief leader of the Anglo-Norman forces, died in Dublin of a mortification in one of his feet, and was buried in Christ Church Cathedral, where his monument still remains well preserved, probably because the rents of many of the tenants were made payable on Strongbow's tomb. A fresh charter was granted in 1207 by King John to the inhabitants, who had not yet made their peace with the neighbourhood, but, like the settlers in other towns, were at constant feud with the native Irish; so that two years after the date of this charter, whilst the citizens of Dublin were celebrating Easter at Cullenswood, they were set upon by the Irish of the neighbouring mountains and 500 of them killed. The scene of slaughter was afterwards called the Bloody Fields, and Easter Monday denominated Black Monday. On each succeeding anniversary of that day, with the desire unfortunately so prevalent of perpetuating a feud, the citizens marched out to Cullenswood with banners displayed—"a terror to the native Irish." In 1216 Magna Charta, a copy of which is to be found in the red book of the exchequer, was granted to the Irish by Henry III. In 1217 the fee farm of the city was granted to the citizens at a rent of 200 marks per annum; and about this period many monastic buildings were founded.

In 1227 the same monarch confirmed the charter of John fixing the city's boundaries and the jurisdiction of its magistrates. During the invasion of Ireland by Edward Bruce, who had landed at Carrickfergus with 6000 men, in the commencement of the reign of Edward II., some of the suburbs were burnt to prevent them from falling into his hands. The inroad of Bruce had been countenanced by the native Irish ecclesiastics, whose sentiments were recorded in the statement addressed to Pope Innocent XXIII. by Donald O'Neill:—"That a nation governed for four thousand years by its own princes, should by Adrian have been made over to a horde of tyrants, far more cruel than the teeth of wild beasts, who had seized all the best of the soil, and driven the rightful owners to the bogs and to the mountains—that instead of reforming the people, and extending the boundary of the church, its property had been plundered, its religious houses wasted, the native clergy persecuted, and *Peter's pence* had not been paid—that the simplicity of the people had by bad treatment been changed into the craft of the serpent—that the object of those he had sent over was the extermination of the Irish race—that no Irishman for any grievance however great could institute an action in the king's court; that if an Englishman murdered an Irishman, be he bishop or layman, the civil court could take no cognisance of the act; and that having often and vainly petitioned the English king for redress, they had offered the crown to Edward Bruce." The energetic preparations for defence made by the citizens induced the Scots to abandon their intention of besieging the city.

Richard II. erected Dublin into a marquisate in favour of Robert de Vere, whom he also created Duke of Ireland. The same weak monarch, "as full of valour as of royal blood," entered Dublin in 1394 with 30,000 bowmen and 4000 cavalry, bringing with him the crown jewels; but after holding a parliament and making much courtly display before the native chieftains, on several of whom he conferred knighthood, the king returned to England. Five years later, enriched with the spoils of his uncle, "Old John of Gaunt, time honour'd Lancaster," Richard returned to Ireland, landing at Waterford, whence he marched through the counties of Kilkenny and Wicklow, to—

> "Supplant those rough rug-headed kerns
> Which live like venom, where no venom else,
> But only they, hath privilege to live."
> (*Richard II. Act II. sc.* 1.)

and subsequently arrived in Dublin, where he remained a fortnight, sumptuously entertained by the provost, as the chief magistrate of the city was then called; until, receiving intelligence of the invasion of his kingdom by the Earl of Hereford, "banished Bolingbroke," he returned to England, having previously committed the youthful Lord Gloucester and Henry of Lancaster (afterwards Henry V.) to Trim Castle, in the county of Meath. In 1404 the statutes of Kilkenny and Dublin were confirmed in a parliament held in the city by the Earl of Ormond. The attachment of the

City.

people of Dublin to the house of York induced them to acknowledge the impostor, Lambert Simnel, who was crowned as Edward VI. in the presence of the lord deputy and other of the chief authorities in Christ Church Cathedral. In the next year, 1486, after having performed the part of a sovereign in Dublin, he sailed from the city with 2000 German troops who had arrived with Lords Loval and Lincoln, together with some Irish auxiliaries, to invade England. In 1534 Lord Thomas Fitzgerald, or Silken Thomas as he was called, a young man of rash courage and good abilities, son of the Lord Deputy Kildare, believing his father, who was imprisoned in the tower of London, to have been beheaded, organized a rebellion against the English government, and marched with his followers from the mansion of the Earls of Kildare in Thomas Court, through Dame's Gate to St Mary's Abbey, where, in the council chamber, he proclaimed himself a rebel. On his appearing before the walls with a powerful force, the citizens were induced through fear to give admission to a detachment of his troops to besiege the castle; but, on hearing that he had met with a reverse in another quarter, they suddenly closed their gates and detained his men as prisoners. He then attacked the city itself; but finding it too strong to be seized by a *coup de main*, raised the siege on condition of having his captured soldiers exchanged for the children of some of the principal citizens who had fallen into his hands. After much vicissitude of fortune, Lord Thomas Fitzgerald and some others concerned in this rebellion were executed at Tyburn in 1536. At the breaking out of the civil war in 1641, a conspiracy of the Irish septs, under the direction of Roger Moore, to seize on Dublin Castle, was disclosed by one Owen Connolly on the eve of the day on which the attempt was to have been made, and the city was thus preserved for the king's party; but the native Irish without commenced an indiscriminate extermination of the Protestant population. "In a few days," says Sir John Temple, "the city was filled with the most lamentable spectacles of sorrow, which in great numbers wandered up and down in all parts, desolate, forsaken, having no place to rest their heads, no clothing to cover their nakedness, nor food to fill their hungry bellies: those sad creatures appeared like living ghosts in every street. The greatest part of the women and children thus barbarously expelled out of their habitations, perished in the city of Dublin; and so great numbers were brought to their graves as all the churchyards within the whole town were of too narrow compass to contain them, so that the lords justices took order to have two large pieces of new ground, one on each side of the river, taken in upon the out-greens, and set apart as burying places." In 1646 it was besieged, but without success, by the Irish army of 16,000 foot and 1600 horse, under the guidance of the pope's nuncio Ripaccini and others, banded together "to restore and establish in Ireland the exercise of the Roman Catholic religion." The city had been put in an efficient state of defence by the Marquis of Ormond, then lord-lieutenant; but in the following year, to prevent it falling into the hands of the Irish, he surrendered it on conditions to Colonel Jones, commander of the parliamentary forces. In 1649 Ormond was totally defeated at the battle of Baggotrath, near Old Rathmines, in an attempt to recover possession. The same year Oliver Cromwell landed in Dublin, as commander-in-chief under the parliament, with 9000 foot and 4000 horse, and proceeded thence on his career of conquest, which commenced with the capture of Drogheda by storm, and the subsequent massacre of its inhabitants. After the resignation of the government into the hands of his brother Henry by Richard Cromwell, the castle was surprised by a party of officers favourable to the royal cause; and though immediately retaken by Sir Hardress Waller, it was forced to surrender again in a few days. When James II. landed in Ireland in 1689, to assert his right to the British throne, he held a parliament in Dublin, which passed acts of attainder against upwards of 3000 Protestants. The governor of the city, Colonel Luttrell, at the same time issued a proclamation ordering all Protestants not housekeepers, excepting those following some trade, to depart from the city within 24 hours, under pain of death or imprisonment, and restricting those who were allowed to remain in various ways. In the hope of relieving his financial difficulties, the king erected a mint, where money was coined of the "worst kind of old brass, guns, and the refuse of metals, melted down together," of the nominal value of L.1,586,800, with which his troops were paid, and tradesmen compelled to receive it under penalty of being hanged in case of refusal. Under these regulations the entire coinage was put into circulation. After his defeat at the battle of the Boyne, James returned to Dublin, but left it again before daybreak the next day; and William III. advancing by slow marches, on his arrival encamped at Finglas, with upwards of 30,000 men, and on the ensuing day the king proceeded in state to St Patrick's Cathedral to return thanks for his victory. In 1783 a convention of delegates from all the volunteer corps in Ireland assembled in Dublin for the purpose of procuring a reform in parliament; but the House of Commons refused to entertain the proposition, and the convention separated without coming to any practical result. In May 1798 the explosion of a conspiracy planned by the United Irishmen to seize the city was prevented by the capture of Lord Edward Fitzgerald and other of the leaders. In 1800 the act of union between Great Britain and Ireland was passed in both parliaments, and on the 1st January following the imperial standard of the United Kingdom was hoisted on Dublin Castle. In 1803 another insurrection, headed by Robert Emmett, a young barrister of much promise, broke out, but was immediately quelled, with the loss of some lives in the tumult, and the death of its leaders on the scaffold.

The population of the city of Dublin was estimated by Rutter, in 1753, at 161,088; in 1798, by Whitelaw, at 182,037, and was ascertained by the census of 1821 to amount at that period to 185,881, and by the census of 1831 to 204,155. The population of the city, according to the most recent enumerations in 1841 and 1851, was as follows:—

Parishes.	Area.	Population in 1841.	Population in 1851.		
			Males.	Females.	Total.
Christ Church (Liberties of)	1 2 19	15	36	14	50
Glasnevin, part of	4 0 27	...	...	...	...
Grangegorman, part of	326 0 8	4,857	1,881	2,449	4,330
St Andrew's	42 1 35	7,634	3,700	3,928	7,628
St Anne's	70 3 17	8,808	3,801	4,783	8,584
St Audoen's	29 3 18	3,966	1,796	2,257	4,053
St Bridget's	37 1 38	10,629	4,887	5,897	10,784
St Catherine's, part of	288 3 14	19,871	9,707	10,832	20,539
St George's, part of	344 1 29	15,048	6,472	9,412	15,884
St James's, part of	500 1 23	10,661	3,949	4,415	8,364
St John's	11 3 16	3,931	1,581	1,902	3,483
St Luke's	38 2 20	4,802	1,960	2,459	4,419
St Mark's, part of	289 2 36	15,234	10,755	10,026	20,781
St Mary's	150 1 32	23,904	10,781	13,287	24,068
St Michael's	5 2 0	1,271	591	726	1,317
St Michan's	122 2 6	22,793	10,965	12,428	23,393
St Nicholas Within	5 0 11	1,694	942	1,057	1,999
St Nicholas Without, part of	58 1 9	11,955	5,734	6,604	12,338
St Patrick's (Liberties of)	9 0 4	2,044	850	1,037	1,887
St Paul's	108 0 37	8,422	4,038	4,598	8,636
St Peter's, part of	501 1 38	30,210	14,331	19,678	34,009
St Thomas's	630 0 34	22,008	13,000	14,637	27,637
St Werburgh's	15 2 32	2,969	1,375	1,553	2,928
	3,592 3 23	232,726	113,132	133,979	247,111
Public Institutions	...	...	6,051	5,199	11,250
Total	3,592 3 23	232,726	119,183	139,178	258,361

City.

The city is divided into 15 municipal wards. In 1851 the poor-law valuation for the city amounted to L.531,079, and the amount of Griffith's valuation, including property exempted from taxation, is L.594,886.

Dublin is the seat of the executive government, consisting of the viceroy or lord lieutenant, assisted by a privy-council indefinite in number, appointed by the crown, and a member of the House of Commons as chief secretary. In the absence of the lord lieutenant, his place is supplied by lords justices, generally the primate or archbishop of Dublin, the lord chancellor, and the commander of the forces. The lord lieutenant resides chiefly at the Viceregal Lodge in the Phœnix Park, and occasionally at Dublin Castle, which is used on state occasions. The Castle of Dublin is situate on high ground, formerly at the eastern extremity, but now in the centre of the city, dividing the ancient from the modern town on the south side of the Liffey. The building was commenced in the reign of King John, by the Lord Justice Fitzhenry, and completed in its original form by Henri de Londres, archbishop of Dublin. It was then a place of much strength, moated and flanked with towers; but the moat has been filled up, and most of the ancient structure removed at different periods to make way for the present patchwork palace, leaving as a memorial of the old castle the Record Tower, now used as the depository of the records of the office of arms, consisting of volumes of the pedigrees of the nobility and gentry of Ireland since the reign of Henry VIII., with records of their deaths, marriages, descents, &c. The Bermingham Tower, formerly a place of confinement for state prisoners, which was taken down in 1775 and rebuilt in 1777, also contains an extensive collection of ancient historical records, the keeper of which formerly received L.10 per annum, which sum was augmented to L.500 in favour of Addison when secretary to the Earl of Wharton, then lord lieutenant. The records are now in the custody of the officer of arms.

The building, as it exists at present, was chiefly erected in the eighteenth century; it is of great magnitude, covering altogether an area of about ten acres, but destitute in its exterior of architectural beauty or regularity of form. It is used as the town residence of the lord lieutenant and the principal officers of state, and a very considerable portion occupied by the offices more immediately connected with the administrative government, including those of the ordnance and metropolitan police. The chief objects of interest in the castle are the ball-room, 82 feet in length by 41 feet in breadth, and 38 feet in height, called St Patrick's Hall, since used as the place of investiture of the knights of St Patrick; the Castle Chapel, an elaborate Gothic building of the present century, erected at an expense of L.42,000; and the Arsenal and Armoury, in the lower castle yard, containing arms for 60,000 men.

Dublin is also the seat of the Irish courts of law and equity, from which an appeal lies only to the House of Lords. The judicial functions are exercised by the lord chancellor, the master of the rolls, and four judges in each of the courts of Queen's bench, common pleas, and exchequer. There are also judges of the courts of prerogative and admiralty, two judges in the bankruptcy court, one in the insolvents' court, and a chairman of quarter sessions; besides a court of commissioners for the sale and transfer of encumbered estates in Ireland, a civil bill court presided over by the recorder, several manor courts, and a borough record court for the trial of all records where the debt shall amount to L.20, and for the issuing of attachment against goods, &c.

The building called the Four Courts, in which the superior courts are held, stands on the site of the ancient Dominican monastery of St Saviour, on King's Inn Quay. It is an extensive and magnificent structure, erected after a design of Mr Thomas Cooley between the years 1786 and 1800, at the enormous cost of L.200,000.

The prerogative, consistorial, and admiralty courts are held in the King's Inns, a massive imposing structure in the northern portion of the city, erected after a design of Mr Gandon, the architect of the Custom-House. Those parts of Dublin not under the civil magistrates are the manor of Grangegorman, which includes a district in the neighbourhood of Glasnevin and Mountjoy Square, of which the dean of Christ Church is the lord, and appoints a seneschal, who holds his court in a private house;—the manor of Thomas Court and Donore, granted to an ancestor of the Earl of Meath, on the dissolution of the monastery to which it had been appended: its court was first established in the reign of King John, and still continues open for trial of petty debts and offences;—the manor of St Sepulchre, including the parishes of St Kevin and St Nicholas Without, of which the archbishop of Dublin is lord, with extensive powers now become obsolete. It has a court-house and prison attached to it. The grounds immediately adjoining the cathedrals of Christ Church and St Patrick were formerly exempt jurisdictions, subject to their respective deans; but their authority is now nominal.

Boards of commissioners having charge of the principal branches of revenue formerly sat in Dublin, but have been removed and merged in those sitting in London, the details here being superintended by subordinate officers. The offices of the boards of customs and excise were in the old Custom-House erected in 1707, and situated in Essex Street; the Stamp-Office was in a building in William Street, once the private mansion of the Earl of Powerscourt. The business of these departments, together with that of the Irish poor-law commission, is transacted in the present Custom-House, architecturally one of the chief ornaments of the city. It was erected at a cost of about L.400,000, after a design of Mr James Gandon, and opened in 1791. This magnificent structure, which stands on the north side of the river below Carlisle Bridge, presents four fronts, three of which may be seen to advantage. The south front, facing the river, 375 feet in length, is built of Portland stone, finished in the Doric order, with an entablature and bold projecting cornice. The other three fronts are composed of granite, and from the centre rises a dome to the height of 125 feet, after the model of that of Greenwich Hospital, surmounted by a somewhat awkward figure intended as an emblem of Hope.

Previous to the operation of the Municipal Reform act, the municipal government of the city was vested in the lord mayor, two sheriffs, a board of twenty-four aldermen, and the common council elected every three years by the twenty-five guilds of trades, in numbers proportioned to the estimated importance of each guild; beside which, every person who had served the office of sheriff had a seat in the commons for life under the name of sheriffs' peer. In the city assembly, the sheriffs, who were chosen annually from among the representatives of guilds, presided. The aldermen were chosen by the common council, and held office during life. The lord mayor was elected annually by the aldermen, generally according to seniority, and approved and sworn in by the lord lieutenant at Michaelmas.

The chief magistrates were originally styled provosts and bailiffs, the former of which titles was changed for that of mayor in 1409, and the bailiffs transformed into sheriffs in 1547. In 1660 Charles II. granted to the mayor a golden collar, a company of foot, and the right of having a sword of state, a mace, and cap of dignity. In 1665 the title of lord mayor was conferred, and L.500 per annum granted in lieu of the foot company. The Tholsel, a corruption of toll-stall, was built in 1682 as the place of assembly of the corporation, but was taken down in 1807, and the City Assembly House in William Street adopted in its stead.

Every third year, by virtue of an old charter, it was compulsory upon the lord mayor and twenty-four corporations to perambulate the city and its liberties for the purpose of maintaining the ancient boundaries. This ceremony was called riding the franchises, and fell into decay towards the close of the last century, all necessity for it having ceased.

"The vigilance of the Dubliners in ancient times was principally to be exercised against their ecclesiastical neighbours of St Mary's Abbey, Kilmainham, Thomas Court, and St Sepulchre's, the latter being the liberty of the Archbishop of Dublin. Various were the disputes and feuds about their respective boundaries, and many are the charters and inquisitions defining them, which are still extant. To guard themselves from encroachment, the citizens from time immemorial perambulated the boundaries of their chartered district every third year, and this was termed 'riding their franchises,' corrupted into 'riding the fringes.' In ancient times, when the ecclesiastics were a powerful body, this was a very necessary ceremony, and in some measure a dangerous service. The worthy citizens went forth 'well horsed, armed, and in good array;' and so they are described in an account of this ceremony in 1488, still extant in the book of Christ Church. But when the power and possessions of their clerical neighbours passed away, there was no one with the will or the means to interfere with them. The citizens had long ceased to march out with a black standard before them—

City.

'a great terror to the Irish enemies;' and their military spirit having completely died away, the riding of the franchises became altogether a peaceful exhibition of civic pomp, consisting chiefly of the following emblematic personages, and display of craft:—

"Every one of the twenty-five corporations was preceded by a large vehicle, drawn by the most splendid horses that could be bought or borrowed; indeed all were eager to lend the best they had. On these carriages were borne the implements of the respective trades, at which the artisans worked as they advanced. The weavers fabricated ribbons of various gay colours, which were sent floating among the crowd; the printers struck off hand-bills, with songs and odes prepared for the occasion, which were also thrown about in the same manner; the smiths blew their bellows, hammered on their anvils, and forged various implements; and every corporation, as it passed, was seen in the exercise of its peculiar trade. They were accompanied by persons representing the various natures or personages of their crafts, mixing together saints and demigods, as they happened to be sacred or profane. Thus, the shoemakers had a person representing St Crispin with his last; the brewers, St Andrew with his cross; but the smiths, though patronized by St Loy, were accompanied by Vulcan and Venus, which last was the handsomest woman that could be procured for the occasion, and the most gaily attired. She was attended by a Cupid, who shot numerous darts, *en passant*, at the ladies who crowded the windows. The merchants, who exist under the patronage of the Trinity, could not without profanation attempt any personal representation; but they exhibited a huge shamrock as the emblem furnished by St Patrick himself, while they were also accompanied by a large ship on wheels navigated by *real* sailors.

"The course of proceeding of this motley assembly was this: they drew up at the old custom-house, and passing along Temple Bar and Fleet Street, they came to the sea at Ringsend. They then proceeded to low-water mark, when a trumpet was sounded, a water bailiff advanced, and, riding into the water as far as he could, hurled a spear eastward. This marked the eastern boundary of the city. They then crossed the Strand, and traversing the boundaries of the city and county, by Merrion, Bray Road, Donnybrook, &c., came by Stephen's Green to the division between the city and liberties. Then traversing Kevin's Port, Bolton Lane, Bride Street, Bull Alley, &c., they again emerged at Dolphin's Barn, from whence they took a round by Stonybatter, Finglass, Glasnevin, and Clontarf, ending a little beyond Raheny. In the course of this peregrination they passed through several houses, and threw down any fences that came in their way, particularly on the confines of the liberties."—(*Ireland Sixty Years Ago*, 3d edition.)

For the purposes of police, the city was, previous to 1830, divided into four districts, in each of which there was an office, at which three magistrates, one an alderman, the second a common councilman, and the third a barrister, all appointed by the crown, sat daily. They had under them an armed force, consisting of 52 peace officers, 30 mounted and 170 dismounted police, and 650 night-watchmen.

"The first appointment even of a permanent night-watch was in 1723, when an act was passed under which the different parishes were required to appoint 'honest men and *good Protestants*' to be night-watches. The utter inefficiency of the system must have been felt; and various improvements were from time to time attempted in it, every four or five years producing a new police act—with how little success every one can judge, who remembers the tattered somnambulists who represented the 'good Protestant watchmen' a few years ago."

Somewhat more than half a century since, the city of Dublin was one of the most turbulent in Europe. Similar feuds to those which have occasionally sprung up in many other cities existed in Dublin, and, as was commonly the case elsewhere, the butchers formed one party, the other was formed by the Liberty boys, or tailors and weavers of the Coombe. The author of the interesting and graphic little book, entitled "Ireland Sixty Years Ago," states that—

"It is in the memory of many now living that the streets, and particularly the quays and bridges, were impassable in consequence of the battles of these parties. The weavers, descending from the upper regions beyond Thomas Street, poured down on their opponents below; they were opposed by the butchers, and a contest commenced on the quays which extended from Essex to Island bridge. The shops were closed; all business suspended; the sober and peaceable compelled to keep their houses; and those whose occasions led them through the streets where the belligerents were engaged were stopped, while the war of stones and other missiles was carried on across the river, and the bridges were taken and retaken by the hostile parties. It will hardly be believed that for whole days the intercourse of the city was interrupted by the feuds of these factions. The few miserable watchmen, inefficient for any purpose of protection, looked on in terror, and thought themselves well acquitted of their duty if they escaped from stick and stone.

City.

"These feuds terminated sometimes in frightful excesses. The butchers used their knives, not to stab their opponents, but for a purpose then common in the barbarous state of Irish society, to *hough* or cut the tendon of the leg, thereby rendering the person incurably lame for life. On one occasion, after a defeat of the Ormond boys, those of the Liberty retaliated in a manner still more barbarous and revolting. They dragged the persons they seized to their market, and, dislodging the meat they found there, hooked the men by the jaws, and retired, leaving the butchers hanging on their own stalls."

Recently, however, the vital importance of an efficient police has been recognized, and in 1836 the act 6th and 7th Will. IV., cap. 29, established the present metropolitan police force, consisting of about 1150 officers and men, including seven divisional superintendents, altogether maintained at a cost of L.74,000 per annum, paid out of funds arising from police rate, carriage and pawnbrokers' licenses, &c., together with an annual parliamentary grant of L.37,000. There are two police commissioners, whose salaries are paid out of the consolidated fund, and under whose control the police are placed, the corporation having no authority over them. There are three police courts, presided over by six magistrates, in Dublin; and a court with one magistrate is held in Kingstown, which is within the jurisdiction of the Dublin metropolitan police commissioners.

A large military force is usually maintained in the city of Dublin, which is the headquarters of the military district of Dublin, and of the staff of Ireland, consisting of the commander of the forces, adjutant-general, and quartermaster-general. The troops are accommodated in several barracks, the most extensive of which is the Royal Barracks, erected in 1704, and subsequently enlarged, consisting of five squares, affording quarters for 10 field officers, 83 officers, 2000 non-commissioned officers and privates, and 460 horses, together with an hospital for 260 patients. Richmond Barracks, for infantry, occupies an elevated healthy situation, on the banks of the Grand Canal, beyond Kilmainham, forming a neat substantial fabric, with extensive courts and yards, covering altogether an area of 14 Irish acres, and furnishing accommodation for 76 officers and 1600 noncommissioned officers and privates, stabling for 25 horses, and an hospital for 100 patients. Portobello Barrack, for cavalry and artillery, is on the bank of the same canal, near Harold's Cross. At Island Bridge, near Kilmainham, there is an extensive artillery barrack, and one for artillery and infantry at the Pigeon House Fort in the bay. Besides these, there are barracks for infantry in Great Ship Street, near the castle, at Aldborough House, a fine massive building erected in 1765 at a cost of L.45,000, on the North Circular Road and in the Linen Hall. The two latter were first used for military purposes in 1848. In the Phœnix Park is Mackenzie's Fort and magazine.

The prisons of Dublin, which were formerly ill conducted, badly arranged, and stored with abuses calculated still further to debase and harden their inmates, are now managed upon the improved principles in vogue at the present day. Besides the county gaol at Kilmainham, there are four convict prisons which are under the control of the Directors of Government Prisons, the Richmond Bridewell, and the Marshalsea of the Four Courts.

Mountjoy Government Prison, a model prison for the reformation of convicts, is conducted on "the separate system," which admits of any amount of communication not considered directly evil, the only prohibition with respect to the intercourse of prisoners with their fellow men being that which cuts them off from association with other criminals. The number in custody is about 900 annually, who are principally drawn from the other convict depôts, especially from Spike Island, and a few directly from the county gaols. The average duration of the detention of convicts in this prison exceeds ten months, and they are afterwards removed to Spike Island, the Dublin depôts, or by transport ships to convict stations abroad. Each prisoner being submitted previous to admission to a strict medical examination, there is not much disease prevalent in this institution, and no instance of mental disease has occurred since the opening of the prison. The annual cost of officers' salaries and maintenance of prisoners is slightly above L.8000, which is reduced to about L.7000 by the earnings of the inmates.

The prison of Newgate, in Green Street, was opened in 1781, having been built from a design of Mr Thomas Cooley, the architect of the Four Courts and the Exchange, at an expense of about L.16,000. It was built to supply the place of the Old Gaol in the Corn Market which had fallen into decay, and is one of those dis-

mal, heavy structures which were formerly considered as models of prison architecture, when no other method of discouraging crime was believed to exist but punishment and terror. It is not without its melancholy historical interest, several gentlemen having been executed there in expiation of the crime of high treason during the rebellion of 1798; in which year also the unfortunate Lord Edward Fitzgerald expired within its walls in a state of phrenzy, from the effects of wounds received on the occasion of his arrest by the late Major Sirr. Originally it was intended for prisoners of every description; but in consequence of the numbers by which it was thronged its use was circumscribed. It is now used as one of the government prisons for the reception of convicts; and notwithstanding the defects of its original construction, which cannot be wholly obviated, the arrangements are such as to secure a constant and regular supervision; and the whole establishment is conducted with strict regard to discipline, and an efficient course of industrial training. The gross total annual cost of officers' salaries and maintenance of prisoners is about L.3500, and the number of prisoners in custody about 500 per annum.

The Richmond Penitentiary is an extensive pile of building in Grangegorman Lane, erected to prevent the necessity for transportation, being intended for convicts sentenced to long periods of punishment. It was under the immediate control of the government, by whom the gaoler and other officers were appointed. The experiment did not at first succeed. An inquiry into its internal management disclosed several grave abuses, which led to the dismissal of the gaoler; and afterwards, in 1832, the building was used for a cholera hospital, but is now again appropriated as a receptacle for female convicts, under the name of the Grangegorman Female Convict Depôt; the prisoners being employed in washing for the other government prisons in Dublin, sewing, knitting, spinning, and embroidery.

Juvenile offenders were formerly sent on conviction to the house of correction in Smithfield, which is now, under the name of the Smithfield Government Prison, a convict depôt. It is unfortunately situate in a densely crowded and low district, and affords very limited accommodation. The prisoners are furnished with employment: the principal trades carried on are shoemaking and mat-making, the work manufactured being disposed of for cash or appropriated to prison use.

The Four Courts' Marshalsea receives prisoners both from the city and from all Ireland. It is situated on a rising ground near Thomas Street, and was built to replace the wretched den on Merchants' Quay formerly appropriated to the same purpose.

The Old Sheriffs' Prison in Green Street is intended for all cases of debt above L.10 contracted within the city. Previously to its erection in 1794, debtors were detained in the residences of the bailiffs, commonly called spunging-houses, a custom which occasioned many gross abuses. For some time also after the opening of this prison, the keeper was partly remunerated by the rents of the apartments. The abolition of prison fees put an end to that abuse. It is not now used as a prison, having of late years been a branch of the North Dublin Union Workhouse, and more recently offered for sale to the government by the corporation of the city of Dublin.

The City Marshalsea, a mean building adjoining the Sheriffs' Prison, was appropriated to debtors in sums of less than L.10, under decrees of the lord mayor's court and the court of conscience. The prisoners were generally of the poorest classes, and many of them had no resource but casual charity for the support of life; even a lodging in the common hall had to be purchased at the rate of a penny a-night. This and the Sheriffs' Prison are now happily extinct, leaving the Four Courts' Marshalsea as the debtors' prison.

The County Gaol, a spacious and well-arranged prison, is at Kilmainham.

It is only of late years that any provision has been made by government for the relief of the poor of Ireland, and the penal enactments against mendicity were consequently of no effect. There were formerly houses of industry, mendicity institutions, and various substitutes for a national provision, but ultimately it was acknowledged that civilization might long exist on the surface of society without penetrating its depths, and that the only security for the existence of a well-ordered community was to be obtained by the formation of an organized substratum which could extract vice and poverty, and restore life and vigour to the mass of the population. Shortly after the establishment of the new efficient system of police, and the national system of education, the law for the relief of the poor in Ireland came into operation, and the city was divided between the North and South Dublin Unions, which also include a portion of the county contiguous to the city. The North Dublin Union Workhouse in Brunswick Street was formerly a portion of the House of Industry which was opened in 1773, with a grant of L.4000 from parliament, but now supported as an hospital by subscriptions and occasional grants from parliament. The South Dublin Union Workhouse was formerly an asylum for the destitute and insane poor, and afterwards the Foundling Hospital until converted to its present use in 1840.

The city is within the ecclesiastical province and diocese of Dublin. The province includes the dioceses of Dublin, Kildare, Ferns, Leighlin, Ossory, Cashel, Emly, Waterford, Lismore, Cork, Cloyne, Ross, Killaloe, Kilfenora, Clonfert, Kilmacduagh, Limerick, Ardfert, and Aghadoe. The diocese of Dublin comprises the entire county, most of the county of Wicklow, part of the Queen's County, and of the counties of Kildare and Wexford. The archbishop exercises spiritual jurisdiction over the two cathedrals of Christ Church and St Patrick. Of these the former claims the priority by right of antiquity. Its foundation is attributed to the Danes in 1038, but it dated its erection as a church from 1038, and its elevation to a deanery and chapter from 1541. The entire length of the nave and choir is 260 feet, that of the transept 110 feet; the extreme breadth of either 80 feet. It stands nearly in the middle of the old city, on the northern declivity of the hill, in a favourable situation for effect if entirely freed from the neighbouring wretched habitations. This cathedral does not contain many monuments. Among the most interesting is that of Strongbow, the invader of Ireland, whose tomb was long the place at which the tenants of the church were accustomed to pay their rents. The monument was injured by the fall of one of the cathedral walls; but was afterwards repaired, and is still to be seen in good preservation, with a smaller tomb by its side, supposed to be that of Strongbow's son who was killed by his father. Several fine monuments are in the aisle; and in the chancel is that of the nineteenth Earl of Kildare, father of the first Duke of Leinster. Synods were occasionally held in this church, and parliaments also, before the Commons' Hall was destroyed in 1596 by an explosion of 144 barrels of gunpowder which were arranged in Winetavern Street, after having been landed on Wood Quay, and by some accident ignited. Here also the impostor Lambert Simnel was crowned. Under the same roof with the cathedral is a small building called St Mary's Chapel. The chapter consists of the dean, precentor, chancellor, treasurer, the three prebendaries of St Michael, St Michan, and St John, and six vicars choral. The cathedral is well endowed. Its economy fund is applied to the payment of the dignitaries and officers, and to the maintenance of the structure, which has undergone a thorough repair, both internally and externally. The deanery-house was in Fishamble Street, which, being considered a situation unsuitable to a dignitary of the establishment, was sold, and is now a merchant's warehouse. The cathedral of St Patrick was founded in 1190 by John Comyn, archbishop of Dublin, in a very low situation, subject to the bad effects of floods, by which it is liable to be inundated. About a hundred years after its first erection it was burnt, but was again raised from its ruins in increased splendour. At the Reformation it was dissolved, and the building used for some of the purposes of the courts of justice. King Edward projected its change into a university. Sir John Perrott, the lord deputy, having reported that there were two cathedrals in the city, "this one dedicated to St Patrick being had in more superstitious reputation than the other ought to be dissolved;" but the project was defeated, a university established elsewhere, and in the succeeding reign of Mary St Patrick's Cathedral was restored to its primary destination. The installations of the knights of St Patrick, the first of which took place in 1783, were originally held here, but now St Patrick's Hall in the castle is used for the investiture of the knights of that order. This cathedral contains the monuments of several illustrious persons, among which the most celebrated, not so much for the execution of the sculpture as for the more durable fame of the characters they commemorate, are those of Dean Swift, who left by will the following epitaph—"Hic depositum est corpus Jonathan Swift, S.T.D., hujus Ecclesiæ Cathedralis Decani, ubi sæva indignatio ulterius cor lacerare nequit; abi, viator, et imitare, si poteris, strenuum pro virili libertatis vindicatorem;" of Mrs Hester Johnson, immortalized under the name of Stella; of Archbishop Marsh, who bequeathed a fine library to the public; of the first Earl of Cork; and of Duke Schomberg, who fell at the battle of Boyne. The chapter consists of the dean, precentor, chancellor, treasurer, the two archdeacons of Dublin and Glandelagh, nineteen prebendaries, four minor canons, and twelve vicars choral. The singing men of these cathedrals perform conjointly at both, and at the chapel of Trinity College, at different hours on Sun-

City.

days; so that it may be said there is only one choir in Dublin; but that one, from the combination of musical talent, is excellent. The deanery house is in the immediate vicinity of the church. Sir James Ware, who wrote in the reign of Charles I., pronounces this cathedral to be superior to all others in Ireland for magnificence of structure and for extent. It is remarkable for its undeviating adherence to the early English pointed style of architecture, and the state of neglect into which it had been allowed to sink. "I never saw a church in such a discreditable state," says Sir John Forbes,—"one part of it may be literally said to be converted into a dovecot, as its roof is filled with pigeons, and its floor in a state not to be described." It is now undergoing repair with as much rapidity as the funds at command for the purpose will allow. Some of the parish churches possess strong claims to admiration. St George's is a fine insulated Grecian fabric, with a noble Ionic portico and highly ornamented spire, 200 feet in height, erected in 1802, from design of Francis Johnston, Esq., at a cost of L.40,000. St Andrew's, commonly called the Round Church, from its elliptical form, is remarkable for a statue of its patron saint over the entrance; this being the only instance of a statue erected in such a locality in Dublin. St Michan's is of ancient foundation, being previous to 1700 the only parish church north of the Liffey, but rebuilt in 1676, in the pointed Gothic style, and since so much altered that nothing but the square tower of the older building remains. The vaults of St Michan's are remarkable for an antiseptic quality, which preserves the relics deposited there from decay.

St Thomas's Church in Marlborough Street is a singular specimen of compound architecture, erected in the middle of last century.

St Mary's Church, in Mary Street, built in 1697, has no architectural merit, and the other parish churches have few pretensions to notice.

The Roman Catholic Archbishop of Dublin also resides in the city. The metropolitan church, in Marlborough Street, is considered as more peculiarly under his charge. This is a building of great dimensions, highly ornamented internally in the Grecian style, and having a fine Doric portico forming the principal front in Marlborough Street, but placed in a situation unworthy of its architectural merit. The building, which stands on the site of Annesley House, was commenced in 1816 at an estimated cost of L.52,000. The number of Roman Catholic parish churches is twelve, all large, but few externally elegant; a circumstance easily accounted for by the fact, that previously to the year 1745 the strict enforcement of the penal laws prohibited the public exercise of their form of worship. The relaxation of the law was occasioned by the falling in of the floor of an upper apartment, where a Catholic congregation had assembled to celebrate mass secretly, and by which several lives were lost. After this accident, Lord Chesterfield, then lord lieutenant, declined further to enforce the statute, and the prohibition was removed.

St Paul's Roman Catholic chapel on Arran Quay is an elegant building in the Ionic style. The church of St Francis Xavier was erected at a cost of L.18,000 from a Roman Ionic design of the Rev. B. Esmonde. The Catholic places of worship have ever since been kept open without molestation; but the apprehensions of their pastors, and the jealousy of the ruling powers, induced them formerly to select places of comparative privacy for their erection. The interior of the chapels in Anne Street, Exchange Street, and Westland Row, are worthy of inspection. Besides the parochial chapels, there are seven belonging to friaries of the Franciscans, the Calced and the Discalced Carmelites, the Capuchins, the Dominicans, the Augustinians, and the Jesuits; and several belonging to nunneries,—viz. two of Discalced Carmelites, one of Poor Clares, two of the Presentation, one of the Sisters of St Dominick, one of the Sisters of Mercy, and three of the Sisters of Charity; besides various others in the neighbourhood of the city.

The Presbyterian meeting-house on Ormond Quay, in a prominent situation, is an elegant building in the Gothic style, erected in 1845, by means of a bequest for the purpose made by Mrs Magee. Protestant Dissenters are not numerous in Dublin. There are congregations of Presbyterians, Independents, Methodists, Quakers, Seceders, Baptists, and Moravians. The few Jews resident in Dublin have a synagogue in Mary's Abbey.

The centesimal proportion of the number of places of worship is about 45 for the Episcopalian churches, 35 Roman Catholic and 20 Dissenters. These figures do not give material for any accurate estimate of the number of each persuasion, on account of the very different size of the buildings and the number of services performed.

City.

Each of the parish churches has a cemetery attached to it, in which the parishioners of every religious persuasion were interred, until the restraints imposed on Catholics by the law called the Burial Casement act, as to performing their burial service over the dead, obliged them to open two large cemeteries, the one at Golden Bridge, the other at Glasnevin. The vaults of the newly built Roman Catholic places of worship are also appropriated to the reception of the dead. The Protestants also have a cemetery at Harold's Cross, called Mount Jerome cemetery, comprising twenty-five acres of land laid out with a view to ornamental effect.

Dublin has had its full share of the benefits arising from improvements in education. As early as the year 1311 a university was erected in it, under a bull of Clement V. in St Patrick's Church; but it gradually declined, until it became virtually extinct at the close of Henry VII.'s reign. After the Reformation, Sir Henry Sidney and Sir John Perrott exerted themselves to convert that cathedral into a university; but they were overruled by Archbishop Loftus, who protested successfully against what he deemed an encroachment on the rights of the church. In lieu of it, however, he prevailed on the corporation of Dublin to apply the dissolved monastery of All Saints or All Hallows, in Hoggins', now College Green, to the same purpose. Hence arose the University of Dublin, which is a college incorporated by charter or letters patent, 34 Eliz. (1591), as "The Mother of an University."

In the charter of foundation the Queen nominated one provost, three fellows, *nomine plurium*, and three scholars, *nomine plurium*, to constitute with their successors for ever a body corporate and politic, under the name of The Provost, Fellows, and Scholars of the Holy and Undivided Trinity of Queen Elizabeth, near Dublin. The number of the corporation has been increased from time to time, and at present consists of a provost, seven senior fellows, twenty-eight junior fellows, and seventy scholars. The system of instruction is superintended by the fellows, both senior and junior, together with professors in the various departments of science and literature. A vacancy among the fellows is filled up by the provost and a select number of the fellows, after a strict examination for four days in metaphysics, mathematics, natural philosophy, ethics, history, chronology, Latin, Greek, and Hebrew. They hold their situation during life, unless they choose to accept of the incumbency of one of the thirty-two benefices at the disposal of the college. Until the year 1840, all the fellows were bound to celibacy, but that restriction was then removed. The scholars are chosen from among the undergraduates, after an examination in Greek and Latin. They hold their situation till they can attain the degree of master of arts. Students, after an examination in Greek and Latin, are admitted as fellow-commoners, pensioners, or sizars; which last class is limited to thirty, and is partially maintained out of the College funds. Noblemen, noblemen's sons, and baronets, have the privilege of forming a separate order with peculiar advantages, on the payment of additional charges. The course of general instruction extends over four years, the principal studies of each year being successively mathematics, logic, natural philosophy and astronomy, and ethics; and two commencements are held every year for the purpose of conferring degrees. A medical school has been long attached to the university, to which has lately been added a school of civil engineering; and diplomas in surgery and civil engineering are granted by the board on the completion of the prescribed courses. The library consists of about 106,000 printed volumes, and 1500 manuscripts; and the number is increased annually by about 1500 vols., which are partly purchased and partly obtained under the copyright act. There is also a botanic garden at Ball's Bridge, and a museum. The funds of the College, arising from lands and the fees of the students, are managed solely by the provost and seven senior fellows, who form a board, to whom the whole government of the university, both in its executive, and, so far as the statutes permit, legislative branches, is committed. The buildings, which include a large extent of ground, now nearly in the middle of the city, consist of one very large and two smaller squares. In

these are the chapel, the theatre for examination, the museum, the library, the dining hall, the printing office, and chambers for the fellows and students. Attached to the buildings is a large space planted for the recreation of the students, and a smaller inclosure for the provost and fellows. The provost's residence and the medical school are apart from the main body of the buildings.

The College Observatory is at Dunsink, about five miles N.W. of Dublin; it is amply furnished with astronomical instruments. It was endowed by Francis Andrews, Esq., LL.D., provost of Trinity College, erected in 1785, and placed in 1791 by statute under the management of the "Royal Astronomer of Ireland," an appointment first filled by Dr Henry Ussher, and subsequently by Dr Brinkley, Bishop of Cloyne. The Magnetical Observatory of Dublin was erected in the years 1837–8, in the gardens attached to Trinity College, and at the expense of the university. A regular series of observations was begun in 1838, and has been continued ever since.

By letters patent, dated 15th August 1850, a university called "The Queen's University in Ireland" was founded, with powers to grant degrees in the faculties of arts, medicine, and law, to students who have completed their studies in any one of the Queen's colleges of Belfast, Cork, or Galway. The university consists of a chancellor and senate, nominated by the crown, and to hold office during pleasure, to be a corporation with perpetual succession, with power to sue and be sued, to make bye-laws, to use a common seal, and to hold lands, the annual profits of which may amount to not more than L.10,000. One or more visitors to be occasionally appointed by the crown. The senate meets at Dublin Castle, for holding examinations and granting degrees pursuant to such examinations; the examiners are appointed annually by the senate. The three Queen's colleges to be colleges of the university, and their professors to be professors of the same; but the colleges not to be under the jurisdiction of the senate, farther than as regards the regulations for degrees in the faculties above mentioned. The senate of the university held its first meeting in June 1851.

During the short reign of James II. a college for Roman Catholics was opened in Back Lane, but was extinguished on his abdication; and in 1854 the Roman Catholic University was established in Stephen's Green.

The Inns of Court were intended for the instruction of law students. Collet's Inn, the first appropriated to this purpose in the reign of Edward I., having been erected without the city walls, was destroyed, together with the king's exchequer, by an incursion of the Irish from the Wicklow Mountains. The inns were revived during the reign of Edward III. in a building near the castle, given by Sir Robert Preston, chancellor of the exchequer, and thence called Preston's Inns, where the institution was maintained for upwards of two centuries. But the society being dispossessed in consequence of a flaw in the title, the inns were removed to the dissolved monastery of St Saviour's, where the four courts now stand, and there took the name of King's Inns. These buildings having been suffered to fall to ruin, a new site was chosen in the northern extremity of Dublin, and a massive but elegant building erected from a design by Mr Gandon the architect of the Custom-House. The principal apartments are the dining-hall and the library, which latter forms a detached building, erected in 1827 at a cost of L.20,000. Law students are obliged to attend terms here for two years previously to being allowed to practise as barristers; but as no arrangements have been made for literary instruction beyond the use of the library, punctuality of attendance is ascertained solely by their presence in the dining-hall, and therefore they are facetiously said "to eat their way to the bar."

There is no classical school on a public foundation similar to the grammar-schools of Westminster and London, but the city is not deficient in means of instruction, as private schools and institutions for the education of the poor are numerous.

In 1833 the grants of public money for the education of the poor were intrusted to the charge of the lord lieutenant, to be expended on the instruction of the children of every religious denomination, under the superintendence of commissioners appointed by the crown, and named "The Commissioners of National Education." The principles on which the commissioners act are, that the schools shall be open alike to Christians of every denomination; that no pupil shall be required to attend at any religious exercise, or to receive any religious instruction which his parents or guardians do not approve, and that sufficient opportunity shall be afforded to the pupils of each religious persuasion to receive separately, at appointed times, such religious instruction as their parents or guardians think proper. This system of united education is one which does not exclude children of any denomination, while it admits to a participation of its benefits those of every religious creed who may wish for instruction without interfering with any conscientious scruples.

In 1845 the commissioners were incorporated under the name of "*The Commissioners of National Education in Ireland*," with power to hold lands to the yearly value of L.40,000, to purchase goods and chattels, to receive gifts and bequests to that amount, to erect and maintain schools where and as many as they shall think proper, to grant leases for three lives or 31 years, to sue and to be sued by their corporate name in all courts, and to have a common seal, a power being vested in the lord lieutenant to fill up vacancies, to appoint additional members provided the total number does not exceed 15, and to remove members at his pleasure.

The school of medicine is partly under the control of the board of Trinity College, which nominates and maintains professors of anatomy and surgery, chemistry, and botany, and partly under that of the College of Physicians, which nominates the professors of the practice of medicine, of the institutes of medicine, and of materia medica and pharmacy, which latter are on the foundation of Sir P. Dun. To these have been added by the university a professorship of surgery, and by the King and Queen's College of Physicians professorships of midwifery and medical jurisprudence. The College of Physicians was first incorporated by charter of King Charles II. in 1667, and incorporated by William and Mary in 1692. It enjoys some important privileges; among others, the right of inspecting the shops and stores of apothecaries, druggists, and chemists, and of destroying drugs of bad quality. The college consists of thirty-six fellows, on whom the management devolves; of honorary fellows, who are excluded from any interference with the financial arrangements; and of licentiates, who, though not entitled to take any part in the management of the collegiate concerns, are summoned on occasions of importance. The College Hall is in Sir Patrick Dun's Hospital.

Surgery was long considered in Ireland, as well as in England, as a trade, the practitioners being included in the worshipful corporation of barber-surgeons. Nor was it till 1784 that a charter, founding a college of surgery, put the practice of that inestimable art on a basis enabling it to advance in a manner suited to the wants and character of a civilized nation. The college, which was at first held in an obscure building near Mercer's Hospital, has been removed to an elegant range of buildings in St Stephen's Green, commenced in 1806, and erected at a cost of L.25,000. Under the direction of the Royal College of Surgeons is a school of surgery, where lectures on the different branches of the art are delivered by the professors. The college building contains a board room, an examination hall, a library, and three museums.

The governor and company of the Apothecaries' Hall, founded by act of parliament in 1791, also had some share in the completion of a medical education, by means of courses of lectures and examinations on chemistry and pharmacy at their school of medicine in Cecilia Street, now discontinued, and the building sold to the Roman Catholic University, to be applied hereafter to purposes of medical education. In Peter Street is the Dublin School of Medicine: the attendance on the lectures delivered here is as a qualification for examination by the Queen's University in Ireland, the universities of London, Glasgow, Aberdeen, and St Andrews; by the Royal College of Surgeons of Ireland, England, Edinburgh, and Glasgow; by the Apothecaries' Halls Dublin and London, and by the army medical and navy boards. Practical anatomy, taken in this school with hospital attendance, constitutes an "*Annus Medicus*" for the Edinburgh University. There are also the Carmichael School of Anatomy in North Great Brunswick Street, and the Original Theatre of Anatomy and School of Medicine and Surgery in Peter Street.

Hospitals or asylums for various cases of disease and classes of persons are numerous, and liberally supported.

Lunatics are maintained in St Patrick's Hospital, founded in 1745, pursuant to the will of the celebrated Dean Swift,

City.

and conducted by governors appointed under the charter of incorporation. The General Lunatic Asylum, erected near the House of Industry, and placed under the care of officers appointed by government, originally received patients from all parts of the country; but, under an act of parliament, its use is now limited to a district consisting of the counties of Dublin, Louth, Meath, and Wicklow, each of these contributing towards its expenses in proportion to the number of patients sent in. Besides these public establishments for the recovery and safe custody of lunatics, there are in the vicinity of Dublin various private asylums for the insane.

The principal institution for the blind is Simpson's Hospital, founded by a merchant of Dublin, who had laboured under severe affections of the eyes and gout. The income is upwards of L.2500 per annum, by which fifty patients, either blind or gouty, are maintained, in a large plain edifice, situate in Great Britain Street. The apartments can accommodate a hundred inmates. The Richmond National Institution in Sackville Street was founded in order to instruct the blind in some of the more useful handicraft occupations. The principal branches taught are weaving, netting, and basket-making. The Molyneux Asylum, opened in Peter Street, in a large building which had been an amphitheatre for equestrian exhibitions, is confined to blind females, of whom those above the age of fifty have in it a permanent asylum, while those under that age are admitted to a temporary residence, until they can procure a permanent livelihood elsewhere. There is a commodious Episcopal chapel attached to this establishment. An institution for the maintenance and education of children born deaf and dumb is maintained at Claremont, near Glasnevin. The plan of the Royal Hospital, for decayed and maimed soldiers, was first suggested by the Earl of Essex, when lord lieutenant, and carried into effect through the repeated applications of the Duke of Ormond to Charles II. The site chosen for it had been the ancient priory of Kilmainham, founded by Strongbow for Knights Templars. Upon the extinction of that order, and the confiscation of its property, which was effected by a simultaneous and secret movement of all the crowned heads in Europe, this part of their possessions was transferred to the Knights of St John of Jerusalem, and it became an hospital for guests and strangers only, to the exclusion of the sick and maimed. On the dissolution of monasteries, it devolved to the crown, and so continued till applied to its present use by Charles II. The building, completed in 1684, according to a plan of Sir Christopher Wren, is an oblong 306 feet by 288, three sides of which are dwelling-rooms, connected by covered corridors. The fourth contains the chapel, a venerable building, of limited size; the dining hall, in which the banners taken from the Spaniards at Gibraltar are suspended; and the apartments of the master, who is always the commander of the forces for the time being. Connected with the main building are several subordinate offices, a garden, and an avenue bordered by rows of stately trees.

Among the asylums for destitute children, the Foundling Hospital was by much the most extensive. It was opened in 1730 for destitute children of every age, but afterwards limited to the reception of those under a year old. The institution was maintained partly by voluntary contributions, partly by a local tax on Dublin, but chiefly by large parliamentary grants and restraints put on the admission of children. The average number annually admitted for twenty years up to 1825 was 2000. The buildings, with large gardens attached to them, are situated in a healthy and elevated situation in the west of Dublin, and are now converted to the use of the South Dublin Union. The Blue Coat Hospital was originally intended as a place of refuge for all the poor in the city. This object being soon found impracticable, it was reduced to an asylum for aged citizens and their orphan sons, and ultimately confined to this last-named class. The buildings in Oxmantown originally covered a considerable space; and previously to the building of the parliament house in College Green the parliament held its sittings there. The present edifice is built nearly on the site of the former. It consists of an elegant centre, with detached wings, one used as a chapel. Of the 120 boys it receives, 58 are named by the corporation, 50 by the governors of Erasmus Smith's schools, 10 by the Bishop of Meath as trustee to a bequest, and 2 by the incumbent of St Werburghs on a similar title. They are educated in the tenets of the Protestant church, and apprenticed to Protestant masters. The Hibernian School in the Park supports and educates the children of soldiers. A preference is given to those whose fathers have been killed, or died on foreign stations. The buildings, which are spacious, have gardens and exercising ground attached to them; and the boys, in addition to the usual routine of scholastic instruction, are trained to the rudiments of military tactics. On the southern quay, near Ringsend, is the Hibernian Marine School, instituted for sailors' children. It consists of a centre building and two wings, the latter containing the school and chapel. At a proper age the pupils are placed in the royal navy, or apprenticed to merchants, who take them without fee. The number of boys was 180; but it has been contracted in consequence of the reduction of the parliamentary grant.

City.

Besides these there are numerous institutions for the relief of various classes of the distressed or vicious portions of the population. The majority of these may be zealously and well managed; but whether a mass of small institutions, creating some evil, and failing to extend relief to much misery, are of substantial benefit to the public, may reasonably be doubted.

The progress of disease is combated, and the sufferings from accidental injuries assuaged, by means of numerous institutions; one of the most extensive of which is Steevens' Hospital. It was founded by the bequest of a physician whose name it bears, and erected by his sister, who having been left a life interest in the property previously to its being applied to its final purpose, immediately devoted the greater part of it to fulfil her brother's intentions, reserving to herself only L.120 per annum, and apartments in the hospital. In addition to the original estate, and to other contributions and bequests, altogether amounting to L.2200 per annum, it receives a grant of public money. This hospital is capable of accommodating 300 patients, and is provided with distinct wards for diseases of children, diseases of the eye, &c. The City of Dublin Hospital, in Upper Baggot Street, was founded in the year 1832, for the purpose of affording additional hospital relief to the sick poor of the metropolis, and is supported by voluntary contributions. The Meath Hospital, originally built in the Coombe, for the benefit of the liberties of Dublin, and afterwards converted into a county hospital by act of parliament, has been transferred from its former confined and low situation to another in the outlets, where a large building was erected for it, chiefly through the munificence of Mr Thomas Pleasants, who contributed L.6000 towards its building and maintenance. Its annual income exceeds L.1000. The medical officers at first received salaries of L.100 each, which they have resigned for the benefit of the institution. The hospital on the Coombe is now the Coombe Lying-in Hospital. The Charitable Infirmary, in Jervis Street, the oldest in Dublin, and opened at first in Cook Street, A.D. 1721, by the contributions and exertions of a few gentlemen of the medical profession, was transferred to its present situation in 1792. It is capable of accommodating 50 patients, but the state of its funds seldom admits of more than 30. The General Military Hospital at the entrance of the Phœnix Park, standing on an eminence in a healthful situation, is a general infirmary for the army. The edifice, though plain, is much admired for the elegance of its proportions. Sir Patrick Dun's Hospital, opened in 1810, is appropriated exclusively to medical cases, for the instruction of the pupils attending the professors of the College of Physicians. The Richmond Surgical Hospital in North Brunswick Street has attached to it the Talbot General Dispensary, and Mercer's Hospital, founded by a benevolent lady of that name, in Stephen Street, on the site of the decayed hospital of St Stephen, and are set apart for surgical cases and accidents. The House of Recovery in Cork Street, the first and largest of the fever hospitals, is supported by subscriptions, the interest of donations, and a grant of public money; and has contributed to check considerably the progress of low fever prevalent among the ill-fed artizans and paupers in that district. It was opened in 1804, and between that date and October 1852, 165,913 patients had been admitted, of which number 154,035 were discharged cured, 11,764 died, and 114 remained in the house. Its beneficial effects led to the opening of a second in the north of Dublin, on a smaller scale, called the Whitworth Hospital, which is not now a fever hospital, but open for the reception of patients labouring under general medical and surgical complaints. The number of patients admitted annually to the Dublin Hospital averages above 4500; of which

City. number 94 out of every 100 have been discharged cured, a sufficient proof of skilful attendance. The Lock Hospital was opened in Townsend Street in 1792, for the reception of venereal patients of both sexes; but in 1820 male patients were excluded, and it has been ever since confined to females. The number of beds, originally 300, is now reduced to half that number. The building, of plain granite, consists of a centre, containing apartments for the officers, and two wings in which are the patients' wards. It is wholly under the control of a board appointed by the lord lieutenant.

The formation of dispensaries was encouraged by a special act of parliament authorizing grand juries to present in aid of them a sum equal to that subscribed by individuals. There are several dispensaries for particular complaints; but the district dispensaries which are attached to the different poor-law unions throughout Ireland, are placed under the control of the Poor-Law Commissioners by the Medical Charities act of 1851, which supersedes the provisions of former acts.

Most of the religious societies spring from kindred sources in England. The chief among them is the Hibernian Bible Society, founded in 1807. Several minor societies for the distribution of the Bible, and differing from one another chiefly as to the channel into which their labours should be directed, have arisen from it, some detached, others auxiliaries or branches of the parent association. The Irish Society was formed for promoting the religious instruction of the Irish through the medium of their own language, by publishing Bibles, Testaments, tracts, and rudimentary books in that tongue, and by sending itinerant teachers through the country for their instruction. The names of the Church Missionary, the Methodist Missionary Societies, &c., announce the origin and objects of each. The Religious Tract Society has an extensive store and sale-room in Sackville Street. The Continental Society professes generally to promote religious knowledge and sentiments throughout Europe.

Scientific and literary societies are few. The Royal Dublin Society is foremost in seniority and importance. It owes its origin to some literary gentlemen, who in 1731 formed an association for scientific purposes meeting in Trinity College. In 1750 it was incorporated by charter, and received an annual parliamentary grant of L.500, which was gradually augmented until it amounted to L.10,000, but of late years it has been reduced. The improvement of agriculture and rural economy is promoted by annual cattle shows, when prizes exceeding L.300 are awarded. There is also an exhibition of farm and dairy produce in November; and an exhibition of manufactures takes place triennially. The professorships of mining and the veterinary art have been discontinued. A drawing school is established, in which pupils of promising talents are instructed gratuitously in landscape, figure drawing, architecture, and modelling, and premiums are periodically awarded. The society is also provided with a good library, containing upwards of 12,000 volumes. It is particularly rich in works on botany, and in those relating to Ireland. It has likewise a gallery of statuary, in which are casts from the Elgin marbles. The museum and gallery are open to the public on particular days. The members, who are admitted by ballot, on payment of an admission fee of L.30, which covers all subsequent expenses, have the exclusive advantage of the library, and of a reading-room well supplied with newspapers and periodicals. By a late bye-law, annual members are admissible to most of the advantages of the society on payment of a subscription of three guineas. The society held its meetings in Shaw's Court until 1767, when it removed to Grafton Street, and thence in 1796 to a building erected for it in Hawkins Street. In 1815 it purchased the splendid museum and grounds of the Duke of Leinster in Kildare Street, where it still continues. The Kirwanian Society, which takes its name from the celebrated chemist and mineralogist, was formed in 1812 for the advancement of chemistry, mineralogy, and natural history. It is supported wholly by individual subscription. The Zoological Society, formed in 1830, on the model of those in Dublin, has a garden on land granted to it by the lord lieutenant in the Phœnix Park, in which it has already collected a menagerie of living animals, which makes it an object of general attraction to the citizens of Dublin. It is supported by subscriptions, and by the money paid by the public for admission. The Royal Irish Academy was instituted by patent in 1786, to promote the study of polite literature, science, and antiquities. Its formation was chiefly owing to the exertions of its president, the first Earl of Charlemont. It holds its meetings in Dawson Street, where it has a library containing some valuable manuscripts, and occasionally publishes a volume of transactions. This society receives an annual parliamentary grant of L.300. City.

Several attempts have been made to create a taste for the fine arts in Dublin. In 1764 an association of artists erected a neat building in William Street for their meetings, and for the exhibition of their works; but the profits of the scheme did not cover their expenses, and the building was consequently offered for sale, and purchased by the corporation of Dublin as an assembly-house. Exhibitions of pictures by native artists were afterwards opened in Hawkins Street, under the patronage of the Dublin Society. Being discontinued in consequence of the society's removal to Leinster House, which afforded no suitable room for exhibition, the artists attempted their revival in the Royal Arcade in 1821, but without success. These failures were attributable not merely to the indifference of the public, but to dissensions among the artists themselves. The want of a permanent place of exhibition has been supplied by the liberality of Mr Francis Johnston, an architect to whom Dublin is indebted for several of its modern buildings, particularly the new Castle Chapel, and the General Post-Office. He built an elegant and appropriate structure, at an expense of L.10,000, which, when finished, he presented to the Society of Artists. Their exhibitions have been held in it since its opening in 1825. The society was incorporated in 1823, and receives an annual parliamentary grant of L.300.

The principal library in Dublin, for the number and value of its books, is that of Trinity College. It is open of right only to such graduates of that university as take a strict oath relative to their conduct while in it, and to their treatment of its contents. Admission by special favour is attainable, but with some difficulty. It contains about 110,000 printed volumes, and 1500 manuscripts, the number of books being annually increased partly by purchase, and partly in consequence of the right conferred by the Copyright act of receiving a copy of every new publication. The King's Inns Library is next in value. The right of reading in it is confined to the members of the King's Inns Society; that is, to barristers, attorneys, and law students. Marsh's Library, attached to St Patrick's Cathedral by the munificent bequest of Primate Marsh, archbishop of Armagh, and incorporated in 1707, contains a good collection of old books, and is open to the public on liberal terms; but, from the very small portion of its funds appropriated to the purchase of books, it is very deficient in modern publications. It possesses some valuable manuscripts. Steevens' Hospital, the Royal Hospital, Sir Patrick Dun's Hospital, and the College of Surgeons, have each a small library attached to it, chiefly of medical books, for the use of the practitioners. The want of a public library easily accessible, and provided with the works most in request, was attempted to be supplied by a society, which, having been formed in 1791, has collected a large number of books in a handsome and well-arranged building in D'Olier Street. The institution is entitled the Dublin Library Society and Hibernian Athenæum. Attached to it is a fine reading-room, well supplied with newspapers. But as the fund, arising solely from annual subscriptions, is not sufficient to stock the library with new publications, and to furnish a sufficient assortment of newspapers, the former of these demands has been made subordinate to the latter, and the library consequently impoverished.

The increase of commercial transactions occasioned by a long continuance of domestic tranquillity after the revolution of 1688, excited a desire among the merchants to have a suitable place for transacting their public business; and consequently the foundations of the Royal Exchange were in 1769 laid on Cork Hill, and the building was opened ten years after—at an expense of L.40,000, procured by subscriptions, lotteries, and grants of public money. It is one of the most admired structures in Dublin. Its principal front consists of a Corinthian portico of six columns. The interior is chiefly occupied by a magnificent circular hall lighted from above, with which several smaller apartments are connected. The progress of civic improvements gradually threw this fine building out of the more convenient channels of business. A more central position for mercantile transactions presented itself in Dame Street. Thither therefore the sagacity of speculation was directed, and a new building has been raised, principally by L.50 shares,

City.

with more extensive and suitable accommodation, under the name of the Commercial Buildings. The value of the Royal Exchange has consequently diminished. It is now wholly appropriated to the municipal business of the city. It is also a depository for the statues of celebrated characters, and has in it those of George III., Henry Grattan, Doctor Lucas, Daniel O'Connell, and Thomas Drummond. The Commercial Buildings form a small square of simple architecture fronting Dame Street. They contain a large saloon occupied as a news-room, and offices for merchants and brokers, together with an hotel and coffee-house, over which is the Stock Exchange. In order still further to promote the commercial interests of Dublin, an association was formed about thirty years ago, under the name of the Chamber of Commerce, which soon decayed; but the idea was revived in 1820, when a number of merchants formed themselves into a society under the same name, which still exists. Its objects are the protection and promotion of the manufacturing and commercial interests of Dublin, and of the country in general. The business is transacted by a president, vice-presidents, and committee, instructed to communicate with the officers of government on the subjects of the association. Their office is held in the Commercial Buildings. The Ouzel Galley is another voluntary association of merchants, for determining commercial differences by arbitration. It takes its name from that of a vessel, which was the occasion of a complicated and protracted suit, that was ultimately adjusted in an amicable manner by the interference of some of the most respectable merchants in Dublin. The effect of steam navigation on the cross-channel trade has produced a great alteration in the state of commerce in Dublin.

The Bank of Ireland was formed in 1783, in order to give security to commerce. It was opened at first in some old houses in Mary's Abbey, with a capital of L.600,000, which was afterwards increased to L.3,000,000. In the year 1802 the parliament house was purchased by the directors, and adapted to its present destination. This edifice was erected in 1729; and notwithstanding the changes made in it since it was diverted from its original purpose, the exterior has been but little altered. It consists of three fronts. The principal, towards College Green, a colonnade of the Ionic order, formed of a façade and two projecting wings, is much admired for the noble simplicity of its elevation. The western front, a portico of four Ionic columns, was connected with the other by a colonnade of the same order, forming the quadrant of a circle. The eastern front, which was the entrance of the House of Lords, was, by their special order, a colonnade of the Corinthian order, which the architect found great difficulty in uniting with the other parts. The apartment for the lords, a fine room, was hung with tapestry. That of the commons having been burned in 1792 (whether by accident or design has never been fully ascertained), was reconstructed after a more elegant design, in the form of a circle surrounded by pillars, between which was a gallery for hearers. This fine hall was taken down by the bank directors, and converted into a square room, now the cash-office.

The commerce of the Port of Dublin had increased so much towards the close of the last century, that the accommodation afforded in the river for shipping was found insufficient, and the Irish parliament granted L.15,000 for forming docks on both sides of it. The Floating and Graving Docks, communicating with the Grand Canal on the south side, including a basin covering 40 statute acres, with a fine quay and store frontage of 7500 feet, were opened in 1796; and St George's, the latest of the Custom-House Docks, in 1821. These latter cover an area of 8 acres, have 16 feet depth of water, and 1200 yards of quay; they are capable of accommodating 40,000 tons of shipping, and the stores have space for 8000 casks of sugar and tobacco, and 20,000 chests of tea, with cellarage for 12,000 pipes of wine. The docks on the south side afford commodious wharfage for 100 sail of merchantmen and colliers, exclusive of that supplied by the river-quays. The formation of the asylum-harbour at Kingstown, then Dunleary, which was commenced in 1817, gave additional aid to the commerce of the port, by the increased protection it afforded to shipping. The improvements made on the bar, in the erection of the great northern wall or breakwater, and the steam dredging of the bed of the Liffey by the ballast board, by rendering the channel sufficiently deep for the navigation of vessels of 1400 tons, has also contributed greatly to the same effect.

There were in 1852 belonging to the port, including steamers, 454 vessels, of every size, from 15 to 1200 tons; the registered burden amounting to 39,814 tons. Most of those vessels were employed in the coasting or cross-channel trade, there having been but 6 or 8 in that of the West Indies, the same number in that of France and the Spanish Peninsula, and 20 or 30 in the North American timber trade. The amount of customs collected averages about L.950,000, and has not varied much during the last twelve years, the reduction of duties having more than balanced the increase in the quantity of articles imported.

City.

The site of the city of Dublin was long confined to the hill on the south side of the river of which High Street forms the crest, and the castle the eastern declivity. The walls, which may be traced now only on maps, did not exceed a mile in length. From the north tower of the castle they were carried over Cork Hill, near which was an entrance called Dame's Gate, looking towards Hoggins', now Gollege Green. Near Essex Bride was another entrance called Essex Gate, erected on the site of Isod's Tower. The wall was then carried westwards along the course of the river to the end of Fishamble Street. Here stood Fyan's Castle, sometimes used as a state prison. Thence it continued along Wood Quay to Winetavern Street, where was another castle; and, still continuing parallel to the river, it joined a castle through which was one of the principal entrances opposite to Bridge Street. Thence it was carried to New Row, and up the hill to Cutpurse Row, at the end of which was Newgate, also used as a prison. From Corn Market it passed along the rear of Back Lane to Nicholas Gate, thence between Ross Lane and Bride's Alley to Pool Gate, afterwards Werburgh Gate, and thence in a straight line till it joined the castle at Bermingham Tower. The part of the city now called Dame Street and College Green was a low swampy plot, subject to inundations of the river, to the north of which were a Danish settlement, now called Oxmantown, a corruption from Ostmen's Town, and the extensive monastery of St Mary's, with its appendage the friary of St Saviour. The only passage across the river by land was by a bridge at the end of Bridge Street—formerly called Old Bridge, Dublin Bridge, Ormond Bridge, and for some time Friars' Bridge. It was taken down in 1815, and its place supplied by an elegant structure of three arches called Whitworth Bridge. All the monastic buildings, except the Dominican Friary, were on the south side of the river. These were the two cathedrals, the abbey of St Thomas the Martyr, since called Thomas Court; the priory of All Hallows, now Trinity College; the monastery of St Francis, in Francis Street; the monastery of the Holy Trinity, on the site of the late theatre in Crow Street; the Carmelite or Whitefriars' Monastery, lately restored, in Whitefriar Street; and the nunnery of St Mary de Hogges, on the ground where St Andrew's Church now stands. The precise situations of the nunnery of St Mary des Dames, whence Dame Street has its name, of the abbey of St Olave, somewhere in Castle Street, of the monastery of Witeshan in the west of Dublin, and of the priory of Knights Templars in Catgott, in the southern suburbs, are now unknown. The abbots of the Cistercians of St Mary's Abbey, and of the Augustinians of St Thomas the Martyr, were united, and with the priors of the Knights of St John of Jerusalem at Kilmainham, of the Augustinians of the Holy Trinity or Christ Church, and of the Augustinians of All Saints (now Trinity College), sat in the Irish parliament as spiritual peers. The hospital of St Stephen occupied the site of Mercer's Hospital; the Steyne Hospital stood on Lazar's Hill, now Bank Street; and Allen's Hospital lay between St Kevin Street and the bounds of the archbishop's palace in St Sepulchre's. Though the buildings spread themselves from an early period in all directions, the walls were never extended beyond their original limits.

In general it may be observed, that the progress of architectural improvement has taken an eastern direction. Most of the public buildings and new streets lie on that side of the castle, whilst those towards the west are rapidly falling into decay. About the year 1770 a road was carried round the city, so as to connect all the outlets; it was called the Circular Road. The boundary thus formed measures somewhat less than nine miles, and comprises an area within its limits of 1264 acres, intersected by the Liffey, which has 478 acres of the entire area on its northern, and 786 on its southern side. Latterly the lines of the Royal and Grand Canal on the north and south have afforded a boundary line still more comprehensive; but the entire of the included area is not covered with buildings.

A circle, with Essex Bridge as a centre, and with a radius of one mile, will comprehend very nearly all the inhabited part of the city, exclusive of the outlying villages. Both sides of the river are cased by walls of granite, forming spacious quays. These are intersected by nine bridges; Carlisle Bridge, nearest to the sea; Wellington, or the Metal Bridge, a single arch of cast iron, erected in 1816, for foot passengers only; Essex Bridge, of five arches; Richmond Bridge, also of five arches; Whitworth Bridge, formerly Dublin Bridge; Queen's Bridge; King's Bridge; and Sarah Bridge. The two last-named are each of a single arch; the first of them of iron, the other, a building peculiarly elegant in its proportions, of stone. All these bridges are of modern erection, and elegant in construction.

"First impressions of Dublin," says Inglis, "are decidedly favourable. Dublin, for its size, is a handsomer city than London. Sackville Street will compare with any street in Europe; Merrion Square and St Stephen's Green surpass in extent any of the squares in the British metropolis. There are points of view in Dublin, the quays, and some of the finest public edifices, more striking, I think, than any that are to be found in London; and although the Irish capital can boast of no St Paul's, yet, in the architectural beauty of some of her public buildings, she has just reason for pride. I need but name the Custom-House, and the Bank of Ireland with its magnificent yet classically chaste colonnades, in proof of this assertion." There is much truth in this description, yet the chief advantage which Dublin has in picturesque beauty lies in the concentration of the objects of interest within a small compass, and further examination does not confirm the first favourable impression. Sir John Forbes, who visited Ireland in 1852, says—"I own myself to have been a good deal disappointed with Dublin as a city. To say nothing of its extent, it is greatly inferior in many other respects, not only to London, but to several towns in England, and some in Scotland. Its site is flat and monotonous, and its streets and squares possess no architectural beauty. The former, to be sure, are often very wide, and some of the latter, as Merrion Square and Stephen's Green, are of immense extent, but there is throughout a general want of elegance and grandeur. Most of the streets seem to want dignity, and the majority of the houses are common-looking, and even mean and dingy. While denying both beauty and grandeur to Dublin as a city, I must join in the universal judgment as to the splendour of many of its public buildings, as the Bank of Ireland—formerly the Parliament House, the Custom-House, the Post-Office, the Royal Exchange, &c."

Few cities present a more striking picture of the extremes of splendour and destitution than Dublin. A line drawn from the King's Inns in the north of Dublin, directly south, through Capel Street, the castle, and Aungier Street, will, together with the line of the Liffey, divide the whole area into four districts, materially differing from each other in appearance and character. The south-eastern district, which comprehends three of the great squares, and the north-eastern, which includes the two remaining squares, are chiefly inhabited by the nobility, the landed gentry, and the liberal professions. These two districts present many symptoms of affluence and luxury. But on proceeding westward the scene suddenly changes. A considerable portion of the south-western district, which includes the liberties of St Sepulchre's and Thomas Court, and was formerly the seat of the silk and woollen manufactures, and also of the north-western portion of the city, are in a state of almost hopeless decay. The squalid misery visible in the ruinous portions of the city is relieved to the eye by the beauty of the environs of the city; and in its immediate vicinity is the Phœnix Park, of which the citizens are justly proud. It comprises an area of 1753 acres, within which are contained the Viceregal Lodge, the usual residence of the lord lieutenant, with 160 acres of demesne and gardens, the chief and under secretary's lodges, and the lodges of the park rangers and their assistants, with their respective inclosed grounds, the Hibernian school for soldiers' children, the military magazine, the military infirmary, the zoological gardens, the constabulary barracks, &c. Inglis, a good authority on such subjects, pronounced this park as superior, both in extent and diversity of surface, to any public park, promenade, prater, or prado, belonging to any other European city.—(Whitelaw and Walsh's *History of Dublin; Thom's Irish Almanac;* Gilbert's *History of the City of Dublin*, 1854. (H. S—R.)

DUBNO, a town of Russian Poland, capital of a cognominal circle in the government of Volhynia, on the Irwa, 36 miles N. by E. of Brody. The town is very irregular and ill-built, but it has a considerable trade in cattle and timber. Pop. 8000.

DUBOI, a town of Hindustan, province of Gujerat and district of Chumpaneer, standing in a low and marshy situation. Here are the remains of a Hindu city of great antiquity. The fortifications which surround it are nearly three miles in circumference. Duboi is 40 miles N.E. from Broach. The vast quantity of massive hewn stone used in the ancient structures of Duboi is calculated to excite surprise, insomuch as scarcely a pebble is to be met with in this alluvial part of Gujerat. Lat. 22. 8.; Long. 73. 25. (E. T.)

DUBOS, JEAN-BAPTISTE, an eminent French author, was born at Beauvais in December 1670. At first he applied himself to theology, but soon renounced this pursuit for the study of public law, and of the political interests of Europe. M. de Torcy, when minister of foreign affairs, employed Dubos with advantage in several secret negotiations; and both the regent and Cardinal Dubois made the same use of his talents, with the same success. Having retired from the field of politics, he entered upon that of history and literature; and in 1720 his works opened to him the doors of the French Academy, of which, in 1722, he was appointed perpetual secretary in the room of M. Dacier. He died at Paris on the 23d of March 1742, at the age of seventy-two, repeating as he expired the well-known remark of an ancient, "Death is a law, not a punishment." According to Dubos, "there are three things which ought to console us for parting with life; the friends whom we have lost, the few persons worthy of being loved whom we leave behind, and lastly, the recollection of our follies, with the certainty that we shall commit no more." His first work was *L'Histoire des quatre Gordiens, prouvée et illustrée par des Médailles*, Paris, 1695, 12mo. The common opinion, which only admits three emperors of this name, has prevailed in spite of all the efforts of his erudition and criticism. About the commencement of the war of 1701, being charged with different negotiations both in Holland and in England, in order if possible to engage these powers to adopt a pacific line of policy, he, in order to promote the objects of his mission, published a work entitled *Les Intérêts de l'Angleterre mal entendus dans la Guerre présente*, Amsterdam, 1703, 12mo. But as this work contained indiscreet disclosures, of which the enemy took advantage, and predictions which were not fulfilled, a wag took occasion to remark that the title ought to be read thus: *Les Intérêts de l'Angleterre mal entendus par l'Abbé Dubos*. His next work was *L'Histoire de la Ligue de Cambray*, Paris, 1709, 1728, and 1785, 2 vols. 12mo. This history, says Voltaire, is profound, political, interesting; it makes us acquainted with the manners and usages of the time, and is a model of its kind. In 1734 he published his *Histoire Critique de l'établissement de la Monarchie Française dans les Gaules*, 3 vols. 4to; a work the object of which was to prove that the Francs had entered the Gauls, not as conquerors, but at the request of the nation, which, according to him, had called them in to govern it. But this system, though unfolded with a degree of skill and ability which at first procured it many zealous partizans, was victoriously refuted by Montesquieu at the end of the thirtieth book of the *Esprit des Lois*. "C'est un colosse," said Montesquieu, "qui a de pieds d'argile, et c'est parce que les pieds sont d'argile que le colosse est immense. Si le système de M. l'Abbé Dubos avait eu de bons fondemens, il n'aurait pas été obligé de faire trois mortels volumes pour le prouver; il aurait tout trouvé dans son sujet; et sans aller chercher

de toutes parts ce qui en était très loin, la raison elle-même se serait chargée de placer cette vérité dans la chaîne des autres vérités. L'histoire et nos lois lui auraient dit: 'Ne prenez pas tant de peine; nous rendrons témoignage de vous.'" His *Réflexions critiques sur la Poésie et sur la Peinture*, published for the first time in 1719, 2 vols. 12mo, but often reprinted in three volumes, constitute one of the works in which the theory of the arts is explained with the utmost sagacity and discrimination. "All artists," says Voltaire, "read it with advantage. It is the most useful book which has ever been written on the subjects of which it treats, in any nation of Europe. The excellence of the work consists in this, that it contains few errors, and many reflections which are just, novel, and profound. It is not a methodical book; but the author thinks, and makes others think. He was, however, ignorant of music; he had never been able to make verses, and he had not a single picture in his possession; but he had read, seen, heard, and reflected much." Besides the works above enumerated, a manifesto of Maximilian, elector of Bavaria, against Leopold, emperor of Germany, relative to the succession in Spain, has been attributed to Dubos, chiefly, we believe, by reason of the excellence of the style, which has been greatly commended. (J. B—E.)

DUBRIS, the ancient Roman name of Dover. See DOVER.

DUBUQUE, the capital of a cognominal county, state of Iowa, North America; on the W. bank of the Mississippi, 72 miles N.N.E. of the city of Iowa. Pop. 4071. It is the great depôt of the Iowa lead region, and this metal constitutes its chief export.

DUCAS, MICHAEL, a Greek historian who flourished under Constantine XII., and, after the fall of Constantinople, was employed in various diplomatic functions by the princes of Lesbos. He is the author of a history beginning with the death of John Palæologus I., and extending as far as the capture of Lesbos in 1462, which has been edited by Bullialdus (Paris, 1649), and by Bekker (Bonn, 1834). Although barbarous in style, it is both judicious and trustworthy.

DUCAT, a foreign coin, either of gold or silver, struck in the dominions of a duke. The ducat was first coined by Longinus, governor of Italy, who revolted against the emperor Justin the Younger, and made himself duke of Ravenna, calling himself *Exarcha*, that is *without lord or ruler;* and he struck pieces of money of very pure gold with his own stamp, which, as Procopius relates, were called *ducati*, ducats. According to Du Cange, ducats were coined by Roger, king of Sicily, in the year 1240. The Venetian ducat was first struck by John Dandolo in 1280, and inscribed with this legend,—

Sit Tibi, Christe, datus, quem Tu regis iste Ducatus.

DUCATO, CAPE, the modern name of the ancient Leucate, a promontory at the S. end of Santa Maura, one of the Ionian Islands; celebrated as the rock from which Sappho precipitated herself into the sea.

DUCATOON, a silver coin, struck chiefly in Italy, particularly at Milan, Venice, Florence, Genoa, Lucca, Mantua, and Parma; though there are also Dutch and Flemish ducatoons. See MONEY.

DUCENARIUS, in *Antiquity*, the name of various officers and magistrates under the Roman emperors. The principal of these were—the imperial *procuratores*, or intendants, who received a salary of 200 sesterces; *ducenarii judices*, petty judges, chosen from among persons possessed of only 200 sesterces; *ducenarii*, officers who had the command of two centuries; and the *ducenarii* or household troops.

DUCENTESIMA, in *Roman Antiquity*, a tax of the two hundredth part; one-half per cent.

DUCHAL, JAMES, D.D. (1697-1761), an Irish Nonconformist divine, was born at Antrim. He studied at Glasgow, and was minister to a Dissenting congregation at Cambridge, Antrim, and Dublin, successively. He was the author of a series of discourses on the *Presumptive Arguments for the Truth of Christianity*. A selection from his other discourses was published posthumously in 1764.

DUCHY, or DUTCHY, the territory or dominions of a duke.

DUCHY *Court*, the court of the duchy or county palatine of Lancaster in England.

DUCK. See ORNITHOLOGY.

DUCKING-STOOL, a chair or seat in which scolding women in former times were tied and plunged into water.

DUCLOS, CHARLES PINEAU, a French author of some celebrity, was born at Dinant, in Bretagne, in 1704. At an early age he was sent to study at Paris. The imprudence of youth, and his love of pleasure, led him at first to contract certain intimacies which were little suited to his circumstances; but having afterwards disengaged himself from these, he courted the society of all the wits of his time, by whom he was well received. He became a member of that club, or association of young men, who published their juvenile productions under the titles of *Récueil de ces Messieurs*, *Etrennes de la St Jean*, *Œufs de Paques*, &c. The romance of *Acajou and Zirphile*, which was composed after a series of plates which had been engraved for another work, was one of the fruits of this association, and was produced in consequence of a sort of wager amongst its members. The epistolary dedication to the public, which was prefixed to this trifle, gave umbrage to some, in consequence of the flippant tone which the author assumed. Duclos had previously written two other romances, which were more favourably received: *The Baroness de Luz*, and the *Confessions of the Count de* ***. His first serious publication was the *History of Louis XI.* The style of this work is dry and epigrammatical, but the author has displayed in it considerable powers of research, and preserved the character of an impartial historian. The reputation of Duclos as an author was confirmed by the publication of his *Considérations sur les Mœurs*, a work which is much praised by Laharpe, and not without justice; for although the style, as in most of the writings of this author, is rather stiff and sententious, the book undoubtedly contains a great deal of just and ingenious reflection. It was translated both into English and German. The *Mémoires pour servir à l'Histoire du dix-huitième Siècle*, which were intended by the author as a sort of sequel to the preceding work, are nevertheless much inferior both in respect of style and matter, and are, in reality, little better than a kind of romance. In consequence of his *History of Louis XI.* he was appointed historiographer of France, when that place became vacant on Voltaire's retirement to Prussia. His *Secret Memoirs of the Reign of Louis XIV. and Louis XV.*, and his *Considerations on Italy*, were not published until after the Revolution. The former work is highly spoken of by Chamfort.

Duclos became a member of the Academy of Inscriptions in 1739, and of the French Academy in 1747. Of the latter he was appointed perpetual secretary in 1755. Both of these academies were indebted to him not only for many valuable contributions, but likewise for several useful regulations and improvements. As a member of the Academy of Inscriptions, he composed several memoirs on the Druids; on the origin and revolutions of the Celtic and French languages; on trial by battle, and proof by ordeal; and on scenic representations and the ancient drama. As a member of the French Academy, he assisted in compiling the new edition of the *Dictionary*, which was published in 1762; and he made some just and philosophical remarks on the *Port Royal Grammar*. On several occasions he resolutely supported the honour and prerogatives of the societies to which he belonged, and maintained the respectability of the literary character in general. He used to say of him-

self, "I shall leave behind me a name dear to literary men." His fellow-citizens, whose interests he always supported with zeal, appointed him mayor of their town in 1744, although he was resident at Paris. He was afterwards elected deputy from the commons to the assembly of the states of Bretagne; and upon the requisition of this body the king granted him letters of nobility.

In 1766 he was advised to retire from France for some time, in order that the government might have an opportunity of forgetting some opinions which he had hazarded on the subject of the dispute between the Duc d'Aiguillon and M. de la Chalotais, the friend and countryman of Duclos. Accordingly he set out for Italy; and on his return he wrote an account of his travels, which is also praised by Chamfort. He died at Paris, March 26, 1772, in the sixty-ninth year of his age.

The character of Duclos, although it exhibited many singular traits, was still respectable, whether we consider him as a man or as an author. Rousseau described him very laconically as a man *droit et adroit.* In his manners he displayed a sort of bluntness in society, which frequently rendered him disagreeable; and his caustic wit on many occasions created enemies. To those who knew him, however, he was a pleasant companion. A considerable number of his *bon mots* have been preserved by his biographers. A complete edition of the works of Duclos was published by Desessarts, at Paris, in 10 vols. 8vo, 1806.

DUCT, any tube or canal by which a fluid is conducted or conveyed. It is particularly used to denote the vessels which convey the fluids in animal bodies; and likewise those which convey the sap in plants.

DUCTILITY (Lat. *ductilis*), in *Physics*, that property of certain solid bodies which consists in their yielding to percussion or pressure, or admitting of extension by drawing, without an actual fraction or separation of the parts of their mass. Some bodies are ductile both when they are hot and when they are cold; as metals. Others are ductile only when heated to a sufficient degree; as wax and glass. Other bodies, again, particularly some kinds of iron called by the workmen *red short*, brass, and some other metallic mixtures, are ductile only when cold, and brittle when hot. Certain bodies are made ductile by the absorption of a fluid; as clay. It is on the property of ductility in metals that wire-drawing depends. The following is nearly the order of ductility of the metals which possess this property in the highest degree—commencing with the most ductile:—gold, silver, platinum, iron, copper, zinc, tin, lead, nickel, palladium, cadmium. The malleability of gold (which, like that of other metals, depends on its ductility) is such, that five grains may be made to cover about 270 square inches—the thickness of the leaf not exceeding 1-200,000th part of an inch. Dr Wollaston succeeded in obtaining a platinum wire of which the diameter was only 1-30,000th of an inch.

DUDLEY, Edmund (1462-1510), a celebrated lawyer and statesman in the reign of Henry VII., who with Sir Richard Empson, another lawyer of the same stamp, assisted in filling that rapacious monarch's coffers by arbitrary prosecutions of the people on old penal statutes. On the accession of Henry VIII., Dudley and Empson were attainted of high treason, and beheaded, Aug. 18, partly in order to pacify the clamours of the people for justice.

Dudley, *John* (1502-1553), Duke of Northumberland, son of the above, a statesman memorable in English history for the part he took in placing the crown on the head of his daughter-in-law, Lady Jane Grey. Ambrose (1530-1589), his eldest son, was a brave general and able statesman under Queen Elizabeth, and received the appellation of "the good Earl of Warwick." Henry, the duke's second son, was killed at the siege of St Quentin. Robert, the third son, a man of bad character, was created Earl of Leicester, and became one of Queen Elizabeth's favourites. His fourth son was the unfortunate Lord Guildford Dudley, the husband of Lady Jane Grey. See England.

Dudley, *Sir Robert*, as he was called in England, and, as he was styled abroad, *Earl of Warwick and Duke of Northumberland*, was the son of Robert above mentioned, by the Lady Douglas Sheffield, and was born at Sheen, Surrey, in 1573. On his father's death, in 1588, he succeeded to the greater part of the patrimonial estate; and being fond of navigation, he fitted out a small squadron at his own expense, with which he sailed to the river Orinoco, and took and destroyed nine sail of Spanish ships. In 1595 he attended the Earl of Essex and the lord high admiral of England in their expedition against the Spaniards; and for his gallant behaviour at the taking of Cadiz he received the honour of knighthood. He now endeavoured to prove the legitimacy of his birth, in order to be entitled to his hereditary honours. But being overpowered by the interest of the Countess Dowager of Leicester, he retired to the court of Florence, where he was well received; and on his refusal to return to England his whole estate was seized by King James I. and vested in the crown. At the court of Cosmo II. grand duke of Tuscany, he acquired considerable influence, and enjoyed distinguished honours. For improvements in shipping and manufactures which he projected, as well as for other services, the Emperor Ferdinand, in 1620, created him a duke of the holy Roman empire. He afterwards drained a vast tract of morass between Pisa and the sea, and raised Leghorn, which was then a mean and insignificant place, into a large and beautiful town, improving the haven, and by his influence drawing many English merchants to settle there. He was also a zealous patron of literature, and held a place in the republic of letters. His most celebrated work is his *Del Arcano del Mare*, Firenze, 1630, 1646, folio. This work, which has always been scarce, has now become extremely rare. There is a copy in the British Museum, dated 1661, called the second edition; but that which we have seen belongs to the Society of Writers to the Signet, Edinburgh. The work, which consists of a collection of tracts, comprehends a great number of projects for the improvement of navigation and commerce, with the charts and plans relating to the subject; all of them schemes which, considering the time when they were devised, are quite remarkable for the boldness and originality with which they are conceived, and the extent of scientific acquirements which they exhibit. Sir Robert Dudley died at his castle of Carbello, near Florence, in 1639.

Dudley, a parliamentary borough and market-town of Worcestershire (in a detached portion of it, surrounded by the county of Stafford), 8 miles W.N.W. of Birmingham. Pop. (1851) 37,962. Registered electors (1851-52), 912, returning one member to parliament. The town of Dudley is generally well-built, the houses are neat, and the streets clean and well paved. The parish church of St Thomas is a handsome modern Gothic structure, with a lofty spire. The other churches are St Edmund's, St James's, St John's, and St Andrew's; and there are also various dissenting places of worship. The free grammar-school, founded by Queen Elizabeth, has endowments of upwards of L.300 a-year, and educates about 40 scholars; besides which there are several well-endowed charity and other schools. It has also a mechanic's institute, savings-bank, subscription library, dispensary, and various charitable institutions. Dudley is a principal seat of the iron trade, the vicinity furnishing abundant supplies of coal and iron-ore. The principal manufacture is iron-ware, including chain-cables, grates, fire-irons, and iron utensils generally; but nails constitute its staple production. It has also extensive glass-works. The numerous forges and furnaces in Dudley and the vicinity illuminate the sky by night in a remark-

able manner. The limestone quarries around Dudley are very extensive, the excavations being carried more than a mile and a half under the hill on which the castle stands. The stratification of this district is highly interesting to the geologist, and the organic remains are very numerous. On a hill to the north are the remains of an ancient castle, founded about A.D. 700 by a Saxon prince named Dudo, from whom the town is supposed to have taken its name. Near the castle are some remains of an ancient priory. In the vicinity of Dudley there are some chalybeate springs. Market-day, Saturday.

DUEL, a combat between two persons. To distinguish it from the unpremeditated combat or rencontre, it must take place at a time and place appointed in consequence of a cartel or challenge, and generally in presence of two or more witnesses or umpires.

The word is derived from *duellum*, an antiquated form of the Latin word *bellum;* and, as a judicial trial, it has been defined "singularis pugnus inter duos ad probandam litem, et qui vicit probâsse intelligitur."—(*Fleta.*)

The origin of duelling may be traced to that barbarous state of society in which personal courage was followed as the ruling principle, and esteemed as the noblest ornament of life. Under the influence of such principles, the considerations of justice and humanity were little regarded; and patience under injuries being branded as infamous and cowardly, men were naturally impelled, not only to avenge their own wrongs, but to gratify their private resentments, at the point of the sword.

Before the dawn of Christianity had thrown its light upon the interesting doctrine of a providence superintending the affairs of men, the belief of an adequate distribution of rewards and punishments in the present life seems to have been generally received. The rich, the prosperous, and the happy, were apt to be considered as the peculiar favourites of Heaven; whilst disease, misfortune, and sudden or violent death, were regarded as the inflictions of divine vengeance for the crimes of the sufferers. Hence, in a superstitious age, arose the practice of making a direct appeal to the Deity in the single combat, under the persuasion that the justice of Heaven would infallibly declare for the innocent, and visit the perjured and the guilty with dishonour and death.

The duel, as a judicial trial, prevailed at an early period amongst the Germans, Danes, and Franks; and by a law instituted in 501, by Gundebald, king of the Burgundians, it was allowed in legal proceedings in lieu of swearing.

Louis le Debonnaire was the first French monarch who permitted to litigants the trial by arms; and the same mode of trial was introduced into England, with other Norman customs, by William the Conqueror. It was only used, however, in three cases: in the court martial or court of chivalry, in appeals of felony, and in civil cases upon issue joined in a writ of right; in which last it was the only decision, until Henry II., with consent of parliament, introduced the grand assize. None were exempt from the trial by battle but females, the sick and the maimed, and persons under fifteen or above sixty years of age; ecclesiastics, priests, and monks, being allowed to produce champions in their stead.

The trial by battle, however, soon degenerated into a convenient pretext for gratifying private revenge under sanction of the law, or on pretence of discovering truth and punishing perjury. Under the feudal system it was of course warmly patronized, being but too congenial with the feelings and habits of the fierce and haughty barons, who, uncontrolled by any principles of law or religion, disdained to submit their differences to any arbitration, or to seek any reparation for an injury but by the sword. Arms were the sport, plunder and revenge the business, of their lives. And to such a height did the evils arising from their private quarrels and petty warfare increase, that it became necessary to adopt some means for controlling and directing the torrent of military violence which threatened to sweep away every feeling of justice and humanity, and subject the peace and comfort of the community to the unrestrained passions of a fierce and lawless aristocracy. Martial societies were accordingly instituted, whose duty it was to protect the weak and defenceless, to relieve the oppressed, to correct abuses, and to promote the public good.

Hence arose chivalry and knight-errantry, which, although they modified in some degree the evil of duelling, by imposing a minute and punctilious system of observances, had yet a tendency to perpetuate the practice, by instituting false and fantastic principles of honour. With the code of punctilious regulations, the grounds and motives of the duel were changed and extended. Malice and revenge gave place to the gratification of personal vanity, and the desire of that renown for deeds of arms which was considered as the glory of the age. Tilts and tournaments were the pastime of the nobles, and were not only countenanced by the presence of the prince, who not unfrequently shared the dangers of the field, but graced by the attendance of female beauty and distinction, from whose hands the successful champion received the prize of his achievements, and at whose feet he longed to lay the trophies of his victory. See Chivalry.

The tournament continued in high estimation, notwithstanding the many valuable lives sacrificed on the most frivolous occasions, until the middle of the sixteenth century, when the death of Henry II. of France, in a tournament given in honour of his sister's marriage, gave a check to these sanguinary amusements. At this entertainment Henry sent his lance to Count Montgomerie, the captain of his guards, who at first declined the challenge; but on the king repeating his commands, he was compelled to obey. At the encounter, Montgomerie purposely broke his lance against the king's breastplate; but unhappily for the monarch he wore his helmet open, and a splinter of the lance flew up into his eye, and pierced his brain. He survived for about a month in great agony, and died on the 10th July 1559. (Cockburn *on Duels.*)

In no country has the duel on private and personal quarrels prevailed to so great an extent as in France. Francis I. encouraged the practice by his well-known determination "that the lie was never to be borne without satisfaction but by a base-born fellow." By his challenge to the Emperor Charles V. he set an example which his fierce and haughty nobles were but too eager to follow; and under the countenance of their monarch their native propensity to the single combat was indulged to an extent which all the power of his successors was scarcely able to control.

The power of the church was frequently exerted to restrain these bloody proceedings, especially by a council at Valentia in 855, and lastly by the council of Trent, session xxv. chap. 19, which excommunicated not only the combatants, but their associates, and even the spectators of the battle; declaring the custom to be detestable, introduced by Satan for the destruction both of body and soul. It adds, that "all advisers, supporters, witnesses, or those in any way concerned, are likewise excommunicated. Princes also who connive at duels are to be deprived of all temporal power, jurisdiction, and dominion over the places where they have permitted duels to be fought."

Philip the Fair, at the close of the thirteenth century, forbade all gages or pledges of battle; but this prohibition was afterwards relaxed in several instances; and in 1306 a royal ordonnance was published, prescribing rules, conditions, and ceremonies for the combat.

In the reign of Henry II. a noted duel was fought in the king's presence between Guy Chabot de Jarnac and Francis de la Chastaignerie, in which the latter was slain; and on

this occasion Henry is said to have taken an oath never to allow another during his reign. An edict was published accordingly; but this, which appears to have been the first royal prohibition of the duel, was productive of no good effects. The prohibition indeed arose rather from the king's grief for the loss of his friend Chastaignerie than from any desire on public grounds to abolish the custom; and it appears rather to have aggravated the evil, by increasing the number of private duels: for the same punctilious notions of honour from which the duel generally originated, and the same dread of the imputation of cowardice which kept it alive, were still entertained; and as the royal permission, without which the duel had formerly been high treason, could not now be obtained, each man became the judge in his own cause; and in those delicate cases, of which the law could take no cognizance, the point of honour was more likely to be stretched than curtailed.

The parliament of Paris in 1599 declared all persons who had assisted or been present at the prosecution of these unlawful quarrels to be rebels to the king, transgressors of the laws, and disturbers of the public peace.

Henri IV., during the first eighteen years of whose reign no less than 4000 gentlemen are said to have perished by the duel, alludes in his edict at Blois, 1602, to the disorders arising from this barbarous custom; and in 1609 he added to the penalties already imposed, punishment by death, confiscation of goods, fines, imprisonment, and degradation from honour, on all who were in any way concerned in these combats, not only principals and seconds, or bearers of challenges, but spectators, and even those who, being accidentally present, did not interfere to prevent bloodshed. The severity of these edicts might have contributed greatly to diminish the evil; but unfortunately they arose rather from the complaints of the people, and the persuasions of the Duke of Sully, than from any desire on the part of Henri himself to abolish a custom for which he privately entertained a great partiality, as was evident from the readiness with which he granted pardons to offenders, and even privately encouraged particular duels. He readily gave permission to Crequi to fight Don Philip of Savoy, and even added this encouraging compliment, "If I were not a king I would gladly offer myself to be your second."

It was not to be expected that laws, however severe, the open violation of which was thus countenanced by the monarch himself, could be productive of any beneficial effects; and we find the passion for the single combat continuing unabated during the reign of the succeeding monarch Louis XIII. To such extent indeed did it prevail, that the common inquiry when acquaintances met was not, "what is the news to-day," but "who fought yesterday;" and Lord Herbert, who was ambassador at the court of Louis, says, that "there is scarce a Frenchman worth looking on who has not killed his man in a duel."

Two noblemen, however, Montmorenci Count de Boutteville, the most renowned duellist of the day, and the Marquis de Beuoron, persisting to fight in defiance of the royal interdict, were tried according to law, and both beheaded. This execution caused for a time a cessation of the sanguinary custom; but it was reserved for Louis XIV. to give the first effectual check to the continuance of the practice.

During the minority of this prince a very desperate battle was fought between the Dukes de Beaufort and de Nemours, each attended by four friends. The seconds of the Duke de Nemours were the Marquis de Villars, the Chevalier de la Chaise, D'Uzerches, and Compan; and the Duke de Beaufort was attended by D'Henricourt, De Ris, Buri, and Brillet. They fought five against five, with swords and pistols. Nemours was shot by Beaufort, the Marquis de Villars killed D'Henricourt, and D'Uzerches slew De Ris: the rest were only slightly wounded.

This, with another desperate encounter fought in 1663, four against four, determined the king on taking some decided step to prevent the recurrence of such disgraceful and bloody quarrels. The famous edict published in 1679, with the solemn agreement entered into by the principal nobility, "that they would never fight a duel on any pretence whatever," and the firmness of Louis in refusing pardon to all offenders, contributed more to restrain this unhappy propensity than all the efforts of his predecessors.

The practice of duelling in England, although it never prevailed to such an extent as in France, may be traced to the same causes which gave rise to it on the Continent. The duel, as we have already mentioned, was early in use amongst the Franks and Normans, and was probably by them introduced into England.

One of the latest instances of the trial by battle occurred in the reign of Elizabeth in the year 1571, of which Sir Henry Spelman, who was eye-witness, gives an account of the whole proceedings, which were conducted, he says, "non sine magna jurisconsultorum perturbatione." A proceeding having been instituted in the court of common pleas, for recovery of some manorial rights in the Isle of Hartic, Kent, the defendant offered to maintain his right to possession by the duel. The petitioners accepted the challenge; and as the court does not appear to have had the power of refusal, champions were appointed, and all the requisite forms adjusted. The queen, to prevent bloodshed, had commanded the parties to compromise; but, anxious at once to save the credit of the defendant, who demanded the combat, and to support the authority of the law, which enjoined its being fulfilled, the ceremony of the duel was allowed to proceed. On the appointed day the justices of the common pleas and the counsellors appeared at Tothill Fields as umpires of the combat; but as the petitioners did not appear to acknowledge their champion, they were nonsuited, and victory declared for the defendant. Thus ended the last judicial combat we read of in a civil case. Another, however, occurred in the court of chivalry in 1631, and one in the county palatine of Durham in 1638; and the trial by battle was claimed so late as 1818, in the case of Ashford *v.* Thornton, in an appeal of murder.

But although the duel was disused in judicial proceedings, the fantastic notions of honour to which it gave rise still prevailed; and as the law could take no cognizance of points of honour and personal affronts, private duelling rather increased in the reigns of Elizabeth and James I.

During the civil wars the minds of men were too much occupied with the agitating events of the time to pay much attention to the settlement of points of etiquette, and private feuds for the time were forgotten. The custom, however, again gained ground after the restoration of Charles II.; and although he did issue a proclamation to put the existing laws in force, this object was defeated by his great laxity in pardoning offenders.

In consequence of a duel between the Duke of Hamilton and Lord Mohun in 1712, which was fought with the greatest ferocity and apparent determination of murder, and in which both parties were killed, the subject again came under the consideration of government. At the meeting of parliament in the following year, the queen's speech alluded to the subject in this sentence: "the practice of duelling requires some speedy and effectual remedy." No precise notice was taken of this part of the speech in the address from the House of Commons; and a bill which was brought in for the more effectual restraint of the duel was thrown out on a second reading.

When the fashion of wearing the sword was abandoned, private duels became less frequent in this country, and we have no longer to deplore the numerous and often fatal rencontres which, during the last century, were so frequently begun and concluded in the moment and heat of passion, and not seldom on the most frivolous occasions. Such was

the duel between Lord Byron and Mr Chaworth in 1765, which originated in a dispute during dinner about the quantity of game on their respective manors. The parties retired to an adjoining room, where they fought by the uncertain light of one small tallow candle, and Mr Chaworth, although the more expert swordsman, was mortally wounded.

By the laws of this country all the parties concerned in a duel which terminates fatally are guilty of murder, however fairly the combat may have been conducted, and however great the provocation.

The suddenness of the provocation, and the agitation of excited feelings, which in other cases may be pleaded in extenuation of the crime, cannot be urged in favour of those who, after ample time for deliberation, meet for the avowed purpose of murder.

The duel between Major Campbell and Captain Boyd, for which the former was executed in 1808, is well known, and was considered as little better than deliberate assassination. But in the case of Lieutenant Blundell, who was killed in a duel at Carisbrooke Castle, in the Isle of Wight, in 1813, everything appears to have been conducted with perfect fairness; yet the surviving principal, the seconds, and two others who were considered accessary, were convicted of murder at the Hampshire assizes, and sentenced to death; and although the royal pardon was obtained, they were all dismissed from His Majesty's service.

It is not one of the least evils of this system, that the word *honour*, which, rightly understood, denotes all that is truly noble and virtuous, should be prostituted as a pretext for gratifying the most malignant of human passions, or as a cover for that moral cowardice—the fear of being thought afraid.

With a view to repress this absurd practice in the army, three new articles of war were issued in the year 1844. The first of these, as embodying the chief points, is here given:—

"Every officer who shall give or send a challenge, or who shall accept any challenge to fight a duel with another officer, or who, being privy to an intention to fight a duel, shall not take active measures to prevent such duel, or who shall upbraid another for refusing, or for not giving a challenge, or who shall reject, or advise the rejection, of a reasonable proposition made for the honourable adjustment of a difference—shall be liable, if convicted before a general court-martial, to be cashiered, or suffer such other punishment as the court may award."

The most salutary effect has resulted from these regulations, and it is to be hoped that the absurd practice of duelling will no more disgrace the service.

DUGDALE, Sir William, an eminent English antiquary and historian, was born at Shustoke, near Coleshill, in Warwickshire, in 1605. He was introduced into the herald's office by Sir Christopher Hatton, and ascended gradually through all the degrees, until he became garter principal king at arms. His chief work is the *Monasticon Anglicanum*, in 3 vols. folio, containing the charters and descriptions of all the English monasteries, adorned with engravings; a work in which he was assisted by Mr Roger Dodsworth. Nor are his antiquities of Warwickshire less esteemed. He wrote likewise, the *History of St Paul's Cathedral*, London, 1658, folio; a *History of Embanking and Draining*, London, 1662, 1675, 1676, folio; a *Baronage of England*; and he completed the second volume of Sir Henry's Spelman's Councils, with a second part of his Glossary. He died on the 10th February 1686, in the eighty-first year of his age. His son, Sir John, was norroy king-at-arms, and published a Catalogue of the English nobility. His daughter Elizabeth was married to Elias Ashmole.

DUGONG. See index to Mammalia.

DUHALDE, Jean Baptiste, was born at Paris, Feb. 1, 1674; and having entered into the society of Jesus, he was at length appointed to succeed Father Legobien, who had been intrusted with the duty of collecting and arranging the letters which they received from different quarters of the globe. He was also for some time secretary to the famous Father Letellier, confessor to the king of France. Towards the close of his life he was attacked with acute spasms, which he endured with exemplary resignation, and died Aug. 18, 1743. Duhalde is represented as a man of mild and amiable character, and as remarkable alike for his unaffected piety and unwearied industry. He was the author of some Latin poems, which do not evince any superior degree of excellence; but the productions for which he is principally distinguished are, 1. *Lettres Edifiantes et Curieuses écrites des Missions Etrangères*, which he edited with great ability from the ninth to the twenty-sixth volume inclusively, and which have been translated into English and German; 2. *Description Géographique, Historique, Chronologique, Politique, et Physique, de l'Empire de la Chine et de la Tartarie Chinoise*, Paris, 1735, in four volumes large folio, with figures and an atlas by D'Anville. This work, the first in which China is described with so much exactness and detail, is at the same time a beautiful monument of French typography. The description contained in this work and in the *Lettres Edifiantes* has contributed materially to advance the science of geography. (J. B—E.)

DUHAMEL, de Vrigny le Monceau, Henri Louis, author of many valuable works on agriculture, natural history, and the arts, son of Alexandre Duhamel, lord of Denainvilliers, and of Anne Trottier, was born at Paris in 1700. His family had formerly emigrated to Holland, but returned to France as early as the year 1400, with the Duke of Burgundy.

He was educated at the College d'Harcourt; but the chief advantage which he derived from his residence there, was the taste for the further acquirement of physical knowledge, which he afterwards pursued with ardour at the Jardin du Roi, having for his fellow-students a number of young men, who afterwards acquired a high degree of celebrity, and among the rest Dufay, Geoffroi, Léméri, Jussieu, and Vaillant. At the age of twenty-eight he obtained the title of adjunct botanist in the Academy of Sciences; in 1730 he became an associate, and in 1738 an academician, having previously been elected a fellow of the Royal Society of London, in the beginning of 1734. Upon his first admission into the list of the academy, his assistance was requested in the investigation of a disease which affected the saffron cultivated in the Gâtinois, where his estate was situated; and he found reason to attribute it to a parasitical fungus attached to the roots of the plant. His memoirs and notes communicated to the academy, as well as his separate publications, are so multitudinous, that the shortest possible enumeration of their subjects can barely be brought within the ordinary limits of a biographical article.

1. *A Disease of Plants*, Acad. Paris, 1728. 2. *The Multiplication of Fruits*, 1728. 3. *The Growth of Plants*, 1729. 4. *Grafting*, 1730. 5. *The Pear Tree*, 1730-1-2. 6. *Soluble Tartar*, 1732-3. 7. *Ether*, 1734. 8. *Salt of Sulphur*, 1734. 9. *Sal Ammoniac*, 3 parts, 1735. 10. *The Purple Dye*, 1736. 11. *The Base of Sea Salt*, 1736. 12. *The Strata of Wood*, 1737. 13. *Frosts*, 1737. 14. *Bones Tinged Red*, 1739. 15. *Polygala as a Pectoral*, 1739. 16. *The Misletoe*, 1740. 17. *Botanico-meteorological Observations*, continued annually for forty-two years, 1740–1781. 18. *The Union of Fractured Bones*, 2 parts, 1741. 19. *The Strength of Timber*, 1742. 20. *The Growth of Bones*, 5 parts, 1742-3. 21. *Frobenius's Ether*, 1742. 22. *Anatomy*, 1743. 23. *Slips, Layers, and Offsets*, 1744. 24. *Moisture in Oak Timber*, 1744. 25. *A Magnetic Ore*, 1745. 26. *The Preservation of Seed*, 1745. 27. *Magnetising a Bar*, 1745. 28. *Cordage*, 1746. 29. *The Wounds of Trees*, 1746. 30. *Lime*, 1747. 31. *Calcination of a Stone*, 1748. 32. *Ventilation*, 1748. 33. *Plants raised in Water*, 1748. 34. *Gunpowder*, 1750. 35. *The Weight of Ignited Metals*, 1750. 36. *Tull's Agriculture*, 1750. 37. *The Compass*, 1750. 38. *The Strata of Trees*, 1751. 39. *The Growth of Horns*, 1751. 40. *Bees*, 1754. 41. *Madder*, 1757. 42. *Spontaneous Combustions*, 1757. 43. *Ergot*, 1759. 44. *An Insect Devouring Corn*, 1761; and separ-

Duhamel.

ately, 12mo, Paris, 1762. 45. *A Descent of the Barometer*, 1763. 46. *The Tea Plant in Sweden*, 1763. 47. *Inflammable Vapours*, 1763. 48. *Salts in Ashes*, 2 parts, 1767. 49. *Overdriving Animals*, 1768. 50. *Rhubarb*, 1768. 51. *Hair Returning after fifty years*, 1770. 52. *A Change of the Needle*, 1771. 53. *Variation Compasses*, 1772. 54. *A Monstrous Apple Tree*, 1775. 55. *The Management of Prisons*, 1780. 56. *Observations and Experiments with Madder Root, which has the Faculty of Tinging the Bones of Living Animals of a Red Colour. Phil. Trans.* xli. 1740, p. 390. 57. *Traité de la Culture des Terres*, 6 v. 12mo, Par. 1750. Ac. Par. 1755-7. 58. *Architecture Navale*, 4to, Par. 1752, 1758. Ac. Par. 1752. *Avis pour le Transport par Mer des Arbres*, 2d edit. 12mo, *Par.* 1753. 59. *Conservation des Grains*, 12mo, Par. 1753, 1754, 1768. *Supplément*, Par. 1765, 1771. Ac. Par. 1765. 60. *Fabrique des Manœuvres pour les Vaisseaux*, 4to, Par. 1757. 61. *Traité des Bois et Forêts*, 8 v. 4to, Par. 1755–1767. *Arbres et Arbustes*, 2 v. 1755. *Physique des Arbres*, 2 v. 1758. *Semis et Plantations*, 1760. *Exploitation*, 2 v. 1764. *Transport, Conservation, et Force*, 1767. Ac. Par. 1755, 1758, 1760, 1767, 1768. 62. *Moyen de Conserver la Santé aux Equipages*, 12mo, Par. 1759. Ac. Par. 1755, 1758, 1759, 1760. 63. *Traité des Arbres Fruitiers*, 2 v. 4to, Ac. Par. 1768. 64. *Traité des Pêches*, 1769. Jointly with M. de la Marre. Ac. Par. 1769. 65. *Art du Charbonnier*. Par. fol. Noticed Ac. Par. 1761. 66. *De la Fabrique des Ancres*, 1761. 67. *Du Chandelier*, 1761. 68. *De l'Epinglier*, 1761. 69. *De Reduire le Fer en Fil*, 1768. 70. *Du Cirier*, 1762. 71. *De Faire les Enclumes*, 1762. 72. *Du Cartier*, 1762. 73. *De Rafiner le Sucre*, 1764. 74. *Du Drapier*, 1765. 75. *De Faire les Tapis*. 76. *De Friser les Etoffes*, 1766. 77. *Du Couvreur*, 1766. 78. *Du Tuilier Briquetier*. 79. *Du Serrurier*, 1768, 80. *De Préparer le Colle*. 81. *De Faire les Pipes*, 1772. 82. *Du Potier de Terre*, 1774. 83. *Du Savonnier*, 1775.

The earlier part of Duhamel's life was chiefly devoted to the study of vegetable physiology, which he had continued for thirty years before the publication of his principal works. The most original of his observations related to the growth of plants, the formation of the bark and the wood, the effects of grafting, the inversion of a tree, the double motion of the sap, and the influence of light, air, and soil. In agriculture he introduced the practice of drying corn in a particular stove or kiln, with a heat sufficient to destroy the insects which infested it and their larvas. He made many experiments on manures; and he conferred a great benefit on several provinces of France, by introducing the cultivation of potatoes into general practice, as well as by promoting that of rhubarb in different places.

Having obtained from M. Maurepas the appointment of inspector-general of the marine, he undertook to make himself master of every department of nautical knowledge; and setting out with the established doctrines of Euler and Bouguer, where theory was wanted, he collected for his works on these subjects an immense mass of facts and experiments, affording the means of resolving every question on practical grounds. He established a school for shipbuilders, which effectually secured to them an education superior to that of simple carpenters. He also made some very valuable improvements in the theory of rope-making, showing especially the disadvantages arising from the excessive twisting of cordage. His conduct in this capacity seems to have been as judicious in a moral as in a mechanical point of view; whilst by his modesty and good nature he silenced the contending passions of those with whom he was obliged to enter into discussion, and was enabled to unite a variety of opposite interests, in the important object of the establishment of an academy for the cultivation of naval science.

His meteorological observations included, besides the usual registers, accounts of the direction of the magnetic needle, of the state of agriculture, of the diseases of the year, and of the times of migration of birds, and of the appearance of their young.

From his experiments on the growth of their bones, he inferred that they are enlarged by means of the ossification of the laminæ of the periosteum, nearly in the same manner as trees are known to grow by the hardening of the cortical layers; although the bones, while they are soft, expand in every direction, as the very young shoots of vegetables are also found to do. Having learned from Sir Hans Sloane that madder possesses the property of giving colour to the bones, he fed animals successively on food mixed and not mixed with madder; and he found that their bones in general exhibited concentric strata of red and white, whilst the softer parts showed in the mean time signs of having been progressively extended. These experiments are still of great importance in illustrating the physiology of ossification, although the actual conversion of the periosteum into bone may justly be disputed.

In trees Duhamel found that the graft was incorporated with the stock so as to form a single substance completely identical with it; and he showed that animal bodies were capable of a similar union, the vessels of the animals forming communications with those of the parts inserted; the spur of a cock, for instance, grafted into his comb, uniting perfectly with it, and becoming gradually furnished with a bony core, like the horn of a bullock, which either forms a joint with the cranium, or is firmly attached to it, and affords nourishment for the growth of this newly adopted member.

Having demonstrated in 1737 the different natures of soda and potass, he made an interesting experiment on the production of these alkalies by different vegetables. He sowed the head of the salsola kali at Denainvilliers, and it was found by the analysis of Cadet that its ashes produced at first soda, but afterwards more and more potass every year; and after several generations almost entirely potass. His other chemical memoirs were of less permanent importance; and with respect to the weight of ignited iron, he was unfortunately inaccurate in his mode of conducting the experiment, otherwise it must necessarily have led him to an anticipation of some of the most important discoveries of the last century.

From his extensive correspondence in different countries, he was enabled to communicate to the academy from time to time a number of detached facts, which were both amusing and instructive, and which appear perpetually in the histories of the respective years. His works were in general of an elementary nature, and calculated for the use of such as possessed but little previous information; and hence they may appear to some readers to contain an unnecessary detail of explanation. "Prolixity," says Condorcet, "is injurious to perspicuity, when we are addressing ourselves to persons accustomed to fix their attention firmly on the subject before them, who are able to observe the slightest shades of difference, and to receive at once a variety of ideas; supplying, where there is occasion, any connecting links of the chain which may have been omitted. If we are too diffuse, the attention of such persons droops for want of excitement; their memory is fatigued with the attempt to retain impressions which have not been communicated to them with sufficient force; and when they are compelled to travel slowly, the delay exhausts them, from having been in the constant habit of a more rapid motion. But it was not for this very limited class of readers that Duhamel's works were calculated. He wrote for the use of those who seldom go beyond the bare expressions of the author, who find all close attention toilsome, and who read rather for simple information than for the cultivation of the mind; and an author may always be said to write well when his style is appropriate to his subject, and to the capacity of his readers."

Duhamel was economical in his habits of life, and disinterested in his views, sacrificing his own pecuniary advantage, and that of his family, to the desire of serving the public by his experiments and his writings. Having once established a certain scale for his expenses, he never troubled himself with keeping a minute account of them. His integrity sometimes wore the appearance of severity, and

his vivacity that of harshness; but no imputation was ever cast on the goodness of his heart. He was averse to all changes, both in political and scientific institutions, which were not connected with obvious improvement. He was punctual in his attention to the duties which his religion imposed on him, but he did not sacrifice to unnecessary parade such of his hours as he thought might be more conscientiously employed in studies of general utility. His application, though assiduous, was seldom severely laborious. He never entered into any matrimonial engagements. On some occasions he felt himself neglected by the public; but he was little disposed to lament this injustice, except from reflecting on the effect which it would have had on an individual less zealous or less independent than himself. Besides his election as a fellow of the Royal Society of London, he obtained the honour of diplomas from the academies of St Petersburg, Palermo, Bologna, Edinburgh, and Padua, and from several agricultural societies; and his name has acquired a celebrity commensurate with the extent of his varied researches.

Few persons have ever passed through life with greater tranquillity of mind, or with a greater desire of rendering themselves useful to mankind, than Duhamel. He was one of the most active promoters of the kind of revolution which took place in the cultivation of science during the last century, and of which the characteristic distinction was, to endeavour to turn its chief course towards the grand objects of public utility and domestic convenience. Upon this modification of the pursuits of natural philosophy, Condorcet very judiciously remarks, that " if the sciences have sometimes raised themselves too high towards heaven, and if it has been of advantage to recall them towards the earth, we must still shun the opposite error of condemning them to creep on it for ever." And when we see the paths of discovery open before us, we must follow boldly wherever they lead us, confident that, sooner or later, all theoretical knowledge may eventually confer some material benefit on society, even with regard to the more practical purposes of life. Duhamel indeed well knew the necessity of previous study and of extensive inquiry for the success of his experimental investigations; and the former half of a long life he spent chiefly in qualifying himself for making the observations which he recorded, and deriving from them the instructions which he published, in the latter. At a very advanced age his memory began to fail; he still continued his pursuits, but without reaping any advantage from his application; he attended the meetings of the academy, but took little or no interest in anything that passed at them; and after having been present at one of these meetings, on the 22d of July 1782, he had an attack of apoplexy, which wholly deprived him of his remaining faculties, and on the 13th of August put an end to his life.

A few years before his death he had felt very severely the loss of his brother, who had lived constantly at Denainvilliers, and had assisted him in many of his agricultural researches and meteorological observations, though he had always remained anonymous. His nephew, M. Fougeroux, had also been useful to him on several occasions in his literary pursuits; and this gentleman became heir to the principal part of the property of both his uncles. *Eloge*, by Condorcet, *Hist. Ac. Par.* 1782, p. 131. (T. Y.)

Duhamel, *Jean Baptiste*, born in 1624 at Vire in Normandy, was the son of an eminent advocate. He commenced his studies at Caen, and completed them at Paris. At eighteen he wrote a treatise on the Spherics of Theodosius, and a tract on trigonometry, designed as an introduction to astronomy. In 1666, when Louis XIV., on the recommendation of Colbert, established the Royal Academy of Sciences, Duhamel was appointed perpetual secretary, a situation for which he was eminently qualified. He was preparing a history of the academy, when he was cut off in the midst of his projects on the 6th of August 1706, at the age of eighty-two. He was a laborious student and a voluminous writer. He published numerous works on philosophy, divinity, and natural science.

DUILIUS, Caius Nepos (B. C. 260), a Roman consul, who gained a distinguished victory over the Carthaginian fleet on the Sicilian coast near Myle. This being the first naval victory of the Romans, Duilius enjoyed a splendid triumph, and was rewarded with the privilege of being attended whenever he had occasion to return from a banquet after nightfall by a torch-bearer and flute-player at the public expense. A column was raised in the Forum to commemorate his triumph, and was still to be seen in the days of Pliny and Quintilian. During the consulship of Duilius the Roman senate passed a decree forbidding the interment of dead bodies within the city.

DUISBURG, a town of Rhenish Prussia, capital of a cognominal circle in the government of Düsseldorf, between the rivers Anger and Ruhr, about a league above the confluence of the latter with the Rhine, and 18 miles north of Düsseldorf. Pop. (1849) 8948. It has a gymnasium and several minor schools, botanic garden, observatory, library, and orphan asylum. Manufactures—woollen and cotton goods, silks, leather, glue, tobacco, soap. It communicates by canal with the Rhine; has ship-building docks and a considerable trade. There are iron-works in the vicinity.

DUKE (Lat. *dux*), a sovereign prince, without the title or quality of king. Some sovereigns have the title of *grand duke*, as the Grand Duke of Tuscany and the Grand Duke of Muscovy. The title of grand duke belongs to the heir-apparent of Russia; and the title of archduke is given to all the sons of the house of Austria, and that of archduchess to all the daughters.

Duke is also a title of honour or nobility, the next below that of prince.

The word *dux* is derived, *a ducendo*, from leading or commanding. The first Roman *duces* were the *ductores exercituum*, leaders or commanders of armies. Under the later emperors, the governors of provinces in time of war were entitled *duces*. The same denomination was afterwards also given to the governors of provinces in time of peace. The Goths and Vandals, upon their overruning the provinces of the Western empire, abolished the Roman dignities wherever they settled; but the Franks, in order to humour the Gauls, who had long been used to that form of government, made it a point of policy not to make any change in these matters; and accordingly they divided all Gaul into duchies and counties, giving to the governors of these sometimes the names of dukes, and sometimes that of counts, or *comites*.

In England, during the Saxon times, Camden observes, the officers and commanders of armies were designated in the ancient Roman manner, without any addition; but after the Norman Conquest the title was disused. The order of duke in England is not of older date than the eleventh year (1335) of the reign of Edward III., who created his son Edward the Black Prince first Duke of Cornwall; a title which has ever since been the peculiar inheritance of the king's eldest son during the lifetime of his father, so that he is *dux natus, non creatus*. Subsequently several more dukes were created. In the reign of Queen Elizabeth, however, that is, in 1572, the order became utterly extinct; but it was revived in 1627 by her successor in the person of George Villiers, duke of Buckingham.

Though the French retained the names and forms of the ducal government, yet under their second race of kings there was scarcely any such dignity as that of duke. All the great lords were called *counts, peers*, or *barons*; excepting, however, the Dukes of Burgundy and Aquitaine, and the Duke of France, which was a dignity held by Hugh Capet himself, and corresponded to the modern dignity of

maire du palais, or the king's lieutenant. By the weakness of the kings, the dukes or governors sometimes made themselves sovereigns of the provinces intrusted to their administration.

The title of duke is no longer given to the governors of provinces, but has become a mere title of dignity, annexed to a person and his heirs-male, without giving him any domain, territory, or jurisdiction over the place of which he is duke. All the advantages of the title now consist in the name, and in the precedence which it gives.

The dukes of our days retain nothing of their ancient splendour except the coronet on their escutcheon, which is the only mark of their departed sovereignty. They are created by patent, cincture of the sword, mantle of state, imposition of a cap and coronet of gold on the head, and a verge or rod of gold in their hand.

The eldest sons of dukes are by the courtesy of England styled *marquises*, though they are usually distinguished by their father's second title, whether it be that of marquis or earl; and the younger sons are *lords*, with the addition of their Christian name, as Lord James, Lord Thomas, Lord Charles; and they take precedence of viscounts, though not so privileged by the laws of the land.

Duke-Duke, a title given in Spain to a grandee of the house of Sylva, on account of his having several duchies from the union of two considerable houses in his person.

DUKINFIELD, a township of Cheshire, on the left bank of the Tame, which separates it from Ashton-under-Line, of which it may be considered a suburb. Pop. (1851) 12,132, chiefly engaged in the cotton manufacture, iron-works, and collieries, which are extensive.

DULCIGNO (the ancient *Olcinium*), a seaport-town of Albania, in European Turkey, situated on the Adriatic, 15 miles W.S.W. of Scutari. Pop. about 7000. It is a place of some trade. The inhabitants were formerly notorious for their piratical habits.

DULVERTON, a market-town of Somersetshire, in a valley on the Barle, 25 miles W.S.W. of Bridgewater. It has some manufactures of woollens and silks. Market-day Saturday. Pop. 1497.

DULWICH, a hamlet in the parish of Camberwell, Surrey, 4½ miles S.S.E. of St Paul's, London. It is beautifully situated, and has numerous pretty villas. Pop. 1632. Dulwich is celebrated for its college, founded by Edward Alleyn in 1619. It contains a fine collection of paintings, chiefly of the Italian and Flemish schools. A more detailed account of this institution is given under ALLEYN, *Edward*.

DUMARSAIS, CESAR CHESNEAU, a French philologer, was born at Marseilles July 7, 1676. His life consisted of a succession of misfortunes; and his merits, considerable as they were, seem to have been entirely overlooked and neglected by his contemporaries. His father died while he was yet an infant; and his mother, by her extravagance, dissipated his patrimony. He was educated in his native town by the Fathers of the Oratory, into whose congregation he entered; but left them at the age of twenty-five, and repaired to Paris, where he married, and was admitted an advocate in 1704. He soon, however, quitted the bar, separated from his wife, to whom he gave up the little he possessed, and went to reside with the President de Maisons, in the capacity of tutor to his son. He was afterwards successively tutor to the son of Law, the famous projector, and of the Marquis de Beufremont. It was during this last period that he published the results of his grammatical investigations, which were received with great coldness. At a subsequent period he opened an establishment for education in the suburb St Victor, which scarcely afforded him the means of subsistence; and he expired, at length, under the accumulated pressure of years, infirmities, poverty, and neglect, on the 11th June 1756, at the age of eighty.

Dumarsais possessed no ordinary talents. His researches are distinguished alike by their accuracy, ingenuity, and depth. As a man, he combined the greatest purity of morals and simplicity of character with a rare degree of manly fortitude in the midst of his misfortunes; yet during the greater part of his life he was left to languish in obscurity, and his merits scarcely attracted any notice until nearly half a century after his death. His works on philosophy and general grammar, however, are worthy of attention. Of these, the best is his *Histoire des Tropes*. D'Alembert and Voltaire have both paid a just and discriminating tribute to the merits of Dumarsais. An edition of his works was collected by Duchosal and Millon, and published at Paris in 1797, in seven vols. 8vo.

In 1804, the French Institute proposed a prize for an *Eloge* on Dumarsais, which was gained by M. Degerando, whose work was published at Paris in 1805, in 8vo. A previous and well-written *Eloge* on the same author, by D'Alembert, is to be found in the *Mélanges de Littérature*, and prefixed to the above-mentioned edition of the *Works of Dumarsais*.

DUMBARTON (anciently called Lennox), a county in Scotland, situated between N. Lat. 55. 53. and 56. 25., and between W. Long. 3. 55. and 4. 53., consists of two districts, which are six miles distant from each other, and are separated by part of Lanarkshire. The western and larger district is about 35 miles long from N.W. to S.E., and 15 broad. It is bounded N. by Perthshire; W. by Argyleshire, from which it is separated by Loch Long; S. and S.W. by the river Clyde and Lanarkshire; and E. by Stirlingshire. The eastern district, which is about 12 miles in length from E. to W., and 4 in breadth from N. to S., is completely inclosed by the counties of Stirling and Lanark. The whole county contains 297 square miles, or 189,844 statute acres. It is divided into twelve parishes, of which there are only two in the eastern district, viz., Kirkintilloch and Cumbernauld. This last belonged to Stirlingshire, till the Earl of Wigton, whose property it was, became heritable sheriff of Dumbartonshire, and annexed it to this county.

The climate is on the whole salubrious, but much more humid than in many parts of Scotland. The prevailing winds are from the west and south-west, but easterly winds are frequent in the spring months. Frosts are seldom severe, and, except on the mountains, snow never lies long. The soils of the lower grounds are schistose clay mixed with small stones, rich black loam on the banks of the Clyde, and gravelly soil on the river Leven. About two-thirds of the county are hilly or mountainous. The most elevated portions are in the W. and N.W.; while in the S.E. is a generally flat district, watered by the Kelvin. Benvoirlich, in the N., attains an elevation of 3330 feet, and several other hills rise to a height of 3000 feet.

Coal, iron-ore, limestone, freestone, and slate, are its most valuable mineral productions. There are pits for working coals at Langfauld and Lawmuir in East Kilpatrick, and at Duntocher in West Kilpatrick, where great quantities are raised for the consumption of the cotton factories at Duntocher, and for calcining lime at the neighbouring lime works. Ironstone is found in considerable quantities in connection with limestone in the parishes of Kirkintilloch and Cumbernauld.

Limestone is found in the higher grounds at Kilpatrick, Dumbarton, and Row. It is wrought, in connection with coal, at Langfauld, Lawmuir, and Duntocher; and also at Row, Netherwood, and Cumbernauld.

Several slate quarries have been wrought with success at Luss, Camstradden, and Roseneath.

The only river of any note which can be said to belong to this county is the Leven, the outlet of Loch Lomond, which, flowing for about five miles through a fine valley, joins the Clyde at Dumbarton Castle. Its waters, which are singularly pure and soft, are well adapted for bleaching and printing cottons, branches of trade which are established to a

great extent along its course. The other streams are the Falloch, Inveruglass, and Douglas. The Clyde, Endrick, and Kelvin, flow along its borders. Loch Long and Gare Loch are arms of the sea, the first of which separates this county from Argyleshire; and the other, penetrating the land for about seven miles, nearly detaches the peninsula of Roseneath from the mainland. Additional water-carriage is provided by the Forth and Clyde Canal, which passes through the county for more than 16 miles. This canal is carried over the valley of the Kelvin by an aqueduct. The only remarkable lake is Loch Lomond, which is about 21 miles long, and in its greatest breadth towards the south above 7. It narrows to about one mile at its north end. About two-thirds of the shore, and most of its islands (thirty in all), are in Dumbartonshire; the rest belong to Stirlingshire. It is probably not to be equalled by any lake in Britain for the variety and magnificence of its scenery; the picturesque beauty of its wooded banks and islands affording a striking contrast to the rugged and lofty mountains that rise in its vicinity. It has an area of about 40 square miles.

The valued rent of the county in 1674 was L.33,327 Scots. The annual value of real property, as assessed in 1815, was L.71,587; and in 1849 was L.150,122. The principal gentlemen's seats are—Rossdhu, Sir James Colquhoun; Roseneath and Ardincaple, Duke of Argyle; Buchanan, Duke of Montrose; Gartscube, Sir James Campbell.

The county sends one member to parliament. The parliamentary constituency in 1853 was 1297.

The arable lands of Dumbartonshire are divided into farms ranging in extent from 30 to 300 acres, and some of them comprise as many as 700 or 800 acres. Of late years great improvements have been made in agriculture, and in the breed of all kinds of stock. The rotation of crops is almost universally practised. Wheat, oats, potatoes, and barley, constitute the principal crops. Leases are held generally for nineteen years. The dairy stock is principally of the Ayrshire breed, and much progress has of late been made in this department. Great improvements have also been introduced in the construction of farm-buildings, and in the fences of the land.

There are in this county many excellent tracts of pasture land. Sheep of the black-faced breed, and a limited number of black cattle, are reared with great success. The sheep are disposed of in Glasgow, where there is a weekly sale; and great numbers of cattle are sold at the Carman market, for the purpose of being fattened on the rich pastures of the south. In the highland district, farms for grazing are necessarily of great extent. But it is not uncommon for fishermen and mechanics to hold pendicles, or "poffles," as they are called, below L.12 of rent; and the cottars, who are usually employed as labourers on the larger farms, rent small patches of arable ground for raising potatoes, with hill pasture for a cow.

The woods and plantations of this county are extensive and valuable, and yield to the proprietors a yearly income almost equal to the rent of the arable lands. On spots unfavourable to oak, the coppice woods consist of ash, yew, holly, mountain-ash, birch, hazel, aspen, alder, crab, thorn, and willow. The soil and climate of this county are particularly favourable to plantations, which begin to make a return to their owner in ten or twelve years, and in thirty years afford supplies to the carpenter. The most extensive plantations are on the estates of Luss and Bonhill. On the banks and islands of Loch Lomond there is a considerable number of yew trees, some of them of large size, and evidently of a very great age.

The manufactures of this county are various and extensive. There are extensive cotton factories at Duntocher; several paper-mills at Dalmuir; five extensive ship-building yards at Dumbarton; and along the course of the Leven are numerous print-works and bleach-fields. According to the census reports, the population of Dumbartonshire since 1801 was as follows:—(1801) 20,710; (1811) 24,189; (1821) 27,317; (1831) 33,211; (1841) 44,296; and (1851) 45,103. Of these last 22,400 were males, and 22,703 females. The number of persons engaged in the cotton manufacture in 1851 was 4071; in calico-printing, 2581; in the manufacture of paper, 165; in the coal mines, 549; while the number of those engaged in agriculture amounted to about 4000. In 1851 there were 55 places of worship in the county, 51 of which having 26,517 sittings. The principal of these were 16 Established churches, 15 Free churches, 10 United Presbyterian, 2 Episcopalian, 2 Independent, 2 Baptist, 2 Wesleyan Methodist, and 2 Roman Catholic. There were also 75 day and 59 Sunday schools, the former having 4778 scholars (2625 males and 2153 females), and the latter, 4966 (2277 males and 2689 females). Of the day schools 10, with 819 scholars, were supported by general or local taxation; 7, with 431 scholars, by endowments; 21, with 1340 scholars, by religious bodies; while 8, with 608 scholars, were subscription schools.

Dumbarton, a royal parliamentary and municipal burgh and seaport-town of Scotland, capital of Dumbartonshire, is situated at the confluence of the rivers Clyde and Leven, 13 miles N.W. from Glasgow. It is a very ancient place, and is said to have been once the capital of a kingdom of the Britons established in the vale of the Clyde. Alcluyd was the name of this ancient capital of the Strathclydenses; but whether it was situated on the site of the present town, or confined within the precincts of the castle, cannot be exactly ascertained. Dumbarton was erected into a royal burgh by Alexander II. in the year 1221, and declared to be free of all imposts and burgh taxes. It afterwards received other charters from succeeding monarchs; and, finally, it obtained a confirmation of the whole from James VI. The town is built upon the eastern bank of the Leven, which almost encircles it; and is chiefly composed of one main street, lying in a semicircular form round the head or west end of the peninsula. A good stone bridge of five arches, 300 feet long, connects the town with a suburb on the western side of the Leven. The waters of the Leven form the harbour, and, for the benefit of trade, a quay and dock have been formed. The commercial prosperity of the burgh has been remarkable during the last few years, in consequence of the rapid extension of shipbuilding, its staple manufacture. It possesses five large shipyards employed in the construction of wooden and iron vessels, chiefly the latter; two marine engine-works; two foundries; one rope manufactory; and Dennystown forge, among the largest and most unique in Britain, both as respects the building itself, and the machinery employed. The municipal corporation consists of a provost, 2 bailies, 15 councillors, &c. It is a contributory borough to Renfrew. The parish church is a handsome modern structure. There are also in the town a Free church, two United Presbyterian churches, an Episcopalian and a Roman Catholic chapel. It has also a grammar-school, savings-bank, news-room, and library. The situation of Dumbarton Castle is eminently picturesque. The buildings composing the fort are perched on the summit of a rocky mount, shooting up to the height of 206 feet sheer out of the alluvial plain on the east side of the debouche of the river Leven. To the west of the castle there are rocky eminences on the verge of the Clyde, of a similar form, though less isolated. The rock of Dumbarton measures a mile in circumference at the base. It diminishes in breadth near the top, which is cloven into two summits, of different heights. The rock is basalt, and has a tendency to columnar formation. Some parts of it have a magnetic quality. The fortress, naturally strong, possesses several batteries, which command a very extensive range. According to a provision in the treaty of union, the defences are

kept in constant repair, and a garrison is maintained in the castle. Dumbarton is a station on the line of railway between Bowling and Balloch; and is in constant communication with Glasgow, Greenock, &c., by means of steamers. Pop. 4590.

DUMBNESS. See Deaf and Dumb.

DUMFRIES, a county in the south of Scotland, is situated between 55. 2. and 55. 31. N. Lat.; and 2. 39. and 3. 53. W. Long. Its greatest length is nearly sixty miles, and its greatest breadth from thirty to thirty-one. The boundaries are Kirkcudbright and Ayrshire on the S.W.; Roxburgh, Selkirk, and Peebles, on the N.E.; Lanark on the N.; and on the S. the Solway Firth and the county of Cumberland. The principal rivers are the Nith, the Annan, and the Esk, all of which discharge themselves into the Solway Firth. These rivers are fed by numerous tributaries, and the whole of them abound in salmon. The square miles of the county are calculated at 1129, and the acres at 722,813. Like many other Scottish counties, Dumfriesshire is popularly divided into districts. Of these there are three principal; Eskdale on the east, Annandale in the middle, and Nithsdale on the west; each taking its name from the river which traverses it. From these larger divisions diverge smaller vales, which likewise derive their titles from the streams that flow through them, such as Moffatdale, Dryfesdale, and Ewesdale. From various circumstances, the limits of these great divisions are but imperfectly defined, and have recently been abandoned. The Solway Firth waters the base of the county for twenty-four miles, and along its margin the land is generally flat for about ten miles. Beyond this the county expands into a series of hills and valleys, which rise gradually northward till they reach the mountain chain which bounds it in that quarter. The principal elevations are, Lowthers near Wanlockhead, which rises 3150 feet, and Hartfell in Annandale, which rises 2629 feet above the level of the sea. In former times it was said that 86 square miles were in general low arable land, lying on the sea-coast, 322 miles chiefly hilly, and 598 mountainous. But this distribution has been disturbed by the steady progress of bone manure and green-crop husbandry. Steeps which it was impossible to sharpen by common manure, from the expense and difficulty of transporting it thither, have been brought into excellent heart by ground bones, and improved by at least 100 per cent. both as crop and pasture land. Many hills which were nearly bare have been covered to their tops with thriving plantations. Since 1810 the Dukes of Buccleuch have inclosed and planted 6600 acres of land; extensive additions are contemplated. Large sums of money have been expended in road-making and fencing. Still a large proportion of the county is mountainous, and is devoted almost exclusively to sheep farming, which, since the mortality of 1829, has again become very profitable. Judging from the map, nearly a third of the land in the county belongs to the Duke of Buccleuch, who possesses a rental of nearly L.200,000 yearly, L.80,000 of which are drawn from Dumfries-shire. In 1811, when the property-tax pressed on the energies of the country, the whole rental of the county was estimated at L.246,001, 12s. 6d.; and although rents have fallen greatly since that period, so marked has been the progress of improvement, that at present (1854) it has risen to L.334,272, made up thus: lands L.280,885; houses and tenements, L.46,287; quarries, mines, fisheries, gas-works, L.7100. The principal proprietors are the Duke of Buccleuch, the Marquis of Queensberry, and the Earl of Mansfield; Mr Hope Johnstone of Raehills, General Sharpe of Hoddam, Mr Rogerson of Dumcrieff, Mr Douglas Baird of Closeburn, and Mr M'Alpine Leny of Dalswinton.

The climate of Dumfriesshire is mild and salubrious. Much of the land has a southern exposure, and, excepting in very severe winters, the snow speedily disappears. The soils are gravel or sand loam, and clay, with moor and moss in some places, particularly along the bed of the Lochar, with alluvial tracts on the banks of the rivers and the Solway Firth. The farms vary greatly in size; but for years there has been a tendency to uproot almost entirely the pendicle system. On the Buccleuch estates the farms are generally extensive. Many excellent steadings of houses have been built, and subdivisions formed over waste tracts, which for centuries remained uninclosed. The usual rate of wages for a ploughman is from L.6 to L.10 per half-year, with board and lodging in the case of unmarried men, and a proportionate allowance of meal, potato-land, &c., for hinds with families. House and dairy maids receive from L.3 to to L.3, 10s. per half-year; day-labourers 1s. 6d a-day in winter, and 2s. in summer.

At one time the quantity of lime used, or at least worked, in Dumfriesshire, was very great, and it is still considerable. The principal pits are those of Kilhead, Closeburn, and Barjarg; and within the last fifteen years the supply was estimated at 1,200,000 Winchester bushels, valued at L.54,000. The capabilities of the pits are still great, but the demand for lime has diminished, owing to the increasing use of bone-dust, a manure which unites to a certain extent the qualities of lime and common dung. Mr Menteath of Closeburn was a great land improver, and converted bogs which were hardly worth five shillings an acre into some of the finest pasture land in the county, by the combined effects of pairing, careful selection of seed, the application of lime, and irrigation. Cattle and sheep are bought at the Falkirk trysts, and fattened during winter and the early part of spring. The latter branch of traffic is yearly extending. The indigenous breed of cattle is still the Galloway, although not always pure and unmixed. Of heavy or drove cattle, about 20,000 head are driven south annually, and their value in good years amounts to nearly L.200,000. Mr Charles Stewart of Hillside, who has devoted much attention to agricultural statistics, gives the following valuable information respecting the present state (1854) of Dumfriesshire:—"In addition to drove cattle, there are also sent to other markets in the northern counties of England, Galloway heifers bred in Dumfriesshire, and West Highland cattle kept a year in the county, of both sorts about 8000, and at an average value of L.8 a-head. Taking both these, the produce of the county may be about L.120,000. Of fat cattle, between 2500 and 3000 are stall-fed for the butchers; about one-half of which are consumed in the county, the other sent to Liverpool—value in all about L.40,000. The sheep are of three kinds—black-faced, Cheviots, and half-breds, the latter being a cross between the Leicester and the Cheviot. Rather under half the extent of the county is still occupied entirely by pure Cheviot or black-faced breeding stocks, of which five-sixths are Cheviot. The whole number of both is about 150,000. The annual sale from these are—lambs, 80,000; draft ewes about 22,000. The lower hill pastures with portions of the arable farms are occupied with Cheviot and black-faced ewes (four-fifths of the former) crossed with Leicester rams, and may amount to nearly 90,000. These produce almost but not quite one lamb for every ewe, say 85,000. On the arable farms, winter-fed nearly all on turnips, there are at least 110,000; of which in average years there may be 20,000 ewes and Highland wedders, and the remainder lambs or hogs, partly pure Cheviots and partly Leicester crosses, there being rather more of the latter. Then of the 165,000 lambs sold, one-half or rather more are fed in the county, and the other sold out of the county. Total sheep in the county, computed in November yearly, 350,000. Taking the last three years, the gross returns to the farmers would be—cattle store L.120,000, fat L.40,000, total L.160,000. Sheep, first class, 150,000, giving an annual clear return of 11s. each, L.82,500; second class, 90,000,

do. of 16s., L.72,000; third class, 110,000, do. of 17s., L.93,000. Total L.248,000. Exclusive of this, there are sales *off* the farms, the produce of the dairy cows and grain; but these do not amount to L.100,000. Allowing another L.100,000 for the produce of pigs, we have thus the sum total of L.608,000 of *sold* produce for the county of Dumfries."

Swine-rearing is much cultivated in Dumfriesshire and Galloway; and a large proportion of the hogs reared in the stewartry are sold in Dumfries, and cured in Annandale and Cumberland. The curing trade lasts for about three months, commencing in December and ending in February. The sales are all paid in ready money; and instances have occurred in which green pork to the amount of L.6000 has been sold before breakfast-time on a market-day. The curers have good and bad seasons; but the capital required induces caution, and it is a fact that bankruptcy is nearly unknown among the bacon traders of the district. The hams of Dumfriesshire are so much esteemed that they are frequently sold in London under the name of Westphalian. Those who farm pendicles trust mainly to their pigs when rent-day comes round; and the trade every year brings L.2000 into Johnstone. Its annual value to the district, including the curer's profit, must be very nearly L.100,000 sterling.

The manufactures of the county are dressed leather, hosiery, clogs, and carpets. The cotton mill at Langholm has ceased to work, and such weavers as remain there are supplied with webs by the manufacturers of Carlisle. In Dumfries and other parts of the district the weaving population derive employment from the city of Glasgow. The hosiery trade exceeds L.30,000 per annum; but that of dressed leather has much decreased. The carpet and spinning and dyeing manufactory at Crawick Mill, in the neighbourhood of Sanquhar, employs 150 persons, young and middle-aged. It consumes nearly 5000 stones of wool, and produces 70,000 yards of carpeting yearly. The wages average from L.180 to L.200 monthly.

Although, as we have already remarked, Dumfriesshire is mountainous, its lakes are inferior to those of Galloway, both as to number and extent. We must make an exception, however, in favour of the Castle Loch of Lochmaben. Bruce's castle stood on a promontory on the farther side of the loch; but it is so much dilapidated that such artists as sketch it contrive to hide the nakedness of bare unashlared walls by the enlivening screen of green trees. In some of the lakes a singular fish is found, known under the name of vendace, and which is supposed to be peculiar to this place, if we except, perhaps, the lake of Geneva. At the "four towns of Hightae," in the neighbourhood, King Robert granted feus to a class of persons who were known as "the king's kindly tenants." Their possessions are small, but the land is rich, and they sit at almost a nominal rent. They are a peculiar race, who live in a little world of their own, and are beginning to feel the effects of continued isolation and intermarriage among the members of their own tribe. Loch Skene, about ten miles from Moffat, is the only other lake of consequence. It is 1300 feet above the level of the sea; the scenery around is stern and savage in a high degree; and its superfluous waters, in escaping to the strath or valley below, foam and leap from the dizzying heights above, and form the fine cascade called the Gray Mare's Tail.

Considerable quantities of salmon are caught in the Nith, and in the stake-nets at Caerlaverock and Annan Water Foot. The finny tribes push into other streams, such as the Milk, the Esk, the Ewes, and the Wauchope; and in former times were speared in Moffat Water. The supply of red fish is augmented by importations from Galloway.

The lower parts of Dumfriesshire consist of different varieties of sandstone, the strata of which generally dip to the Solway. There is a considerable body of limestone, as we have already observed. Iron in different forms is also found in the strata. Marl abounds in various parts; and of freestone and whinstone there is abundance everywhere. Marble is also procured, and employed for some purposes. A little slate is likewise found. Coal in considerable quantities exists at the two extremities of the county, Sanquhar and Langholm; and, with one or two exceptions, all the pits belong to the Duke of Buccleuch. Lengthened land-carriage prevented the tacksmen from competing with the coal miners of England; and consequently the town of Dumfries and many parts of the county were supplied with fuel from Workington and Maryport; but the opening of the Glasgow and South-Western railway has completely changed the state of matters. Abundance of coals is now supplied from Kilmarnock, Cumnock, and Sanquhar. The lead mines at Wanlockhead belong to the Duke of Buccleuch, and are distant two miles from Leadhills in Lanarkshire, which belong to the Earl of Hopetoun. Both have declined greatly from the increased difficulty of working the shafts, and the poverty of the ore. For 30 years previously to 1828, each of the places mentioned produced about 700 tons of melted lead annually; the price L.23 per ton, and the gross revenue L.20,700. The Duke of Buccleuch now works Wanlockhead mines on his own account, and erected in 1846 a mill for separating the silver from the lead. The following are the quantities of silver and lead procured during the last six years.

1848............	4168	oz. of silver.	614	tons of lead.
1849............	5307	...	797	...
1850............	5286	...	715	...
1851............	4596	...	701	...
1852............	3774	...	549	...
1853............			530	...

During that period the price of lead has varied from L.15 to L.20 per ton. The number of persons employed on Wanlockhead at present (1854) amounts in all to 245. Each miner on an average may be supposed to earn at present L.28 during the year. Whether we regard the comforts or the intelligence of the mining population, we shall find it equal, and even superior, to that of any former period.

The mineral waters of Moffat are well known; but the spas in other parts of the county are too obscure to require special notice. The chalybeate at Hartfell acts as a powerful tonic, and contains, of sulphate of iron 84 grains, sulphate of alumina 12, oxide of iron 15, and 5 inches of azotic gas, in a wine gallon. This spring was discovered about 100 years ago, but is too remote from the village to be of much use. The other spring, which is much more accessible, is strongest and best at the fountain-head, and probably the walk or ride (about a mile and a half) does as much good to invalids as the water. The Moffat Spa contains, muriate of soda 36 grains, sulphuretted hydrogen gas 10 cubic inches, azotic gas 4 inches, carbonic acid gas 5 inches. More than two centuries have elapsed since this spring was discovered. Many years ago baths, with a pump and reading-room, were erected by subscription in Moffat, at an expense of L.2000; an immense improvement, which has greatly increased the annual number of visitors. Annan, Lockerby, and Langholm, are all thriving, well-built towns. The scenery of the latter place is much admired, particularly the ride along the banks of the Esk to Longtown.

The county sends one member to parliament, and the united burghs of Dumfries, Annan, Lochmaben, Sanquhar, and Kirkcudbright, a second. The population amounted in 1841 to 72,830, and in 1851 to 78,123. The parliamentary constituency in 1853 was 2530.

Dumfries, the capital of the above county, is a royal burgh of considerable antiquity, although the period at which it became incorporated is not exactly known. During the border wars it was frequently stormed, and the public records were destroyed. The current belief, however, is, that it received its charter before the middle of the eleventh cen-

tury, as a gravestone was discovered a number of years ago, bearing the date 1079, and mentioning that the individual whose ashes it covered had been conspicuous as a merchant and burgess of the town. From this time it gradually increased in importance; and in the year 1307, Edward the Second appointed the estates of Scotland to assemble on the banks of the Nith. In certain chronicles the ancient name of the town is said to have been *Cotiac*, but this we suspect is mere fancy. It seems much more probable that, like many other places, it derived its name from its physical appearances and character. In remote times the Gaelic was spoken on both sides of the Firth of Forth; and we concur in the etymology of Mr George Chalmers, who conceives the word to be composed of *dun* a castle, and *fries* a ridge. Dumfries, which may be regarded as the capital of the south of Scotland, is beautifully situated on the left bank of the river Nith, 35 miles below its source, and upwards of 10 above the point where its waters mingle with and are lost in the Solway. The Nith in point of size ranks fifth among the rivers of Scotland, and is navigable from Carsethorn to Glencaple quay, even for vessels of considerable burthen. In consequence of the extraordinary manner in which the tides ebb and flow in the Solway during the winter months, the river is similarly affected.

The origin of the town appears to have been owing to a strong castle, which flourished as a border fortress during the twelfth century, and frequently became an object of contention, both prior and subsequent to the times of Wallace and Bruce. Of this stronghold not a vestige remains; but the street occupying the ground on which it stood retains the name.

In razing what remains of this place of strength, the local authorities, more than a century ago, found materials for building the new church. The Gray Friars, like the castle, attracted settlers; and, as early as the thirteenth century, the old bridge was planned and built at the expense of the Lady Devorgilla, third daughter of Alan, lord of Galloway, and grandmother to John Comyn, who was slain by Robert Bruce in the above-mentioned cathedral in the beginning of the year 1305. Originally it consisted of thirteen arches, and was guarded at the middle by a gate or port, which was removed in 1769, to lessen the central pressure when the structure became frail. This bridge, which still remains, and is crossed every day by foot passengers, was certainly a wonderful erection for the time; and, accordingly, the writer of a work entitled *A Journey through Scotland*, published by J. Pemberton, London, in 1723, says, "I passed the river Nith from Galloway to Dumfries over a fair stone bridge of thirteen arches, the finest I saw in Britain next to London and Rochester." A right of toll was attached to the bridge, which in 1789, according to Captain Grose, yielded a yearly rental of L.300, and which at the present day, a little higher up the river, produces to the town L.500 sterling. The new bridge was commenced in 1793, and finished in 1795. The original contract price was L.4500; but as no rock could be found at one point, the landstool on the Dumfries side was founded on piles of wood, and for this the commissioners of supply allowed an additional sum of L.500.

After Bruce had committed the crime already mentioned, and commenced that career which terminated at last in the redemption of his country from a foreign yoke, he became a mark for the vengeance of Edward of England. His friends and adherents also suffered along with him. Amongst these, Sir Christopher Seaton was betrayed by a pretended friend of the name of Macnab, apprehended at the Castle of Lochore in Fifeshire, marched to Dumfries, and barbarously executed on the Gallows-Hill, a slight eminence on the north-eastern side of the town, better known by the name of the Christell Chapel. Bruce sincerely regretted his fate, and, in the words of Sir Richard Maitland of Lethington, said, "'It is ane pity that sa noble ane knight should die sa cruel ane dead.' And incontinent in the same place where he was standing when the tidings came to him, garred found a chapel in honour of the Virgin Mary; and, in remembrance of the said Sir Christell, founded a priest to devine service therein perpetually, and pray for the said Sir Christell; and gave to the said priest and his successors the sum of L.5 sterling, to be taken of the barony of Carlaverock, for their sustentation." The ruins of the Christell Chapel were visible in the beginning of 1715; but when the Jacobite rebellion broke out in Scotland, the inhabitants of Dumfries hastily constructed a rampart, and during the operation the ruins of the old chapel disappeared, the line of fortification having passed close by their site. It is evident, from the traces of the foundation, that the building must have been very small. When Lord Scroop made an excursion in 1570 for the purpose of plunder, the chief magistrate of Dumfries, at the head of the burgesses, joined Lord Maxwell in opposing the invaders. They fought gallantly, but were at length defeated. Dumfries suffered considerably during the reigns of Charles I. and II. In 1617 it was visited by James VI. whilst returning to England. It was at this period that the incorporated trades received from James what is called the "siller gun," which was ordered to be shot for at stated periods, with the view of fostering their martial spirit, and skill in the exercises performed at the wappinshaw. This relic is still in existence, and the custom till lately was observed at the distance of seven or nine years, more as a holiday exercise than for any other purpose. The trades mustered in great strength, borrowed guns far and wide, spent three-fourths of the day in shooting, returned to an entertainment in their hall in the evening; and the "siller gun," after being won, was worn for a short period by the best marksman. This festival forms the subject of a poem, written by Mr John Mayne, and which is praised for its humour and spirit in the notes appended to the *Lady of the Lake*.

Almost no town in Scotland stood forward half so prominently as Dumfries did at the period of the union in 1707. On the 20th of November of the preceding year, according to Chalmers, two hundred Cameronians entered the burgh, issued a manifesto against the great pending measure, and burnt the articles at the market-cross. The last commotion of any consequence occurred in 1715, when the Viscount Kenmure hung on the heights of Tenwald, willing to do mischief, and yet timid as to the means and manner of attack. By a well-managed stratagem he was induced to depart; and this is believed to have been the last occasion on which the ancient war-cry of the town, "Loreburn," or "A Loreburn," was heard.

Dumfries is the seat of a presbytery, synod, sheriff's court, record of sasines, and seven banks, branches of the principal companies of Scotland. There are three churches in connection with the Establishment, an Episcopalian, a Catholic, and a number of other chapels supported by Dissenters.

In 1745, the Pretender and his rebel army, whilst retreating from England, paid a domiciliary visit to the town of Dumfries; and for a misdemeanour committed against some of his followers on their march southward, the town was compelled to pay a fine, which amounted altogether to L.4000 sterling. In 1750, however, the crown granted to Dumfries L.2800 out of a forfeited estate.

Hosiery, leather, hats, wooden shoes, and baskets, are the only manufactures worth naming in Dumfries. Cotton checks at one time were woven on speculation in considerable quantities; but the trade has declined. The stocking trade gives employment to about 300 persons, and produces annually not less than L.30,000 sterling. At Kingholm Mills, the property of Messrs Scott, near Dumfries, there are spinning frames in operation, each containing 1200 spindles, which produce per frame 750 miles length of yarn daily, with

the aid of only one man and four young persons. The tanning trade, as regards value, is very considerable. The extensive grazing district in the midst of which Dumfries stands produces annually large quantities of hides, notwithstanding the great number of bullocks that are driven south; and in good years dressed leather brings a return amounting to about L.30,000. Wooden shoes or *sabots* were long peculiar to Dumfriesshire and the lower part of Galloway; but the trade is increasing. These promote greatly the health of such as are exposed to outdoor labour. Of these shoes more than L.1000 worth are annually disposed of in Dumfries alone.

In the year ending 10th June 1854, the tonnage of Dumfries stood as follows: Foreign vessels inwards 959 tons, coasting do. 6866, goods 4935, coal 3654, and lime 222; income to the commissioners of navigation L.385, 5s. 4d., it having been in 1831, L.870, 12s. 8d. In the same year vessels that cleared outwards paid duty on 712 tons register, and on goods 2475 tons, yielding L.150, 6s. 3d. Total revenue for year, L.585, 11s. 7d. Foreign vessels are charged at the rate of 6d. per ton, coasters 2d.; goods 1s. 2d., and lime and coal 1d. The revenue and tonnage have decreased greatly since the opening of the Glasgow and South-Western Railway Company. The navigation of the Nith has been much improved of late years by the formation of embankments, and the deepening and straightening of the course of the river. The exports consist chiefly of grain, bark, wool, and hosiery; and the imports of coal, timber, and goods.

The infirmary was built more than 70 years ago, and the hospital or poor-house in 1753. Both are well endowed, though supported partly by subscriptions; and the former expends fully L.1100 annually on medicine and other necessary outlays. Its present capital amounts to L.8400. The infirmary, since the time it was founded, has received in the shape of donations L.18,000, and the hospital L.6000; and the expenditure of the latter is about L.600 annually. In connection with such institutions it may be noticed that the late Dr Crichton of Friar's Carse left in 1823 upwards of L.100,000 to his widow and certain trustees to be applied to such charitable purposes as they might think proper. With L.60,000 of this money the Crichton Royal Institution for Lunatics has been erected near to Dumfries. A building for first-class patients was opened in 1839, and the Southern Counties' Institution for paupers from the shires of Dumfries, Kirkcudbright, and Wigton was opened in 1849. Paupers are supported and clothed for L.17 each. Dumfries possesses an excellent academy, where Greek, Latin, French, English, mathematics, geography, drawing, &c. are taught. It has also a very handsome theatre. In 1826 a gas-work was erected in Dumfries, and has since flourished well. There is a weekly market, which is held on Wednesday, when a great deal of business is transacted.

St Michael's churchyard attracts the notice of all strangers. It is to a great extent a city of tombs, and has been frequently referred to as the Westminster of Scotland. Many of the monuments are very beautiful; and amongst these there is a sumptuous one over the ashes of the celebrated poet Burns.

The situation of Dumfries is admired by all tourists. With the exception of the point where it dips to the ocean, it is surrounded by a chain of hills, many of which are green to the top, and undulate in a very pleasing manner. In point of latitude, Dumfries is nearly a degree farther south than Edinburgh, and considerably more than a degree in climate. The chilling east winds which prevail so much on the east coast of Scotland are but little felt on the banks of the Nith; and pulmonary complaints, though not unknown, are comparatively unfrequent.

The parliamentary boundary of the burgh, which differs from the municipal, consists of part of the parish of Dumfries, containing 12,298 inhabitants, and parts of the following parishes, viz. Terregles, containing 566 inhabitants, and Troqueer, containing 4925 inhabitants (both in the stewartry of Kirkcudbright). Total pop. (1851) 13,166.

DUMONT, Etienne, or Stephen, the friend, and often the Mentor, of Mirabeau, the redacteur of the principal works of Jeremy Bentham, and one of the most remarkable men of his time, was born in the month of July 1759 at Geneva, of which his family had been citizens or good repute from the days of Calvin. Shortly after his birth his father died, leaving a widow and five children wholly unprovided for. But the good widow, though placed in such destitute circumstances, and supported by little except the courage inspired by maternal affection, found means to educate her children in a place where necessary knowledge was accessible, and poverty not disgraceful. Induced by an anticipation of future eminence, seldom more happily realized, she accordingly contrived to send Stephen to the College of Geneva, where he justified her determination and the sacrifices necessary to carry it into effect, not only by his ability and proficiency, but by the virtuous purpose to which he turned his earliest attainments; for ere long, he not only defrayed the cost of his own education, but even contributed to the support of the family, by assisting the private studies of his comrades in the capacity of *répétiteur;* an office somewhat resembling that of a private tutor in our academical system, and having for its object to prepare the students for examination in the public class, by "grinding" them on the contents of the preceding lecture. Having completed his academical course, he took clerical orders; and in the year 1781 he was chosen one of the pastors of the city, where his talents as a preacher soon attracted general notice, and gave promise of his becoming one of the most brilliant and persuasive of pulpit orators. But the political troubles which disturbed Geneva in 1782 suddenly turned the course of his life into a different channel.

Two parties of opposite principles, one being attached to the authority of the magistrates, and the other anxious to extend the privileges of the people, but most widely separated as to the extension or limitation of the right of suffrage, had long divided that republic; and the disputes of these parties gained lustre from Jean-Jacques Rousseau, the most wayward, moody, and perverse of all the men of genius who have approached the borders of insanity, which, indeed, he appears more than once to have overpassed. The more liberal party received the name of *représentans*, or *petitioners*, from a representation presented by them against the legality of the proceedings of the magistrates respecting the writings and person of that celebrated but unhappy man; whilst, on the other hand, the magistrates, who refused the prayer of the petition, and their adherents who supported them in this refusal, were thenceforward called the *negatives*. During twenty years a struggle had been maintained between these parties with various success, but without bloodshed, though certainly not without violence. At length, in the autumn of 1782, when the petitioners had gained the ascendency, the courts of Versailles and Turin, in concert with the canton of Berne, surrounded Geneva with an armed force, and, under pretence of some ancient guarantees, imposed a new constitution on the republic, and at the same time compelled the leaders of the representative party to fly from their country.

Dumont was not included in the proscription. But his heart had been touched with the love of liberty; he could endure chains nowhere patiently, and chains at home, where he was free by birthright, not at all. He therefore became a voluntary exile, and went to join his mother and sisters at St Petersburg, a city to which many Genevese had carried their honourable patrimony of ability and

knowledge. In this he was probably influenced in part by the example of his townsman Lefort, who was the first tutor, minister, and general of the Czar At St Petersburg he became pastor of the French church, an office he filled for eighteen months, during which time he obtained the consideration due to his great merit and excellent character. But his views were directed towards Great Britain, where most of the Genevese exiles had taken refuge, and where some of them were actually employed in negociating with government for permission to establish a Swiss colony in Ireland. He left St Petersburg in 1785; and soon after his arrival in London went to reside with Lord Shelburne, then a minister of state, who confided to him the education of his sons. Lord Shelburne, afterwards Marquis of Lansdowne, a man distinguished for his cultivation of the society of men of letters, foreign as well as native, soon discovered the great talents of Dumont, who gradually became a friend, or rather member of the family; and it was at the house of this minister that he became acquainted with some of the most illustrious men of the country, amongst whom may be mentioned Fox, Sheridan, Lord Holland, and Sir Samuel Romilly. His connection with these and other distinguished individuals, founded upon friendship, similarity of opinions and literary occupations, and the pursuit of great objects of public utility, gave them full opportunities of appreciating his worth. He was generally known as a man of profound knowledge, correct judgment, irreproachable character, and brilliant wit, and esteemed for the possession of these high and invaluable qualities, which were exemplified throughout the whole course of his life.

About this time began his close connection with Sir Samuel Romilly, "a man," says Sir James Mackintosh, "whose whole excellence will be little understood by the world, until they see the narrative traced by himself of those noble labours of self-education, by which he taught himself every sort of ability which is necessary to serve mankind, and still more of that self-discipline by which he at length formed a character yet more exalted than his genius, composed of a probably unparalleled union of tender affection with unbending principle, and producing those dispositions towards the magnanimous and heroic which were hidden from the vulgar by the solemn decorums of a formal profession, and are seldom found to be capable of breathing so long under the undisturbed surface of a well-ordered and prosperous community. The habitual or mechanical part of Romilly's life was necessarily governed by those of his profession and country. The higher element, however, secretly and constantly blended itself with every thought and feeling; and there were moments when his moral heroism carried the majesty of virtue into the souls of the perplexed and affrighted vulgar." The friendship which united these two remarkable men increased daily; nor did its ardour or activity cease, until death unexpectedly rent asunder the tie which bound them together, and left Dumont inconsolable for the loss of his departed friend, whom he never mentioned without tears. There was a third in the circle, who is very strikingly described by Sir James Mackintosh.

"Among the closest friends of Romilly and Dumont was George Wilson, a man little known beyond the circle of his friends and that of his contemporaries in the profession of the law, and one whom it would be difficult to make known to others, without the use of that language of vague panegyric, the abuse of which had more lowered it in his own eyes, than even in those of most men of modesty and taste. It might be said by as unaffectedly conscientious a man as himself, if such another there be, that among those who thoroughly knew him, the degree of esteem for him was always considered as exactly indicative of the degree of sagacity and purity of the man who entertained it. Yet even he was not more upright and benevolent than his two friends; though, having less vivacity than the one and less ardour than the other, he was not so liable to be allured by imagination from the rigid observance of the severe maxims of that moral prudence which is the safeguard of virtue. With a keen relish for pleasantry, and perfectly exempt from all gloom and harshness, he yet shunned the amusement of Wilkes's conversation, solely from deference to morality. When Mirabeau visited England about 1786, Wilson did not follow the example of his friends in cultivating the society of that extraordinary man, whose ill-trained fancies were better adapted to sudden felicities than to composition, and whose conversation was animated by an irregular benevolence, neither smothered by the profligacy of his youth, nor altogether extinguished by the intrigues and corruptions of his latter years."

In 1788 Dumont undertook a journey to Paris in company with Romilly; and it was under the auspices of the latter that he first became acquainted with Mirabeau. During a sojourn of two months in the French capital, he saw that extraordinary man almost every day; and a certain affinity of talents and pursuits led to an intimate connection between two persons diametrically opposed to each other in habits and in character. It was after his return from Paris that Dumont commenced his acquaintance with Mr Bentham; a circumstance which exercised a powerful influence over his future opinions, and, as it were, fixed his career as a writer on legislation. Filled with admiration for the genius of Bentham, and profoundly impressed with the truth of his theory, and the important consequences to which it immediately led, Dumont applied all his talents to make the writings of the great English jurist generally known, and devoted the greater part of his life in order to render available to the world at large the inexhaustible store of knowledge which the active mind of Bentham was continually increasing. We may mention here, that the following works are the result of that confraternity of genius, talents, and labour, which was thus established, viz. *Treatises on Legislation*, published in 1822, in 3 vols. 8vo, now (1833) in the third edition; *Theory of Punishments and Rewards*, 2 vols. 8vo, also in the third edition; *Tactics of Legislative Assemblies*, two editions, 1815 and 1822; *Judicial Evidence*, published in 1823, second edition 1830; and *Judicial Organization and Codification*, 1828, 8vo. Of course we make no mention here of the numerous editions published in foreign countries.

In the summer of 1789, that season of promise and of hope, especially to a Genevese exile, Dumont suspended his labours in England in order to proceed to Paris along with his friend Duroverai, ex-attorney-general of the republic of Geneva. The object of the journey was to obtain through M. Necker, who had just returned to office, and by means of the events which were then passing in France, an unrestricted restoration of Genevese liberty, by cancelling the treaty of guarantee between France and Switzerland, which prevented the republic from enacting new laws without the consent of the parties to this treaty. The proceedings and negociations to which this mission gave rise, necessarily brought Dumont into connection with most of the leading men in the Constituent Assembly, and made him an interested spectator, sometimes even a participator, indirectly, in the events of the French revolution. The same cause also led him to renew his acquaintance with Mirabeau, whom he found occupied with his duties as a deputy, and with the composition of his journal, the *Courrier de Provence*, in which he was assisted by Duroverai, Clavière, and other Genevese patriots. For a time Du-

mont took an active and very efficient part in the conduct of this journal, supplying it with reports as well as original articles, and also furnishing Mirabeau with speeches to be delivered or rather read in the assembly. This is now completely established by his highly instructive and interesting posthumous work entitled *Recollections of Mirabeau.* In fact, his friend George Wilson used to relate, that one day, when they were dining together at a table d'hôte at Versailles, he saw Dumont engaged in writing the most celebrated paragraph of Mirabeau's address to the king for the removal of the troops, which was believed to have been written by the orator himself. He also reported such of Mirabeau's speeches as he did not write, and, with a disinterested sacrifice of his own reputation to the diffusion of what he considered as truth, embellished and strengthened them from his own stores, which were inexhaustible. But this co-operation, so valuable for Mirabeau, and so self-devoted on the part of Dumont, was destined soon to come to an end; for, being attacked in pamphlets as one of Mirabeau's writers, he felt hurt at the notoriety thus given to his name in connection with a man occupying Mirabeau's peculiar position, and resolved to return to England, which he accordingly did in 1791. The reputation of being a subaltern writer was, as he himself states, by no means flattering; and the credit of an influential connection with a man whose character was far from being untainted alarmed his delicacy. He saw that he had no alternative but to put an end to a copartnership of which Mirabeau was certain to reap all the advantage, whilst the odium or discredit would alone fall to the lot of Mirabeau's associate; and he acted upon this conviction with a promptitude and decision worthy of his character.

In the eventful years which followed he continued to live chiefly at Lansdowne House, or at Bowood, where the most remarkable men of Europe as well as of Britain were frequent and welcome guests. Latterly, he began to form an intimate friendship with Lord Holland, whom he had known from childhood; and he became a member of the society of familiar friends, the habitual visitors at Holland House, who, during many years, saw a succession of celebrated guests of every country, party, religion, and of every liberal profession or station, which is likely to continue unmatched until another house be found that boasts such a master. "His mind was at that time in a most perfectly mature state, with much experience of very memorable events, and familiar intercourse with the most eminent men," besides an abundant store of amusing and striking anecdotes. "He had entirely subdued the popular and declamatory propensities which characterize youthful genius, yet without being in the least degree withdrawn from the love of letters and the delights of society by those scientific pursuits which occupied a subsequent period." In 1801 he travelled over various parts of Europe with Lord Henry Petty, now Marquis of Lansdowne, and brought back a fresher acquaintance with the mental occupations of the continental nations, from whom England had for years been separated by a wider and deeper channel than that formed by the hand of nature. But Dumont had then opened a new course of more serious occupations.

"In 1801 he published the *Traités de Législation;* the first fruits of his zealous labours to give order, clearness, and vivacity, to the profound and original meditations of Bentham, hitherto praised only by a very few patient readers, and but little better known, even by name, to the English than to the European public. The extraordinary merit of these writings, manuscript and printed, chiefly attracted his mind towards them; inferior circumstances, however, contributed their part to the fervour with which he devoted himself to them. Trained in the hasty and shallow philosophy which then reigned, metaphysical principles were a novelty, in the contemplation of which he was too agreeably employed to examine the solidity of the foundation on which they rested. Wearied with the common-places of philanthropic declamation, which passed for philosophy, he ran with eagerness into the opposite extreme of new terms, dry definitions, and simple principles. The method of Bentham is undoubtedly a powerful instrument for the discovery of truth, especially in the juridical part of moral science. It is, however, a method which may become more than mischievous, by the very circumstance of its apparent perfection.

"Supposing every other objection to that system to be answered, it will still be evident that the value of its application in every particular instance must be in proportion to the exactness and completeness with which every circumstance is enumerated that can affect the determination of the question. But the enumeration is not *complete,* merely because the names of all such circumstances are enumerated. It is not thus that the philosopher proceeds in those sciences where the success is uncontested. He calculates the *degree* of every force that acts on a body; he ascertains the *proportion* of every element which goes to make up a compound; and an error in either of these respects is, in truth and effect, a want of exact and complete enumeration, which may lead to the most false results. Such mistakes in the physical sciences are easily detected. In the moral sciences it is extremely easy *to seem* to form a complete theory by such general and vague inductions, because the means of quick and palpable detection are wanting. Wherever analysis is *really* exhaustive, it is the most perfect of instruments; but where it only reaches a semblance of exactness, it produces or perpetuates error in the exact proportion of its seeming approach to truth. There is no remedy against this dangerous distemper but the habit of never forgetting that, in each case, the main question always must be, 'How much of each enumerated cause is likely to act in the instance before me?' No show of accuracy, no superiority of method, can dispense with this question, or enable any man to answer it otherwise than by approximation. But with these high and arduous matters we must not deal more largely in this place. The talent with which M. Dumont performed his task is as generally acknowledged as the perfect disinterestedness which led him to employ so much talent in expounding the opinions and enlivening the reasoning of others. It is due to him to say, that he always considered the system as a model, to be always consulted and approached, but never imposed without a cautious regard to circumstances. It must also be observed, that however entirely he adopted the speculations, delighted in the method, and even acquiesced in the language of Bentham, that for which he really felt a warm zeal, and consecrated the labour of his life, was the practical establishment of that grand reformation of law, which owes indeed much to the writings of Bentham, and to the discussions which they daily contribute to spread and keep up, but which, so far from being peculiar to him, is zealously supported by those who dissent from his moral theories, and was common to him, at least in that more obvious part of it which relates to criminal law, with the philosophers of the eighteenth century, who pursued the same object, though with less distinctness of view, less precision of language, and less knowledge of the abuses to be reformed. The mind of Dumont moved onward with that of the reformers of jurisprudence throughout Europe. He does not needlessly question the singularities of his venerable master; but his attachment was to the main stock of reforming principle. Those who knew him need not be reminded, that if his principles have any

Dumont || Dumouriez.

tendency to a cold and low morality, they were in that respect altogether defeated by the nature of Dumont; a man of the utmost simplicity and frankness, of a most unusually affectionate and generous disposition."

In 1814 the restoration of Geneva to independence induced Dumont to return to his native place, and he soon became at once the leader and ornament of the supreme council. At the time of his death, he was on the eve of proposing a complete code of law by which he fondly hoped to make the legislation of Geneva an example to Europe. He died at Milan when on an autumn tour of relaxation in October 1829, in the seventy-first year of his age. (J.B—E.)

DUMONT, *Jean*, a well-known publicist, was born in France in the seventeenth century. He followed the profession of arms; but not obtaining promotion so rapidly as he expected, he quitted the service, and travelled through different parts of Europe. He stopped in Holland with the intention of there publishing an account of his travels. But in the interval, at the request of his bookseller, he wrote and published several pamphlets, which were eagerly sought after, by reason of the unceremonious manner in which he treated the ministry of France. This freedom having deprived him of all hope of employment in his own country, he now thought of forming a permanent establishment in that where he resided; and the knowledge which he had already acquired of the relations and interests of different nations having led him to entertain the idea of opening a course of lectures on public law, he lost no time in carrying it into effect. The project succeeded far beyond his expectations; and some useful compilations which he published about the same period made him favourably known in foreign countries. The emperor of Germany appointed him his historiographer, and some time afterwards conferred on him the title of Baron de Carlscroun. He died at Vienna in 1726, at an advanced age. Dumont wrote with facility, but his style is deficient in vigour and correctness; nevertheless, his works are esteemed as containing a great number of documents valuable for history.

The following is a list of the works published by Dumont: 1. *Nouveau Voyage au Lévant*, Hague, 1694, reprinted under the title of *Voyages en France, en Italie, en Allemagne, à Malte et en Turquie*, Hague, 1699, 4 vols. 12mo; 2. *Mémoires Politiques pour servir à la parfaite intelligence de l'Histoire de la Paix de Ryswick*, Hague, 1699, 4 vols. 12mo; 3. *Mémoires sur la Guerre présente* (1700), Hague, 1703, 12mo, reprinted under the title of *Recherches modestes des Causes de la présente Guerre, en ce qui concerne les Provinces Unies*, 1713, 12mo; 4. *Récueil de Traités d'alliance, de paix, et de commerce entre les Rois, Princes, et Etats, depuis la paix de Munster*, Amsterdam, 1710, 2 vols. 12mo; 5. *Soupirs de l'Europe à la vue du projet de paix contenu dans la harangue de la reine de la Grande-Bretagne*, 1712, 12mo; 6. *Corps Universel Diplomatique du Droit des Gens, contenant un Récueil des Traités de paix, d'alliance* etc. *faits en Europe, depuis Charlemagne jusqu'à présent*, Amsterdam, 1626, and following years, 8 vols. fol., continued after Dumont's death by J. Rousset; and 7. *Battailles gagnées par le Prince Eugène de Savoie*, Hague, 1723. To the *Corps Universel Diplomatique, du Droit des Gens* ought to be subjoined, 1. *L'Histoire des anciens Traités jusqu'à Charlemagne*, by Barbeyrac, 1739, in 2 vols. folio; 2. *Supplément au Corps Diplomatique, avec le cérémonial des Cours de l'Europe*, collected by Dumont, and arranged by Rousset, 1739, in 3 vols. fol.; 3. *Histoire des Traités de Paix du dix-septième Siècle*, by St Priest, 1725, in 4 vols. folio. Dumont was also the author of *Lettres Historiques contenant ce que se passe de plus important en Europe*, 12mo. This periodical, which was commenced in 1692, and two volumes of which appeared annually, Dumont conducted till 1710, from which time it was continued by Basnage, with the aid of several collaborateurs, until 1728. The earlier volumes are much esteemed. (J. B—E.)

DUMOURIEZ, CHARLES-FRANÇOIS, general of the French republican army, was born at Cambray in 1739 of a respectable family of Provence. His father was an intendant of the royal army, and had acquired some celebrity from an important publication on military affairs; and from him young Dumouriez received his earliest instructions. His studies were continued at the college of Louis-le-Grand for three years; but in 1757, his father having been attached to the army under d'Estrees about to invade Hanover, he accompanied him to Mauberge, and there, at nineteen years of age, made his first campaign as cornet in the regiment of Escart. In 1763 he attained the rank of captain; but in consequence of a reform reducing the numbers of the army he retired with a small pension, and the cross of St Louis. He afterwards received a subaltern situation in the secret missions.

Dumouriez.

On his return from a pedestrian tour in Italy, he addressed a memorial to the Duc de Choiseul, urging him to embrace the cause of the Corsicans against the Genoese; and in a public audience which he had with the minister on the subject, it led to a violent altercation, the result of which was a lettre de cachet which forced Dumouriez to leave France. But the expedition which he had advised being afterwards resolved on, Choiseul made him an honourable public reparation, and appointed him quartermaster-general of the troops.

The political conjunctures of the times offered an unlimited scope for the fertility of his diplomatic expedients. and he mingled in all the intrigues of the age. In 1770 he was sent on a secret mission to Poland with the view of neutralizing the efforts of Catherine II., and succeeded in securing fifty senators for the cause of independence, effected a unity of action among the confederates, and disciplined a militia; but when there was some appearance of the resurrection of Poland being effected, Choiseul fell under a cabal of the Duc d'Aiguillon and Madame Du Barry, and Dumouriez was recalled to Paris. He was soon, however, sent back on a similar mission by D'Aiguillon. He endeavoured to assist the revolutionists in Sweden, and to raise troops in the Hanse towns to menace Stockholm, but this was contrary to the views of the French cabinet; and the Duc d'Aiguillon, having discovered his project, had him arrested and thrown into the Bastile, where he was imprisoned six months, and then sent to the castle of Caen.

Disgusted with the dangerous career of intrigue, he now directed his attention to the improvement of his own country. He wrote a memoir on the great importance of the harbour of Cherbourg; and in the month of June 1786 he there met Louis XVI., who had come to assist at laying the first stone.

In 1788 Dumouriez was promoted to the rank of maréchal-de-camp, and pronounced in favour of political reform without breaking with the court. The connections which he held with the leading men of the Girondist party greatly advanced his political career. At the opening of the second legislative assembly he was appointed minister for foreign affairs in place of Delessart. This portfeuille, however, he only held for three months. During his short tenure of office he exerted himself to the utmost in reforming abuses, and in introducing the greatest economy into every department.

He held for one month the office of minister of war after the dismissal of his colleagues Roland, Servan, and Clavière. At length his own resignation followed, which increased his popularity. When the troops of the coalition advanced against France, he was appointed to the command of the army of the north as lieutenant-general under Marshal Luckner. (For the military operations which followed, see FRANCE.)

After the unsuccessful battle of Neerwinden in January 1793, being recalled by the Convention and threatened with the scaffold, he sought refuge in the camp of the Austrians, accompanied by the Duc de Chartres (afterwards Louis Philippe) and his brother.

Lost without hope of return to his native country, Dumouriez wandered a long time an exile in Brussels, England, Switzerland, Germany, Denmark, and Petersburg. At last he returned to England, where the government conferred on him a pension of L.1200 a-year. In 1814 and 1815 he endeavoured to procure from Louis XVIII. the baton of a marshal of France, but was refused.

After a long residence in England, where he enjoyed the hospitality and friendship of many distinguished men, he died at Turville Park on the 14th March 1823, in the eighty-fourth year of his age.

DUN, or BURGH, the name of an ancient species of building, of a circular form, common in the Orkney and Zetland Islands, the Hebrides, and the northern parts of Scotland. The latter term indicates the founders, who at the same time bestowed on them their native name of *borg*, a Sueo-Gothic word signifying a defence or castle; and the Highlanders universally apply to these places the Celtic name *dun*, signifying a hill—a term easily transferred to the tower itself by which a hill was usually defended. They are confined to the countries once subject to the crown of Norway. With few exceptions, they are built within sight of the sea, and several of them within sight of each other; so that, on a signal by fire, by flag, or by trumpet, they could give notice of approaching danger, and afford mutual support. In the Orkney and Zetland Islands they are most frequently called *wart* or *ward hills*, which shows that they were garrisoned. They had their wardmadher, or watchman, a sort of sentinel, who stood on the top, and challenged all who came in sight. The gackman was an officer of the same kind, who not only had to watch against surprise, but was also bound to give notice if he saw any ships in distress. He was allowed a large horn of generous liquor, which he had always by him, to keep up his spirits. Along the Orkney and Zetland shores they almost formed a chain, and by that means not only kept the natives in subjection, but were situated commodiously for covering the landing of their countrymen, who were perpetually roving on piratical expeditions. These towers were even made use of as state prisons; for we learn from Torfæus, that after Sueno had surprised Paul, count of Caithness, he carried him into Sutherland, and confined him there in a Norwegian tower. Out of this kingdom no buildings similar to these are to be found anywhere, except in Scandinavia. On the mountain of Swalberg in Norway is one; on the Stir-biskop, at Upsal, in Sweden, is another; and on Umsborg, in the same kingdom, is a third.

These towers vary in their inner structure, but externally they are universally the same, though some have an addition of strength on the outside. The burgh of Culswick, in Zetland, notwithstanding it is built on the top of a hill, is surrounded with a dry ditch 13 feet broad; that of Snaburgh, in Unst, has both a wet and a dry ditch, the first being cut with great labour through the solid rock. The burgh of Moura is surrounded by a wall, now reduced to a heap of stones, and the inside is cylindrical, not tapering, as is usual with others. The burgh of Hogster, upon an isle in a loch of the same name, has also the addition of a wall; a peculiarity in a causeway to join it to the mainland, and a singular internal structure. Numbers of little burghs, with single cells, are scattered about in the neighbourhood of the greater, and were probably built by the poorer sort of people, in order to enjoy their protection. A multitude of places in these islands have the addition of burgh to their names, notwithstanding there is not a vestige of a tower near them, the materials having long since been carried away and applied to various uses.

DUNA, or southern DWINA, a river of Russia. See RUSSIA.

DUNABURG, a strongly fortified town of Russian Poland, capital of a cognominal circle in the government of Vitebsk, on the right bank of the Düna, 60 miles W.N.W. of Drissa. It has some trade, and 6000 inhabitants.

DUNBAR, a royal and parliamentary burgh, and seaport of Scotland, county of Haddington, situated on an eminence, near the mouth of the Firth of Forth. It consists of one wide main street, with several other streets and lanes which diverge from it. Dunbar is a place of great antiquity. It originated in a castle, once of great strength and importance as a bulwark against English invasion. The site of the fortress was well chosen both for defence and convenience. The coast is here bold, and studded with rocky islets. The rocks on the shore in early times afforded room for the battlemented walls of a fort, which gradually increased by connection with the adjoining land, and with the islets by walls of great strength. It was thus admirably adapted to receive succour by sea, or to favour the escape of its defenders. We find it mentioned as early as 856; and subsequently it stands conspicuously prominent in the various conflicts in which Scotland was engaged. It endured several memorable sieges, the most remarkable of which was that by the English in 1337, when it was defended by Black Agnes countess of March and a member of the Douglas family. Montague the English commander had constructed a machine called a sow (resembling the Roman pluteus), with which he began to undermine the walls. The countess, discharging a great stone from the rampart, destroyed this machine, calling out at the same time,

> "Marry, Montagow,
> For farrow shall thy sow."

The castle is now a total ruin. The harbour and quay of Dunbar are on a confined plan, and the usual depth of water is scarcely sufficient to float vessels of 300 tons burden. The main evil of the port arises from the existence of various craggy islets and sunken rocks near the entrance, which render the navigation somewhat dangerous. Market-day Tuesday. Dunbar is chiefly famous for its herring fishery, which is extensively carried on. There are in the town a soap-work, and several iron foundries, breweries, and distilleries. Ship-building is also carried on to a small extent. The most remarkable house in Dunbar, a large plain mansion, facing the west end of the main street, is the property, and was formerly the residence of the family of Lauderdale; but it is now in a neglected condition. At the entrance to the town from the west there are remains of an ancient monastery of Greyfriars, founded in 1218. In 1819 a handsome new Gothic church was erected upon the site of a previous one, founded in the fourteenth century. There are also two United Presbyterian chapels, a Free church, and a Methodist chapel. There are two public schools, several private seminaries, a mechanics' institute, and a subscription library. There are also several charitable institutions. The town is governed by a provost, three bailies, a treasurer, town-clerk, and chamberlain, with 15 councillors. The annual revenue of the burgh is about L.1700. It was created a royal burgh by David II., and unites with Haddington, Jedburgh, Lauder, and North Berwick, in returning a member to parliament. Pop. (1851), 3038. Dunbar is a station on the North British railway, 29½ miles E.N.E. from Edinburgh.

DUNBAR, *William*, the most eminent of all the early Scottish poets, appears to have been born about the middle of the fifteenth century. Notwithstanding the high reputation which he enjoyed among his contemporaries, the records of his personal history and character are extremely scanty; and although he belonged to the church, his progress is not to be traced by successive preferments. He describes himself as a native of Lothian. Kennedy represents him as related to the earl of March; but this perhaps is only to be considered as a poetical fiction, introduced for the purpose of heightening his invective. His latest biographer, however, supposes that he may have been the grandson of Sir Patrick Dunbar of Beill in the county of Haddington, a younger son of George the tenth earl of March. "This Sir Patrick," we are informed, "signalized himself on many occasions, and was one of the hostages for James the First in 1426; and it also appears from an original charter, dated 10th August 1440, that one of his sons was named William, who in all probability was either

the father or uncle of the poet. No other person of the same baptismal name can be traced during the whole of that century; and as such names generally run in families, the circumstance of our author's alleged descent from the earls of March, in connection with his own avowal respecting his birth-place, adds some strength to the conjecture of his being the grandson of Sir Patrick Dunbar of Beill."[1] During the present age, the births, marriages, and deaths of persons possessing little property and less distinction may in a great variety of instances be very easily traced; but as the same diurnal records did not exist in the fifteenth century, it is only where names are connected with property, rank, or office, that in most cases we can succeed in an attempt to discover the outlines of private or domestic history. Neither the name nor the surname was uncommon: at that period Scotland certainly contained many Williams and many Dunbars; and if numerous instances of this combination of name and surname have not been detected, it is not difficult to assign a reason.

In the year 1477, William Dunbar of St Salvator's College took the degree of A. B. in the university of St Andrews; and as the statutes required the candidate to be of three years standing, he must have been matriculated in 1474. In 1479 he took the degree of A. M.[2] Whether this was the poet, or another individual of the same name, we have no means of ascertaining: but there is an apparent coincidence in the time; and the supposition that he studied at St Andrews, is highly probable in itself. There is likewise some reason to suppose that he studied in the university of Oxford: "Quod Dunbar at Oxenfurde," is the colophon of one of his poems; and we need scarcely remark that Oxenford was once the current name of this seat of the Muses. But it is also to be recollected that the poet might visit Oxford in some other capacity than that of a student. In his youth he appears to have been a novice of the order of St Francis. His sentiments with regard to this profession we are enabled to glean from one of his poems; and those sentiments we shall here endeavour to exhibit in plain prose. "Before the dawn of day," says Dunbar, "methought St Francis appeared to me with a religious habit in his hand, and said, go, my servant, clothe thee in these vestments, and renounce the world. But at the sight of him and his habit I was scared like one who sees a ghost. And why art thou terrified at the sight of the holy weed? St Francis, reverence attend thee, and thanks for this intended benefit; but with regard to those garments of which thou art so liberal, it has never entered into my mind to wear them: sweet confessor, take it not in evil part. In holy legends have I heard it alleged that bishops are more frequently canonized than friars; if therefore thou wouldst guide my soul towards heaven, invest me with the robes of a bishop. Had it ever been my fortune to become a friar, the season is now long past: between Berwick and Calais, in every flourishing town of the English dominions, have I made good cheer in the habit of thy order; in friar's weeds have I mounted the pulpit at Dernton and Canterbury, in them have I also crossed the sea at Dover, and instructed the inhabitants of Picardy; but this mode of life compelled me to have recourse to many a pious fraud, from the guilt of which no holy water could cleanse me. What had thus appeared to me as St Francis, was a fiend in the likeness of a friar: he vanished away with stench and fiery smoke; methought he carried one end of the house along with him, and I awoke like a wight in perplexity."[3]

From this and some other passages of his works, it is evident that Dunbar had in some degree imbibed the spirit of a reformer; and it is obvious that in all countries which have in any measure been extricated from the superstitions and delusions of the Romish church, the poets have contributed to prepare the way for the theologians. Wit and satire, when thus directed, are formidable weapons, and although ridicule is no test of truth, it has often been found a powerful instrument for exposing inveterate error The best arguments may be employed in vain, and force commonly interposes in behalf of established opinions but poets have in all ages claimed and exercised considerable freedom of animadversion; and, as light troops are sometimes more serviceable than the heavy-armed soldiery, the gay satirist is sometimes more successful in his attacks than the learned controversialist. Another inference to be drawn from this poem is equally obvious: as the author had preached in England and France, he must have been familiarly acquainted with the languages of both countries; or, if we suppose him to have preached at Canterbury in his native tongue, we must at least conclude that he spoke French when he instructed the inhabitants of Picardy. His travels are likewise mentioned in Kennedy's Flyting, where we must however make some allowance for satirical exaggeration.

Fra Atrik Forrest furth ward to Drumfreiss
 Thow beggit with ane pardoun in all kirkis,
Collapis, crudis, meill, grottis, gryce, and geiss,
 And undir nycht quhylis thow stall staigis and stirkis.
 Becauss that Scotland of thy begging irkis,
Thow schaipis in France to be a knycht of the feild;
Thow hes thy clamschellis, and thy burdoun keild,
 Unhonest wayis all, wolroun, that thow wirkis.[4]

Dunbar, in one of his invectives against Kennedy, has furnished us with some further information respecting his own adventures.

Or thow durst move thy mynd malitius,
 Thow saw the saill abone my heid updraw;
But Eolus full woid and Neptunus,
 Mirk and moneless, wes met with wind and waw,
 And mony hundreth myle hyne cowd us blaw
By Holland, Seland, Zetland, and Northway coist,
 In desert [place] quhair we wer famist aw;
Yit come I hame, fals baird, to lay thy boist.

After the period of his travelling noviciate, Dunbar appears in the character of a court poet, and of a candidate for preferment in the church. On one occasion he speaks of his dancing "in the quenis chalmer."

Than cam in Dunbar the makkar,
On all the flure thair was nane frakkar,
And thair he daunsit the Dirrye dantoun;
He hoppet lyk a fillie wantoun,
 For luiff of Musgraiffe, men tellis me;
He trippet quhill he tint his pantoun:
 A mirrear dance mycht na man see.

Than cam in Maistriss Musgraiffe;
Scho mycht haiff lernit all the laiffe.
Quhen I saw hir sa trimlye dance,
Hir guid convoy and countenance,
 Than, for hir saik, I wissit to be
The grytast erle or duik in France:
 A mirrear dance mycht na man see.

But neither his dancing nor his solicitations seem to have procured him any considerable preferment. From the strain of his earlier compositions, it is evident that his first hopes were sufficiently sanguine, and from that of his

[1] Laing's Memoirs of Dunbar, p. 8.
[2] Ibid. p. 9.
[3] Dunbar's Poems, vol. i. p. 28.
[4] Ibid. vol. ii. p. 81.

later compositions, that those hopes had been completely frustrated. "Why shouldst thou," says the desponding poet, "be induced to hope for preferment, when an Italian impostor finds means to thrust himself into the chair of an abbot? How the affairs of the church are managed, I know not; but assuredly its benefices are not distributed with an impartial hand. While some enjoy seven, I am not possessed of one; and some, unworthy as they are to fill a stall, would fain climb to the rank of cardinal, a bishopric being too mean an object for their ambition." He addressed some stanzas to the king when many benefices were vacant; he frequently renewed his petition, and frequently complained that his life was suffered to wear away in fruitless expectation. From the wish which he expresses "To the King, that he war Johne Thomsounis Man," it may be inferred that Queen Margaret was anxious to promote his interest: the tenor of his prayer is, that the king were more subservient to the wishes of his consort.

> My advocat, bayth fair and sweit,
> The hale rejosing of my spreit,
> Wald speid in to my errandis than,
> And ye war anis Johne Thomsounis man.

Whether Dunbar's advancement was in any degree retarded by his own imprudence, can only be conjectured. The clergy of that age do not appear to have been generally promoted for their piety or learning; and so very moderate was the ordinary standard of external decency, that it must only have been the most gross and flagrant profligacy that could operate as a disqualification for preferment. It must however be acknowledged that some of his strains are highly reprehensible: his compositions are occasionally tinctured with expressions which we cannot but regard as grossly indecent and profane; one of his addresses to the queen is such as might offend a modern courtezan; the more solemn observances of the church he has converted into topics of ridicule; the litanies are burlesqued in a parody which is not easily to be paralleled for its profanity. But it is more than probable that such indecent levities excited little or no disgust in his contemporaries: the age was not distinguished by any uncommon share of piety, nor had it attained to that degree of refinement which frequently secures a certain ostensible decorum, a decent appearance of virtue, where virtue itself is not to be found. To whatever cause his failure may be attributed, there is reason to suspect that he never obtained a benefice. But we learn from the public records that he was indebted to the king for a regular pension, as well as for occasional grants of money. The register of the privy seal, 15th August 1500, mentions a yearly pension of ten pounds, payable at Whitsuntide and Martinmas, to "Maister William Dunbar for all the dayis of his life," or until he should be promoted by the king to a benefice of the yearly value of forty pounds or upwards. It appears from the treasurer's accounts that the payment due at Martinmas 1501, was deferred on account of his being then in England; and it has been considered as "probable that he accompanied the ambassadors who were sent to England to conclude the negociations for the king's marriage in October 1501; and that he remained to witness the ceremony of affiancing the princess Margaret, which took place at St Paul's cross, with great solemnity and splendour, on the 25th of January 1502. Under this supposition, we can have little hesitation in believing that Dunbar was the person then styled *the Rhymer of Scotland*, who received L.6. 13s. 4d. in reward from Henry VII. on the 31st of December 1501, and a similar sum on the 7th of January following."[1] He speaks of his long and faithful services to the king, and of his having been employed in many foreign countries, in England, Ireland, France, Spain, Italy, and Germany. Mr Laing conjectures, perhaps with sufficient probability, that in these extensive peregrinations he was attached to diplomatic missions, in which his knowledge of Latin and French might be available to persons of higher rank and inferior learning.

On the 17th of March 1504, or, according to our present computation, 1505, Dunbar for the first time said mass in the king's presence; and on that occasion he received a gratuity of seven French crowns, which was a larger sum than the king usually allotted for a priest's first mass. At the term of Martinmas 1507 his pension was encreased to twenty pounds; and on the 26th of August 1510 it was encreased to eighty pounds, to be paid during his life, or until he should be promoted to a benefice of the yearly value of one hundred pounds or upwards. How long he enjoyed this pension, and whether he ever exchanged it for a benefice, no research has yet ascertained.[2] On the 9th of September 1513 the king perished at Floddon-field; and there may be some reason to apprehend that his interest was not unaffected by that fatal event. From one of his poems, written "quhen the Governour past into France," it is evident that he must have survived for several years. John duke of Albany, regent of the kingdom, sailed for France in June 1517, again in October 1522, and finally in May 1524; nor can we safely decide to which of those three voyages the poet refers. It is at least certain that he was dead in the year 1530, when Sir David Lindsay composed his Complaynt of the Papingo.[3] He describes himself as having attained to an advanced age; nor does he appear to have been so unwise as to continue his levities to the utmost verge of life; several of his poems are written in a moral and religious strain, not unbecoming an aged priest.

The poems of Dunbar are numerous and miscellaneous, but none of them extends to any considerable length. He evidently unites a brilliant imagination with an elegant taste; nor is he less conspicuous for his skill in the mechanical part of poetry. The elasticity of his mind and the versatility of his talents enabled him to arrive at eminence in different departments of composition: his allegorical poems display a rich and fertile invention; and he is equally distinguished for his powers of description and satirical humour. His diction is often remarkable for its terseness and forcible simplicity; but it is not always free from the vicious and pedantic phraseology with which the English poetry of that period is so deeply infected. Dr Nott observes that Dunbar, "a poet of a rich and lively fancy, and possessing great natural command of language," was nevertheless induced to use such pedantic diction as occurs in the opening of his beautiful moral

---

[1] Laing's Memoirs of Dunbar, p. 20.

[2] "The treasurer's accounts from the 8th of August 1513 (a month previous to the battle of Floddon) to the 25th of January 1515, which might have thrown some light on the subject, have not been preserved; and in those from that date to the 4th of September 1518 (from which time to the 5th of June 1522 there is another blank in the series) there is no mention of Dunbar's name. We cannot therefore discover the date of the last payment of his pension; but although we now lose all trace of his name, it by no means follows that his pension was entirely withdrawn: it might either have been transferred to some other branch of the royal revenue, or the poet might at last have been promoted to a benefice, when consequently his pension would cease." (Laing's Memoirs of Dunbar, p. 34.) The treasurer's accounts, 1st April 1513, mention a payment to Dunbar of so small a sum as forty-two shillings.

[3] Lindsay's Works, vol. i. p. 285.

poem, entitled the Goldyn Targe.[1] He has employed a great variety of measures; and his versification, when compared with that of his most eminent contemporaries in both kingdoms, will in general appear highly ornamented and poetical.

Mr Ellis, after having quoted three of his shorter poems, subjoins the following remarks: "In these specimens we see much good sense and sound morality, expressed with force and conciseness. This indeed is Dunbar's peculiar excellence. His style, whether grave or humorous, whether simple or ornamented, is always energetic; and though all his compositions cannot be expected to possess equal merit, we seldom find in them a weak or redundant stanza."[2] The accomplished historian of English poetry likewise mentions him with no faint approbation. "I am of opinion," says Mr Warton, "that the imagination of Dunbar is not less suited to satirical than to sublime allegory; and that he is the first poet who has appeared with any degree of spirit in this way since Pierce Plowman. His Thistle and Rose and Golden Terge are generally and justly mentioned as his capital works: but the natural complexion of his genius is of the moral and didactic cast."[3] But, subjoins Mr Pinkerton, "this remark must not be taken too strictly. The Goldin Terge is moral, and so are many of his small pieces; but humour, description, allegory, great poetical genius, and a vast wealth of words, all unite to form the complexion of Dunbar's poetry. He unites in himself, and generally surpasses, the qualities of the chief old English poets; the morals and satire of Langland, Chaucer's humour, poetry, and knowledge of life, the allegory of Gower, the description of Lydgate."[4]

But the most striking proofs of his genius are certainly to be found in his two allegorical poems. The Thrissill and the Rois was composed in celebration of the nuptials of James the Fourth and Margaret Tudor; an event productive of very important consequences to both kingdoms, inasmuch as it ultimately led to that happy union which the nature of the territory and the kindred origin of the people rendered so suitable and so desirable. In the plan of this poem Dunbar displays boldness of invention and beauty of arrangement; and some particular passages are remarkable for their strength and even beauty of colouring. The Goldyn Targe, which is written in a different stanza, is another allegorical poem of nearly equal merit. The golden targe, or the shield of reason, is found an insufficient protection against the assaults of the train of love.

Some of his short poems, of a serious character, are likewise to be distinguished from the ordinary compositions of that period. The stanzas bearing the title of Learning vain without guid Lyfe possess superior merit as a moral descant. His Meditatioun in Wyntir is also to be classed among the best of his serious pieces: some of the stanzas are beautiful and pathetic; and they may all be perused with more than common interest as the solitary musings of neglected genius.

Nor are his satirical less remarkable than his serious productions. His poem entitled the Dance of the sevin Deidly Synnis presents many admirable strokes of comic and grotesque description. On the eve of Lent, the poet falls into a trance, and is presented with a glimpse of heaven and hell. Mahoun, or the devil, proclaims a dance of those wretches who have died without absolution; he commands them to prepare a mummery, and to "kast up gamountis" according to the newest French fashion. The seven Deadly Sins immediately present themselves, and are each accompanied by a select band of votaries. Pride is with evident propriety represented as leading the dance, and is dressed in the first fashion of that period: his hair is thrown back, his bonnet is placed on one side of the head, and his gown flows to his heels in ample folds.

Lat se, quoth he, now quha begynnis:
With that the fowll sevin Deidly Synnis
  Begowth to leip at anis.
And first of all in dance was Pryd,
With hair wyld back, and bonet on syd,
  Lyk to mak vaistie wanis;
And round abowt him, as a quheill,
Hang all in rumpillis to the heill
  His kethat for the nanis.
Mony prowd trumpour with him trippit;
Throw skaldand fyre ay as thay skippit,
  Thay gyrnd with hyddouss granis.

This group is succeeded by holy harlots; but Mahoun and the other fiends are not much entertained till a company of priests present their shaven crowns.

Heilie harlottis on hawtane wyiss
Come in with mony sindrie gyiss,
  Bot yit luche nevir Mahoun,
Quhill priestis come in with bair schevin nekkis:
Than all the feyndis lewche and maid gekkis,
  Black-belly and Bawsy-Broun.

Anger, who next makes his appearance, is very forcibly described in a single distich.

Than Yre come in with sturt and stryfe,
His hand wes ay upoun his knyfe.

He is attended by a band of ruffians, who follow in pairs, all equipped for war; and, as they move along, they frequently wound each other with swords and knives. The train of Anger is followed by that of Envy. He is attended by many a dissembler, flatterer, and back-biter, with "rownaris of fals lesingis," or whisperers of lies; from whom the poet cannot avoid expressing his regret that the courts of princes are never free. The next prominent figure in the dance is Covetousness, who is accompanied by catives, wretches, usurers, and hoarders of wealth. From their throats they discharge at each other torrents of molten gold; and when this ammunition is exhausted, the fiends replenish them with the same metal.

Nixt him in dans come Cuvatyce,
Rute of all evill, and grund of vyce,
  That nevir cowd be content:
Catyvis, wrechis, and ockeraris,
Hud-pykis, hurdaris, and gadderaris,
  All with that warlo went.
Out of thair throttis thay schot on udder
Hett moltin gold me thocht a fudder,
  As fyre-flawcht maist fervent;
Ay as thay tumit thame of schot,
Feyndis fild thame new up to the thrott
  With gold of allkin prent.

Sloth, after being twice called, joins unwillingly in the dance, attended by many suitable companions. He drags

---

[1] Nott's Dissertation on the State of English Poetry before the Sixteenth Century, p. cxci.

[2] Ellis's Specimens of the Early English Poets, vol. i. p. 385.

[3] Warton's History of English Poetry, vol. iii. p. 109.

[4] Pinkerton's List of the Scotish Poets, p. xciv.—"It is evident," says Dr Drake, "that a union of talents of this wide range must necessarily be of rare occurrence; nor can we wonder that a century should elapse before a poet in any high degree approaching the genius of Chaucer made his appearance in our island. Not indeed until Dunbar arose in the sister kingdom, had we another instance of the combination of first-rate abilities for humour and comic painting, with an equally powerful command over the higher regions of fiction and imagination." (Mornings in Spring, vol. ii. p. 4. Lond. 1828, 2 vols. 8vo.)

them along with a chain, and Belial lashes them on the loins; but their motion is nevertheless so tardy, that they are occasionally roused by being scorched in fire. The succeeding group consists of Lust and his loathsome train; he snorts like a stallion, is led by Idleness, and is attended by many foul associates who have died in their sins. When they engage in the dance, their visages become as red as the turkis stone. The foul monster Gluttony next presents himself, followed by many a drunkard and prodigal. When they become clamorous for drink, the fiends drench them with melted lead. All these terrific exhibitions might have been expected to satisfy Mahoun himself; but he is nevertheless pleased to close the entertainment with a Highland pageant.

> Than cryd Mahoun for a Heleand padyane,
> Syne ran a feynd to feche Makfadyane,
> Far northwart in a nuke:
> Be he the correnoch had done schout,
> Ersche men so gadderit him abowt,
> In hell grit roume thay tuke.
> Thae tarmegantis, with tag and tatter,
> Full lowd in Ersche begowth to clatter,
> And rowp lyk revin and ruke.
> The devill sa devit wes with thair yell,
> That in the depest pot of hell
> He smorit thame with smuke.

Dunbar's tale of "The twa maryit Wemen and the Wedo" presents us with the only specimen of blank verse which the ancient Scottish language affords. The rhythm is of that species which the author of Piers Plowman, or some of his predecessors, borrowed from the Anglo-Saxon poets, and which appears to have derived its origin from a remote era. It was employed by the Islandic as well as by the Anglo-Saxon poets, and was constructed with some degree of nicety.[1] Their lines are generally short, and they do not rigorously confine themselves to a definite number of syllables. Here alliteration supplies the place of rhyme; the corresponding sounds are at the commencement, not at the termination of words. In two contiguous and connected lines there must be three words beginning with the same letter; and, according to the strictest rule, two of those words ought to occur in the first, and the other ought to begin the second line. It was on such a model that Dunbar and the author of Piers Plowman constructed their verses, though they have not observed all the niceties of their predecessors. In the editions, and indeed in the manuscripts of their respective poems, what is exhibited as a single verse is in reality a distich, and admits of a division without any degree of violence.

This work of Dunbar presents us with a lively though indelicate picture of ancient manners, and is a very curious relique of ancient poetry. Bishop Percy considers it as equal to one of the most humorous productions of Chaucer. The peculiarity of the versification has compelled the author to adopt many uncouth terms; and accordingly the language of this tale is more difficult to be understood, and appears more obsolete, than that of his other poems; but his shrewdness of remark and strength of description shine through the mist of obscure phraseology in which they are sometimes involved. Soon after midnight in a morning of June, the poet walks by a goodly garden, and, on hearing the sound of voices, is induced to look through the lofty hedge, when he perceives three ladies seated in a green arbour, and regaling themselves with wine: he secretly listens to their conversation, of which he professes to give a faithful report. As the wine circulates, they become more communicative, and, at the suggestion of the widow, they successively detail their experience of a married life. The sentiments which they utter, are as profligate as can well be imagined; and it is to be hoped that Dunbar did not intend this as a general representation of the ladies of his own age and nation.

Two of his satirical poems relate to a certain Italian, named John Damian, on whom James the Fourth had bestowed the abbacy of Tungland in Galloway. This adventurer appears to have been an empiric and an impostor, and to have persuaded the king that he had discovered the secret of converting baser metals into gold; nor is it surprising that Dunbar should feel some degree of indignation on seeing high preferment bestowed upon such a person. The abbot having failed to produce the promised gold, made a still more desperate attempt to maintain his reputation as an adept in science and art: he provided himself with a pair of wings, and appointed a particular day for taking his flight from the walls of Stirling castle; when the day arrived, he indeed plunged from the rampart, but instead of mounting in the air, he fell to the ground, and broke his thigh-bone. These anecdotes do not rest on the authority of a satirical poet, for this must commonly be regarded as a very dubious authority; but they are circumstantially related by Bishop Lesley in his history of that reign;[2] and the one account may so far be considered as a confirmation of the other, although the poet has added many particulars of ludicrous exaggeration. Thus, according to Dunbar's dream, he slew a friar in Lombardy, in order to obtain possession of his habit; and having fled to France, he began to practise physic, and in this way committed many new murders. The course of his adventures at length conducted him to Scotland, where he followed his leechcraft with similar success. When raised to the dignity of a prelate, he was not to be seen at mass; he did not appear at matins in his stole and scarf, but was generally to be found in his laboratory, as sooty as a blacksmith.

> In lechecraft he was homocide;
> He wald haf for a nycht to byd,
> Ane haknay and the hurt mannis hyd,
> So mekle he was of myans.
> His irnis was rude as ony rauchtir,
> Quhar he leit blude it was no lauchtir,[3]
> Full mony instrumentis for slauchtir
> Was in his gardyvians.
>
> He couth gif cure of laxatif,
> To gar a wicht horse want his lyf;
> Quha evir assay wald, man or wyf,
> Thar hippis yeid hiddy-giddy.
> His praktikis nevir war put to preif
> Bot sudand deid, or gret mischeif;
> He had purgacioun to mak a theif
> To de without a wedye.

---

[1] Wormii Literatura Runica, p. 178. Hafniæ, 1636, 4to. Olafsen om Nordens gamle Digtekonst, dens Grundregler, Versarter, Sprog og Foredragsmaade, S. 57. Kiöbenhavn, 1786, 4to. Rasks Vejledning til det Islandske eller gamle Nordiske Sprog, S. 211. Kiöbenh. 1811, 8vo. Rasks Angelsaksisk Sproglære, S. 108. Stokholm, 1817, 8vo. Hickesii Grammatica Anglo-Saxonica, p. 195. 217. Bosworth's Elements of Anglo-Saxon Grammar, p. 215. Conybeare's Illustrations of Anglo-Saxon Poetry, p. lxv. Percy's Essay on the Metre of Pierce Plowman's Vision: Reliques, vol. ii. p. 298. Whitaker's Introductory Discourse on P. Ploughman, p. x.

[2] Leslæus de Rebus gestis Scotorum, p. 345. Romæ, 1578, 4to.—"Eadem tempestate rex (ut hoc quoque, quod vulgo non sine risu hucusque memoratur, dicam) Italum quendam, cujus faceto sermone ingenioque delectatus erat, abbatem Tunglandiæ creavit." See likewise Lesley's History of Scotland, p. 76. Edinb. 1830, 4to.

[3] "Lors que mon frere fut en Escosse, il n'y avoit qu'un medecin, qui estoit medecin de la reyne, et de mon temps en Angleterre, il n'y avoit gueres de medecins. En Escosse un menuisier saignoit, et il y avoit des barbiers qui tondoient seulement." (Scaligerana, p. 223.)

Unto no mess preissit the prelat,
For sound of sacrying bell nor skellat;
As blak smyth brukit was his pellat,
For battiring at the study.
Thocht he come hame a newe maid channoun,
He had dispensit with matinnis cannoun;
On him come nothir stole nor fannoun,
For smwking of the smedye.

His unfortunate flight is afterwards related in a very ludicrous manner. The abbot of Tungland has furnished Dunbar with the subject of another poetical dream, which contains one passage remarkable for the strength of its satirical conception.

He sall ascend as ane horrible griphoun,
Him meit sall in the air ane scho dragoun;
Thir terrible monsteris sall togidder thrist,
And in the cludis gett the Antechrist,
Quhill all the air infeck of thair puysoun.

Many of the comic and satirical compositions of Dunbar are valuable memorials of ancient manners; and, if incapable of gratifying the reader of taste, they are at least objects of curiosity to the antiquary. Of this description are the stanzas entitled the Devill's Inquest; which strongly evince that our ancestors were grossly addicted to profane swearing. "It might," as Dr Ogden remarks, "puzzle a philosopher to trace the *love of swearing* to its original principle, and assign its place in the constitution of man." This vice is now regarded as a characteristic of the vulgar, of those who are truly vulgar in their habits and associations, whatever may be their external circumstances; but during the age of Dunbar, it seems to have been practised by all ranks and denominations. To swear like a Scot, was once a proverbial expression.[1] In this general muster of swearers, the priest takes precedence.

Me thocht as he went throw the way,
Ane priest sweirit braid, be God verey,
Quhilk at the alter ressavit he.
Thou art my clerk, the devill can say,
Renunce thy God, and cum to me.

Bishop Douglas, who certainly did not fall below the common standard of clerical decorum, has not scrupled to bedeck his compositions with abundance of oaths. The vice of profane swearing at length arrived at so scandalous a height as to require the interference of the legislature, and it was found necessary to extend the penalties to the clergy as well as the laity: by an act of Q. Mary in 1551, a "prelate of kirk," earl, or lord, was to be fined in twelve pence for the first offence committed within the next three months; different penalties were apportioned to different ranks during the first year; and for the fourth offence committed after the expiration of that period, a prelate, earl, or lord was to be banished or imprisoned for the space of a year and a day.[2]

Dunbar has left some examples of a motley species of composition, which at that period was not uncommon, and in which shreds of different languages are fantastically combined. It does not strictly come under the denomination of macaronic poetry, in which Latin are mingled with vernacular words of Latin terminations, and in which the rules of prosody are observed with at least some degree of care.[3] The earliest macaronic poet is sometimes supposed to have been Teofilo Folengo, a Benedictine monk, better known by the name of Merlinus Cocaius, who was born near Mantua in the year 1491.[4] Of his Macaronics the first edition bears the date of 1518; but during the preceding century a work had appeared under the title of "Typhis Odaxii Patavini Carmen Macaronicum de Patavinis quibusdam Arte magica delusis."[5] This model was followed by Folengo, and by Antonius Arena, or Antoine du Sablon, a French lawyer; and these two are the most celebrated poets of this fantastic school. Among the Scottish poets they have found a few imitators, particularly Drummond and Dr Geddes. Dunbar has not adhered to the same model; without regarding the rules of prosody, he intermingles Latin with Scottish lines, and produces an effect sufficiently ludicrous. Of this particular mode of composition, much earlier specimens are to be found; and Dante himself has written a *canzone* which

[1] "I have never been able to discover," says Lord Hailes, "from what cause our ancestors became so monstrously addicted to profane swearing. I remember Tom Brown some where uses, 'swear like a Scotsman,' as a proverbial expression. There certainly must be a tradition on the continent, that the inhabitants of the whole island were apt to swear in common conversation; for in Holland, the children, when they see any British people, say, 'there come the G— dams;' and the Portuguese, when they acquire a smattering of English, say, 'How do you do Jack, G— damn you?'—Queen Elizabeth was a common swearer." (Notes on Ancient Scottish Poems, p. 241.) Of the truth of one of these remarks we find a curious confirmation in the collection of Norman *chansons* subjoined to the "Vaux-de-Vire d'Olivier Basselin." Caen, 1821, 8vo.

Mauldicte en soyt trestoute la lignye!
Ils ont chargé l'artellerye sus mer,
Force bisquit et chascun ung bydon,
Et par la mer jusq' en Bisquaye aller
Pour couronner leur petit roy *Godon.*

Their little king *G— damn* was Henry the Sixth, who succeeded his father at a very tender age. The subsequent passage occurs in the works of Cretin, a Norman poet who wrote about the beginning of the sixteenth century. (Les Poesies de Guillaume Cretin, p. 168. Paris, 1723, 8vo.)

Cryant qui vive aux *Godons* d'Angleterre.

[2] Acts of the Parliaments of Scotland, vol. ii. p. 485. See likewise p. 482.

[3] Dr Good has made the following remarks in reference to the English translators of Blainville's Travels through Italy: "When they tell us that macaronic poetry, which is a mixture of Italian and Latin words, possessing a Latin termination, 'is so called from its being supposed to resemble (as being a mixture) the Italian maccheroni, these being composed of flour, cheese, and butter'—they display a woeful ignorance of the subject they attempt to elucidate. Maccherone is a term in the Italian language, significative of a blockhead, an ignoramus, or in equivalent English a *pudding-pated* fellow: and Maccheronéa (Macaronics) are obviously, therefore, burlesque imitations of the unclassical style of such writers." (Memoirs of the Rev. Alexander Geddes, LL. D. p. 256. Lond. 1803, 8vo.) The style of blockheads must generally be unclassical; but the origin of the term macaronic, as applied to this motley species of composition, is nevertheless very truly explained by the translators. For this explanation we have the authority of Folengo himself, who in the *Apologetica* prefixed to his *Opus Macaronicorum* speaks in the following manner: "Ars ista poetica nuncupatur ars macaronica, a macaronibus derivata, qui macarones sunt quoddam pulmentum, farina, caseo, botiro compaginatum, grossum, rude, et rusticanum; ideo macaronice nil nisi grassedinem, ruditatem, et vocabulazzos debet in se continere." See likewise Menage's Origini della Lingua Italiana, p. 301.

[4] Tiraboschi, Storia della Letteratura Italiana, tom. vii. p. 1469.

[5] Morellii Bibliotheca Pinelliana, tom. ii. p. 456. Tiraboschi, tom. vii. p. 1468. Specimens of Macaronic Poetry, p. xi. Lond. 1831, 8vo.

Dunbar.

contains a mixture of three languages, Latin, Romance, and Italian. It concludes with the following lines:

Chanson, vos pogues ir per tot le mond;
Namque locutus sum in lingua trina,
Ut gravis mea spina
Si saccia per lo mondo, ogn' uomo il senta:
Forse pietà n' avrà chi mi tormenta.[1]

Skelton, the contemporary of Dunbar, has occasionally indulged in this vein of humour; and a poem of the same description occurs among the works of Dr Arbuthnot, though it has likewise been attributed to Meston. The following stanza, which forms the conclusion of Dunbar's Testament of Kennedy, may be considered as a sufficient specimen.

I will na priestis for me sing
Dies illa, dies iræ,[2]
Na yit na bellis for me ring,
Sicut semper solet fieri;
Bot a bag-pipe to play a spryng,
Et unum ail wosp ante me;
In stayd of baneris for to bring
Quatuor lagenas cervisiæ,
Within the graif to set sic thing
In modum crucis juxta me,
To fle the feyndis, than hardely sing
De terra plasmasti me.

The Flyting of Dunbar and Kennedy is an extraordinary effort of unrefined wit; and is at least sufficient to evince that the ancient Scotish tongue was not deficient in terms of abuse.[3] Lord Hailes is inclined to believe that this altercation may have been a mere play of illiberal fancy, without any real quarrel between the antagonists; and this opinion he supposes to be confirmed by the affectionate manner in which Dunbar afterwards speaks of Kennedy, and of Quintin Shaw, who in this literary duel seems to have acted the part of Kennedy's second. A similar altercation was maintained by Luigi Pulci and Matteo Franco: although for the amusement of their readers they loaded each other with the grossest abuse, yet the intimacy of their friendship is said to have continued without interruption.[4] The example of Dunbar and Kennedy was followed by James the Fifth and Sir David Lindsay, and at a later period by Montgomery and Hume. It is not to be imagined that a king and one of his courtiers were engaged in actual hostilities; and in the verses prefixed to the "Flyting betwixt Montgomery and Polwart," it is expressly stated that their altercation was not the result of a real quarrel, but of what is there described as generous emulation.

A comic tale, entitled the Freiris of Berwik, and possessing a large fund of genuine humour, seems to have been composed about the period to which our attention is now directed. Mr Pinkerton supposes it to have been written by Dunbar; but this opinion is founded on no historical evidence, nor can the internal evidence of style and manner be considered as very striking or satisfactory. "But this tale," he remarks, "cannot at any rate be above thirteen years later than Dunbar, who must have died about 1525. In 1482, Berwick was wrested from Scotland, and was ever after in the possession of the English. Now this poem speaks of all the monasteries as actually standing and flourishing while it was written; and it is well known that in 1535 Henry VIII. suppressed the lesser monasteries, and in 1539 the greater. It follows that this tale must, at all events, have been written before 1539."[5] But the poet, whoever he may have been, does not speak of the monasteries of Berwick as actually flourishing; he merely avers, that when the adventures took place, friars of the different orders were not to seek, but were dwelling in the town. It is therefore evident that this chronological argument is by no means satisfactory, and that the tale may have been written after the suppression of the English monasteries.

In the Freiris of Berwik, every reader acquainted with the poems of Allan Ramsay must recognize the original of the Monk and the Miller's Wife; and we will venture to add that the ancient is greatly superior to the modern tale. Ramsay's tale, says Lord Woodhouselee, "would of itself be his passport to immortality, as a comic poet. In this capacity he might enter the lists with Chaucer and Boccaccio, with no great risk of discomfiture. Though far their inferior in acquired address, his native strength was perhaps not widely disproportionate. Of this admirable tale, I conceive he has the merit of the invention; as the story is not to be found in any of the older writers, as Sachetti, Boccaccio, or in the *Cento Novelle antiche.* In a few circumstances there is indeed a small resemblance to the 73d of the *Cent nouvelles Nouvelles,* entitled 'L'Oiseau en la Cage,' which barely affords a presumption that Ramsay may have read that story; but in all the material circumstances, his Monk and the Miller's Wife is original. A story of more festive humour could not have been devised. The characters are sustained with consummate propriety; the manners are true to nature; and poetic justice is most strictly observed in the winding up of the piece."[6] But whatever merit this comic tale may possess, it is evident that the praise of invention does not belong to Ramsay: he had doubtless read the old Scotish tale in Bannatyne's MS. from which he transcribed other poems less capable of arresting his attention. It may scarcely be worth while to remark that the ecclesiastic whom he introduces is a secular, a parish-priest, and is therefore most improperly described as a monk. That the author of the Freiris of Berwik was likewise indebted to some preceding poet, may perhaps be considered as highly probable. In the collection of Le Grand d'Aussy there is a *fabliau* which exhibits some lineaments of the story. A poor clerk, after having studied at Paris, is returning homeward without any money in his pocket, and, on the approach of night, calls at a solitary house to entreat a lodging; but the farmer's wife very unceremoniously refuses to shelter him during the absence of her husband. As he is leaving the house, he observes a servant bringing some wine in a basket; and at the same time the maid

[1] Opere di Dante Alighieri, tom. iv. p. 342. ed. Venezia, 1758, 4 tom. 4to.—Rodrigo de Valdes, a Jesuit, has written a long and extraordinary poem, containing a mixture of Latin and Spanish, and entitled "Poema heroyco Hispano-Latino panegyrico de la Fundacion y Grandezas de la muy noble y leal Ciudad de Lima." Madrid, 1687, 4to.

[2] This is an allusion to an ancient sequence, known to many English readers from the translations of Drummond and the earl of Roscommon. It begins in the following manner:

Dies iræ, dies illa
Solvet seclum in favilla,
Teste David cum Sybilla.

[3] The Poems of William Dunbar, with notes, and a memoir of his life, by David Laing: to which are added Poems by Walter Kennedy, and other contemporaries. Edinb. 1833, 2 vols. 8vo.—Of the poems of Dunbar this is the first collective edition that has yet been undertaken; and it is fortunate that the task was reserved for so industrious and so skilful an editor.

[4] Roscoe's Life of Lorenzo de' Medici, vol. i. p. 252.

[5] Ancient Scotish Poems, vol. ii. p. 394. Lond. 1786, 2 vols. 8vo.

[6] Woodhouselee's Remarks on the Genius and Writings of Ramsay (p. cvii.) prefixed to his Poems. Lond. 1800. 2 vols. 8vo.

Dunblane.

places in a cupboard a cake which she has just made, together with a piece of fresh pork which she has taken out of the pot. A priest, wrapped in his cope, soon afterwards passes the clerk in silence, and glides into the house. The wayfaring scholar, overwhelmed with fatigue, and dying of hunger, seats himself by the road-side: there he is found by the farmer, who happens to return sooner than he is expected; and they procure admittance, after the priest has found a place of refuge in the stable, which seems to be the ground-floor under the family-dwelling. While the maid is preparing some refreshment, the *laboureur* proposes that the clerk should either sing a song or tell a story: he declares that he knows neither song nor story, but offers to relate an adventure which happened to him in the morning; and by detailing this supposed adventure, he very dexterously contrives to take his revenge on the farmer's wife. As he was traversing a wood, he saw a numerous herd of swine: some of them were large, others small, some white, others black; in a word, they were of all sizes and of all colours. But above all he admired the leader of this herd; he was fat, shining, plump—in a word, just such another as must have been that of which Catherine lately took a morsel from the pot. The clerk prosecutes his tale with the same arch simplicity, and contrives to reveal the secret of the wine, the cake, and finally of the priest concealed in the stable. The enraged farmer, having seized a cudgel, chastises his wife; and the priest, anticipating the same discipline, makes an attempt to escape, but is unmercifully beaten, stripped naked, and in this condition turned out of the house, leaving the clerk to enjoy his joke, together with the supper and wine provided for another guest.[1] This is certainly not the identical story of the Freiris of Berwik: several of the incidents are essentially the same, but the comic scene of the pretended conjuration is wanting. Still however the Scottish tale may have been borrowed from some preceding writer. A story not materially different occurs in a French collection published in 1665, and probably in many others: the scene is laid in Granada; the unfortunate gallant is an advocate, and the pretended magician a soldier.[2] This publication is indeed of a recent date; but such a tale is too pungent and characteristic to have been devised by the obscure compiler of the collection; and it is sufficiently probable that this tale and the Freiris of Berwik were both derived from one common source.[3] (D. I.)

DUNBLANE, a market-town of Scotland, Perthshire, pleasantly situated on the E. bank of the Allan, a tributary of the Forth, 4 miles N. of Stirling. In the middle ages it was the seat of a convent of Culdees, and continued to be so till about the twelfth century. It was constituted the seat of a bishop by David I., by whom the cathedral, founded in 1142, was richly endowed. Among its bishops was the celebrated Robert Leighton, who bequeathed his valuable library to the cathedral and diocese. This library still exists, and has been greatly augmented by subsequent donations. Dunblane is at present only a village, consisting of a single old-fashioned street, with various diverging lanes. A mineral well in the neighbourhood causes an influx of visitors during the summer months. The chief attraction of Dunblane is the cathedral, the choir of which is now the parish church. It is a large Gothic edifice, with a steeple of modern erection, 128 feet in height. The prebendal stalls of richly carved dark oak have fortunately been preserved. Market-day Thursday. About 2 miles from the town is Sheriff-muir, which gives name to the battle fought there on 13th November 1715, between the Earl of Mar and the royal forces under the Duke of Argyle. In this engagement the left wing of each army was defeated, and the right of each was victorious, but the fruits of the victory remained with the Duke of Argyle. At a short distance from Dunblane is the small village of Ardoch, in the immediate neighbourhood of which is the celebrated Roman camp, esteemed the most entire in the kingdom. The measure of the entire area of this camp is 1060 feet by 900, and it is calculated to have contained at least 20,000 men. The prætorium rises above the level of the camp, but is not exactly in the centre. It measures exactly twenty yards on each side. Pop. of Dunblane (1851) 1816.

Duncan.

DUNCAN, Adam, Lord Viscount, an illustrious naval commander, the second son of Alexander Duncan, of Lundie, in the county of Angus, Scotland, by Helen, daughter of Haldane of Gleneagles, in the county of Perth, was born in the month of July 1731. He received the rudiments of his education at Dundee, which is only about 4 miles distant from the family residence; and as his elder brother Alexander was designed for the army (in which he died lieutenant-colonel in 1771), Adam appears to have been early intended for the naval service. Accordingly, about the year 1746, he was placed under Captain Haldane, who then commanded the Shoreham frigate, and he remained two or three years with that officer. In 1749 he was entered as midshipman on board the Centurion of fifty guns, which then bore the broad pendant of Commodore Keppel, commander-in-chief on the Mediterranean station. In the beginning of 1755 he was promoted to the rank of lieutenant, and appointed to the Norwich, a fourth rate, one of the squadron under Keppel, destined to convoy to America the transports having on board the land forces commanded by General Braddock. After the debarkation of this armament he was transferred to the Centurion, where he continued until that ship returned to England; when Captain Keppel, who had for a short time commanded the Swiftsure, procured his appointment as second lieutenant of the Torbay seventy-four, to which he himself had just been appointed. Having remained on the home station for three years, he proceeded with the expedition sent against the French settlement of Goree, on the coast of Africa, and was slightly wounded in the attack of the fort; after which he became first lieutenant of the Torbay, and in this capacity returned to England. His promotion was now rapid. In September 1759 he was raised to the rank of commander; in February 1761 he was advanced to that of post-captain; and having been appointed to the Vaillant, of seventy-four guns, he again became connected in service with his original friend and patron Keppel, who, having received the command of the naval part of the expedition against Belleisle, now hoisted his broad pendant on board the Vaillant. After this affair Captain Duncan accompanied the commodore in the same ship to the attack of the Havanna, and commanded the boats in which the troops were landed, the commodore covering the disembarkation. He was afterwards very actively employed in the siege, during which he greatly distinguished himself; and when the town surrendered, he was despatched to take possession of the Spanish ships in the harbour, namely, five of seventy and four of sixty guns.

[1] Fabliaux ou Contes du XIIe. et du XIIIe. Siecle, tom. iv. p. l. edit. Paris, 1781, 5 tom. 12mo.

[2] Les Recreations Françoises; ou nouveau Recueil de Contes à rire; pour servir de divertissement aux melancholiques, et de joyeux entretien dans les cours, les cercles, et les ruelles, part. i., p. 178. A Rouen, chés David Berthelin, dans la Cour du Palais, 1665, 2 part. 8vo. The compiler, whose name is Nipe, professes to have gleaned from all the ancient and modern books of tales, and to have added new stories of his own invention, "plus capables de faire mourir de rire, que de faire dormir de bout."

[3] A similar incident occurs in Ravenscroft's London Cuckolds, a Comedy, act ii., sc. ii., Lond. 1683, 4to. In reference to this scene, Langbaine has remarked that "Loveday's discovering Eugenia's intrigue, and pretending to conjure for a supper, is borrowed from *Les Contes d'Ouville*, part ii. p. 235." (Account of the English Dramatick Poets, p. 421. Lond. 1691, 8vo.)

After the capture of the Havanna, he, in the same capacity as formerly, accompanied Admiral Keppel, who had been appointed to the command on the Jamaica station, and continued with him as captain of the flag-ship until the conclusion of the war, when he returned to England.

On the recommencement of war with France in the year 1778, Captain Duncan was appointed to the Suffolk, of seventy-four guns; but before the end of the year he was removed into the Monarch, of the same rate, which, during the summer of 1779, was employed in the Channel fleet under Sir Charles Hardy, who, owing to the junction of the French and Spanish fleets, was now acting upon the defensive. Towards the close of the same year, the Monarch was one of the ships placed under the orders of Sir George Bridges Rodney, who had received instructions to force his way through all impediments into Gibraltar, and to relieve that fortress, then closely invested by a Spanish army on the land side, whilst it was blockaded on the seaward face by a flotilla sufficiently powerful to oppose the entrance of any ordinary force. In the beginning of 1780, the British fleet, when off Cape St Vincent, fell in with a Spanish squadron under Don Juan de Langara, which had been stationed there to intercept Sir George Rodney, who was supposed to have only a squadron of four sail of the line. On this occasion Captain Duncan carried the Monarch into action before any other ship of the fleet; and the St Augustin, of seventy guns, struck to him, after having been so much disabled that he was obliged to abandon her. In this action the disparity of force was great; the British fleet consisting of nineteen ships of the line, and the Spanish of only eleven ships and two frigates. Of the latter, four were taken, one was blown up, three surrendered, but afterwards got away much damaged, one was reduced almost to a wreck, and two others, together with the frigates, made their escape. Soon after his arrival in England Captain Duncan quitted the Monarch, and remained without employment until the beginning of 1780, when he was appointed to the Blenheim, of ninety guns, and continued in command of this ship during nearly the whole remainder of the war. He was constantly employed with the Channel fleet, then under the command of Earl Howe; and in September 1780, having accompanied his lordship to Gibraltar, he was appointed to lead the larboard division of the centre, or squadron of the commander-in-chief, and greatly distinguished himself in the encounter with the combined fleets of France and Spain, which took place off the entrance of the Straits. Soon after the return of the fleet to England Captain Duncan was removed into the Foudroyant, of eighty-four guns; and on the conclusion of the peace in the spring ensuing he passed into the Edgar, of seventy-four guns, one of the guard ships at Portsmouth, where, as is customary in such cases, he continued in command during the three succeeding years

This was the last commission which he ever held as captain of a ship. In September 1789 he was promoted to the rank of rear-admiral of the blue, and in September 1790 he was made rear-admiral of the white; in February 1793 he was raised to be vice-admiral of the blue, and in April 1794 he became vice-admiral of the white; in June 1795 he was appointed admiral of the blue; and lastly, in February 1799 he received the rank of admiral of the white. But during all these periods, excepting the two last, the merit of Admiral Duncan, which was never of an obtrusive, bustling, or forward kind, seemed to have been wholly overlooked; and though he frequently solicited employment, his applications proved unavailing; in consequence of which he had it in contemplation to retire altogether from the service. This period of obscuration, however, at length passed away. In February 1795 he received an appointment, constituting him commander-in-chief of the North Seas, that is, from the North Foreland to the Ultima Thule; and he accordingly hoisted his flag on board the Prince George, of ninety-eight guns, at Chatham, but afterwards shifted it to the Venerable, of seventy-four guns, the Prince George being considered as too large for the particular quarter in which he was destined to act. Having thus attained the object of his wishes, Admiral Duncan lost no time in proceeding to carry into execution the important trust which had been confided to him; and during the whole time he held the command, he exhibited that inexhaustible patience and unwearied constancy, which, with cool judgment and determined gallantry, formed the great attributes of his professional character. In the midst of many discouragements, and on a station exposed to peculiar dangers from the shoals and sand-banks which cover the coasts of the United Provinces, and the storms with which the North Sea is frequently visited, he never shrunk from the duty which had been assigned him, or failed at any season, however tempestuous, to show his squadron off the coast which it domineered over and insulted.

For more than two years, however, nothing occurred beyond the ordinary routine of such a service; namely, occasional captures, and smart affairs with the coast batteries and the craft which took shelter under their guns. The Dutch trade, however, was nearly annihilated; their merchant-vessels were frequently captured in sight of their own ports; and the whole coast was so completely blockaded that few vessels could venture out to sea, and escape the vigilance of the British fleet or its cruisers. The Batavian fleet, though consisting of five sail of the line, six frigates, and five sloops, was also obliged to remain quietly in port, or to confine itself to short cruises, at times when want of water or provisions compelled the British ships to repair for a few days to their own coasts; and in the beginning of June 1797, it even suffered itself to be blocked up in port, although for several days Admiral Duncan's force was limited to his own ship the Venerable, of seventy-four guns, and the Adamant, of fifty. This was owing to the unhappy and dangerous spirit of mutiny which at that period had infected in succession almost every portion of the British navy. It first broke out amongst the ships at Portsmouth, then extended itself to the fleet at the Nore, and afterwards reached the North-Sea fleet, in which almost every ship hoisted the flag of defiance. At this alarming and unprecedented crisis, the conduct of Admiral Duncan proved him to be equal to the fearful exigencies of the occasion, and perhaps contributed more to the safety and true glory of the country than even his subsequent victory. Although by the secession of the disaffected ships his fleet had been so thinned that, towards the end of May 1797, he found himself at sea with only his own ship and another, he nevertheless proceeded to his usual station off the Texel,[1] where

[1] On the 3d of June 1797, Admiral Duncan having assembled the officers, seamen, and marines of his own ship (the Venerable), addressed them from the quarter-deck as follows:—"My lads, I once more call you together with a sorrowful heart, from what I have lately seen of the disaffection of the fleets; I call it *disaffection*, for the crews have no *grievances*. To be deserted by my fleet in the face of an enemy, is a disgrace which I believe never before happened to a British admiral; nor could I have supposed it. My greatest comfort, under God, is, that I have been supported by the officers, seamen, and marines of this ship; for which, with a heart overflowing with gratitude, I request you to accept my sincere thanks. I flatter myself, much good may result from your example, by bringing those deluded people to a sense of the duty which they owe, not only to their king and country, but to themselves. The

there lay at anchor the Dutch fleet of fifteen sail of the line, under the command of Vice-Admiral de Winter; and in order to detain the latter in port until a reinforcement should arrive, he caused repeated signals to be made, as if to the main body of his fleet in the offing; a stratagem which, it was supposed, had the desired effect. At length, about the middle of June, several line-of-battle ships, in detached portions, joined the British admiral, and in a short time thereafter the two fleets were again placed on an equal footing.

But the Venerable having been upwards of eighteen weeks at sea, and during part of that time exposed to boisterous weather, was now in want of almost every description of stores; whilst others of the ships had also suffered by the recent gales, and were besides short of provisions. In these circumstances, the admiral, on the 3d of October, put into Yarmouth roads in order to refit and revictual; having left off the Dutch coast a small squadron of observation under the orders of Captain Trollope of the Russell. But early on the morning of the 9th, the Black Joke hired armed lugger showed herself at the back of Yarmouth sands with the signal for an enemy flying at her mast-head. Immediately all was bustle and preparation, and, by incredible exertions, Admiral Duncan, with eleven sail of the line, was enabled, a little before noon, to weigh and put to sea; directing his course with a fair wind right across to his old station. On the following day, the Powerful, Agincourt, and Isis joined, and on the afternoon of the 11th the advanced ships were near enough to count twenty-two sail of square-rigged vessels at anchor in the Texel. Meanwhile the admiral having received from Captain Trollope information of the course the enemy's fleet was steering, now stood along shore to the southward. At about seven on the morning of the 12th, the Russell, Adamant, and Beaulieu were descried in the south-west, bearing at their mast-heads the signal of an enemy in sight to the leeward; and about half-past eight, a strange fleet, consisting of twenty-one ships and four brigs, made its appearance in the quarter pointed out by the signal.

This was the Dutch fleet, under Vice-Admiral de Winter, consisting of four seventy-fours, seven sixty-fours, four fifty gun ships, two forty-four gun frigates, two of thirty-two guns, two corvettes, four brigs, sloops, and two advice-boats, all which had quitted the Texel at ten o'clock in the morning of the 10th, with a light breeze at east and by north. As soon as Admiral de Winter had learned that the British fleet was approaching, he recalled some ships which he had previously detached, and edged away with the wind at north-west, towards Camperdown, the appointed place of rendezvous. At daylight on the 11th, the Dutch fleet was about nine leagues off the village of Schevenningen, in loose order; but on receiving additional information, Admiral de Winter ordered his captains to their respective stations, and, to facilitate the junction of the ships to leeward, stood towards the land. On the Wykerdens bearing east, distant about four leagues, the Dutch fleet hauled to the wind on the starboard tack, and shortly afterwards discovered the British fleet in the north-north-west; upon which it put about, and as soon as a close line was formed, with frigates and other smaller vessels opposite the openings, the Dutch ships throwing their main-top-sails aback, resolutely awaited the approach of the British.

When the Dutch appeared in sight, the British fleet was, owing to the inequality of the ships in point of sailing, in very loose order. To connect the squadron, therefore, and enable the heavy-sailing ships to take their allotted stations, the admiral made the signal to shorten sail, and bring to on the starboard tack; but observing, soon afterwards, that the Dutch ships were drawing fast in shore, and finding there was no time to be lost in making the attack, he made the signals to bear up, break the enemy's line, and engage them to leeward, each ship her opponent, and also for the van to attack the enemy's rear. In his dispatch the admiral states that his signals were obeyed with the greatest promptitude; but it has been asserted that, owing to the thickness of the weather, the signal to pass through the enemy's line and engage him to leeward was not generally understood during the short time it was displayed, and that hence some uncertainty prevailed in the fleet as to the precise mode of attack. In fact, the admiral perceived that if he waited to form line, there would be no action; and, with equal judgment and boldness, he dispensed with this preliminary arrangement, and notwithstanding the still disunited state of the ships, he hurried them into action as fast as possible. The signal above mentioned was replaced by that for close action, which continued flying for an hour and a half, until it was shot away by the enemy. This signal could not possibly be mistaken.[1]

About forty minutes past twelve o'clock (12th October)

British navy has ever been the support of that liberty which has been handed down to us by our ancestors, and which, I trust, we shall maintain to the latest posterity, and that can only be done by unanimity and obedience. The ship's company, and others who have distinguished themselves by their loyalty and good order, deserve to be, and doubtless will be, the favourites of a grateful country; they will also have, from their individual feelings, a comfort which must be lasting, and not like the fleeting and false confidence of those who have swerved from their duty. It has often been my pride with you to look into the Texel, and see a foe which dreaded coming out to meet us. My pride is now humble indeed. My feelings are not easily to be expressed. Our cup has overflowed, and made us wanton. The all-wise Providence has given us this check as a warning, and I hope we shall improve by it. On Him, then, let us trust, where our only security can be found. I find there are many good men among us: for my own part, I have had full confidence of all in this ship, and once more beg to express my admiration of your conduct. May God, who has thus far conducted you, continue to do so; and may the British navy, the glory and support of our country, be restored to its wonted splendour, and be not only the bulwark of Britain, but the terror of the world. But this can only be effected by a strict adherence to our duty and obedience; and let us pray that the Almighty God may keep us in the right way of thinking. God bless you all." If this speech has but little to recommend it on the score of rhetoric, it has qualities of a nobler kind to compensate for the want of the graces of diction or oratory: it is indeed affecting and impressive in a very high degree; and it is recorded that, among the crew of the Venerable who listened to it, there was not a dry eye when the good admiral had concluded his address.

[1] The following anecdote, which is told by Admiral Sir Charles Ekins (*Naval Battles*, p. 236), shows that the instinct of true valour sometimes supplies the place of knowledge, if not of genius. Captain Inglis of the Belliqueux, sixty-four guns, owing either to long absence from active service, or an inaptitude for the subject sometimes apparent in naval officers, had neglected to make himself competently master of the signal-book; and hence, on the morning of the day of battle, when it became necessary to act with promptitude, in obedience to the signals, he found himself more puzzled than enlightened by it; so, throwing it with contempt upon the deck, he exclaimed in broad Scotch, " Damn me, up wi' the hellem, an' into the middle o't." In this manner he bravely anticipated the remedy in such cases provided by the illustrious Nelson, who, in his celebrated *Memorandum* on the eve of the battle of Trafalgar, observed, that " if a captain should be at a loss, he would not do *very wrong* if he laid his ship alongside of the enemy." In strict conformity with this doctrine, the Belliqueux was carried by her brave and honest captain into the very thickest of the fight, and got very roughly handled by the van of the enemy.

the action commenced, when Vice-Admiral Onslow in the Monarch, which led the advanced or larboard division of the British fleet, cut through the Dutch line between the Haerlem and Jupiter, pouring into each in passing a well-directed broadside; and then leaving the Haerlem to the Powerful, luffed up alongside of the Jupiter, upon which the two ships became warmly engaged. In rounding, the Monarch received the raking fire of the Monnikendam frigate and the Atalanta brig, stationed in the rear or second line. The remaining ships of the larboard division, particularly the Monmouth and Russell, were soon in action with those of the enemy's rear; amongst which the last to surrender was the Jupiter, which had been first engaged. About twenty minutes after the Monarch had passed through the Dutch line, the Venerable, frustrated in her attempt to pass astern of the Vryheid, by the promptness of the States-General in closing up the interval, ran under the stern of the latter, and soon compelled her to bear up; whilst the Triumph, the Venerable's second astern, found immediate employment for the Wassemaer, the second astern of the States-General. In the meanwhile the Venerable had ranged up close on the lee-side of the Vryheid, with which, on the opposite side, the Ardent was also warmly engaged, and, in front, the Bedford, as she cut through the enemy's line astern of the Gelykheid. The Brutus, Leyden, and Mars, not being pressed by opponents, advanced to the assistance of their admiral, and did considerable damage to the Venerable, Ardent, and other ships of the British van. At this time the Hercules, having caught fire on the poop, bore up out of the line, and came drifting near the Venerable to leeward; but although the Dutch crew contrived to extinguish the flames, yet having thrown their powder overboard, they were compelled to surrender their ship to the nearest opponent. The Venerable, which had sustained serious damage, was now obliged to haul off, and to wear round on the starboard tack. As soon as this was observed, the Triumph, which had compelled the Wassemaer to strike her colours, approached to give the finishing blow to the Vryheid, which still persisted in defending herself. At length, from the united fire of the Venerable, Triumph, Ardent, and Director, the three masts of the gallant ship fell over her side, and disabled her starboard guns; upon which the Vryheid dropped out of the line an ungovernable hulk, and then struck her colours. With the surrender of De Winter's ship the action ceased, and the British found themselves in possession of the Vryheid and Jupiter, seventy-fours; Devries, Gelykheid, Haerlem, Hercules, and Wassemaer, sixty-fours; Alkmaar and Delft, fifties; and the frigates Monnikendam and Ambuscade. The victors then hastened to secure their prizes, in order that, before night-fall, they might get clear of the shore.

This battle presented on both sides the singular spectacle of heroic courage and determined perseverance, contrasted with conduct little, if at all, short of downright cowardice or disaffection; and from first to last the opposing forces were, from various causes, pretty nearly equal. Seven Dutch line-of-battle ships quitted the action in order to return home, and nearly as many British seem scarcely to have entered it. The actual combatants, however, maintained the strife with fierce, unflinching valour; and hence the loss on both sides was proportionally severe. That of the British amounted to 203 killed and 622 wounded, while the Dutch had 540 killed and 620 wounded. During the action the latter directed their shot solely at the hulls of their adversaries, and this not until they were so near that scarcely any aim could miss; which accounts for the unusual severity of the loss sustained. On the other hand, the captured ships were all either dismasted outright, or so injured in their masts that most of these fell in the passage home; whilst as to their hulls, they were completely riddled, and only worth bringing into port as trophies of the victory.

If any proof were wanting of the superior efficacy of Admiral Duncan's mode of attack, it would be found, first, in a manly declaration made by the gallant Dutchman, and, secondly, in the practical testimony to its excellence borne by Lord Nelson. "Your not waiting to form a line," said De Winter to Admiral Duncan, "ruined me; if I had got nearer the shore, and you had attacked, I should probably have drawn both fleets on it, and it would have been a victory to me, being on my own coast." And after the battle of the Nile, Nelson, although unacquainted with Lord Duncan, wrote his lordship to tell him how he, Nelson, "had profited by his example." Besides, the British squadron was composed of very indifferent and inadequate ships; many of them having been intended for Indiamen, and otherwise ill conditioned and deficient. Had Lord Duncan's fleet been composed of the same materials as Lord St Vincent's, every Dutch ship would have been taken; and had all the ships imitated the example of their chief, the same result must have followed. Few people are aware of the merits of the chief on that memorable day. When the action ceased, the ships were in nine fathoms water, within five miles of a lee shore, with every appearance of the gale which followed; a situation as critical as it is possible to imagine. And it should also be recollected, that when the Dutch put to sea, the admiral had only been two days in port, after a blockade of nineteen weeks. It was the opinion of Lord Duncan that, upon such occasions, the commander-in-chief should hoist his flag on board of a frigate; and he stated that, if he should ever fight another battle, he would certainly do so. He was often heard to declare that, if his flag had been flying on board of a frigate in this action, not one of the Dutch fleet would have escaped.

No victory was ever more seasonable, none more gratifying to the nation, than that of Camperdown. Politicians beheld in it the annihilation of the marine of Holland, long our most formidable rival on the seas; naval men admired the promptitude, decision, and address displayed by the admiral in approaching to the attack, in circumstances altogether unprecedented; and the people at large were transported with admiration and delight, though they did not very well know why. Hence the honours which were immediately conferred on the admiral received the approbation of all parties. On the 21st of October he was created Lord Viscount Duncan of Camperdown, and Baron Duncan of Lundie, in the county of Angus; his second in command, Vice-Admiral Onslow, was made a baronet; gold medals were struck and presented to the flag officers and captains; and the thanks of parliament were voted to the fleet. A pension of L.2000 per annum was likewise granted to Lord Duncan for his own life, with remainder to the two next heirs of the peerage.

After the victory of Camperdown, Lord Duncan continued to hold the same command until the commencement of 1800, when, being advanced in years, he withdrew from the service, and passed the remainder of his life in retirement, chiefly at his patrimonial residence. At the period of his death, however, which happened on the 4th August 1804, he was, we believe, about to be recalled into active service; and he had signified his determination to obey the call of his country at a season of unexampled difficulty and danger, when his career was terminated for ever by a sudden and fatal illness. In June 1777 he had married Henrietta, daughter of the Right Honourable Robert Dundas, lord president of the Court of Session in Scotland, and father of Lord Viscount Melville; and by this lady he had a large family. Lord Duncan was suc-

ceeded in his titles and estate by his second son, Robert, now Earl of Camperdown.

Lord Duncan was a man as remarkable in appearance as he was distinguished for character and worth. In person he was of a colossal and athletic form, six feet four inches in height, erect in his carriage, and, notwithstanding his great size, graceful in his movements, with a countenance strongly expressive of intelligence and benevolence. In him, singular meekness of disposition, extreme modesty in all that concerned himself, and the most unaffected dignity of mind, were blended with genuine spirit, high professional genius, vigorous and active wisdom, singular alacrity and ability for performing great achievements, and a decided indifference about success, excepting in as far as it might contribute to advance the good of his country. His private character was that of a man most exemplary in all the social relations of life; an affectionate relative, a steady friend, and a pattern of virtue and true piety. Lord Duncan was a most sincere and devout Christian, nor did he ever lose sight of the duties belonging to that character. He encouraged religion by his own practice, and, wherever he held a command, caused the public observance of it to be maintained. Immediately after the victory, which has immortalized his name, was decided, he ordered the crew of his ship to be called together, and, at their head, upon his bended knees, in the presence of the Dutch admiral, who was greatly affected with the scene, he solemnly offered up praise and thanksgiving to the God of battles for having crowned with success the arms of his country. In like manner, when all eyes were upon him, in the cathedral of St Paul's, on the day of general thanksgiving, in December following, his demeanour was so humble and devout, as not only to increase the admiration which his services had otherwise gained him, but to impress on all present a sense of the real dignity as well as importance of religion. In a word, Lord Duncan afforded a conspicuous instance of the truth of the remark, that piety and true courage are naturally allied, and that death loses its terrors to those who have placed their hope beyond it. (Collins's *Peerage*, by Sir E. Brydes; *Naval Chronicle*, vol. iv.; Charnock's *Biographia Navalis;* Chalmers's *Biographical Dictionary*, art. *Duncan;* James's *Naval History of Great Britain*, vol. ii.; Exins's *Naval Battles*, p. 231.) (J. B—E.)

DUNCAN, *Thomas*, one of the most distinguished portrait and historical painters that Scotland has produced, was born at Kinclaven in Perthshire, May 24, 1807. He was educated at the Perth Academy, and afterwards began the study of the law, which, however, he speedily abandoned for the more congenial pursuits of art. Commencing his new career under the directing guidance of Sir William Allan, he early attained distinction as a delineator of the human figure; and his first pictures established his fame so completely, that at a very early age he was appointed professor of colouring, and afterwards of drawing, in the Academy of Edinburgh. In 1840 he produced one of his finest pieces, "Prince Charles Edward and the Highlanders entering Edinburgh after the Battle of Prestonpans." This painting secured his election as an associate of the Royal Academy in 1843. In that same year he produced his no less famous picture of "Charles Edward asleep after Culloden, protected by Flora Macdonald," which, like many other of his pieces, has been often engraved. In 1844 appeared his "Cupid" and his "Martyrdom of John Brown of Priesthill," the last effort of his pencil, with the exception of a portrait of himself. He died at Edinburgh, May 25, 1845.

DUNCANSBY HEAD, a promontory forming the N.E. extremity of Scotland, county of Caithness, about $1\frac{1}{2}$ miles N.E. of John O'Groat's House.

DUNCOMBE, William, younger son of John Duncombe of Stocks, in Hertfordshire, was born at London in 1690. He published in 1722 a translation of Racine's *Athalie*, which was well received by the public, and has gone through three editions. In 1724 he was editor of the works of Mr Needler; in 1735, of the poems of his deceased brother-in-law Mr Hughes, two vols. 12mo; in 1737, of the miscellanies of his younger brother Mr Jabez Hughes, for the benefit of his widow, in one volume 8vo; and in 1745, of the works of the Rev. Samuel Say, in one vol 4to. In 1726 he married the only sister of Mr John Hughes, whom he long survived. In 1734 his tragedy of Lucius Junius Brutus was acted at Drury Lane Theatre. It was published in 1735, and again in 1747. The works of Horace, in English verse, by several hands, were published by him in two vols. 8vo, with notes, in 1757; and a second edition, in four vols. 12mo, with many imitations, appeared in 1762. In 1763 he collected and republished "Seven Sermons by Archbishop Herring, on public occasions, with a biographical preface." He died in February 1769, at the age of eighty.

DUNDALK parliamentary borough and seaport of Irelan ., county Louth, on the S. bank of the Castletown river, near its mouth in Dundalk Bay, 50 miles N. of Dublin. Pop. (1851) 9995. It possesses some good streets, but a great part of the town is filthy and wretched. The parish church is an old and spacious edifice. The other public buildings are—a Roman Catholic chapel, Presbyterian and Methodist meeting-houses, county court-house, infirmary, prison, guildhall, market-house, linen-hall, endowed grammar-school, national schools, and barracks. It has also two breweries, two flour mills, a large distillery, a flax spinning mill, and a pin factory. It carries on a brisk trade, chiefly in agricultural and dairy produce. The municipal government is vested in a bailiff, a recorder, and 16 burgesses. Dundalk returns one member to parliament. The port and harbour of Dundalk have recently been undergoing extensive improvements. The course of the river has been straitened, and the bar and harbour deepened from 5 to 8 feet, so that vessels drawing 16 feet water can now come up to the town. The channel, when completed, will be 150 feet wide at the quays, and 300 at the point. A lighthouse, on the screw-pile principle, has been erected at the bar. Steamers ply regularly to Liverpool three times a-week. On 31st December 1852 the registered shipping belonging to the port was 23 vessels of 1871 tons, and 2 steamers of 844 tons. The number and tonnage of vessels that entered and cleared at the port during 1852 were—inwards, sailing vessels 519, tonnage 35,928; steamers 109, tonnage 77,782: outwards, sailing vessels 224, tonnage 17,074; steamers 105, tonnage 46,235. Market-day Monday. Three newspapers are published in Dundalk. In the reign of Edward II. Dundalk was a royal city;—the last that we read of where a monarch of all Ireland was actually crowned and resided.

DUNDAS, Henry, Viscount Melville, an eminent British statesman, was born about 1741. He was a younger son of the Right Honourable Robert Dundas, lord president of the Court of Session in Scotland; and his mother was a daughter of Sir William Gordon of Gordonston, Bart. He was educated at the High School and University of Edinburgh; and having been brought up to the profession of the law, was admitted a member of the Faculty of Advocates in 1763. He soon distinguished himself at the bar, and rapidly attained to extensive practice. The first promotion he obtained was the situation of one of the assessors to the magistrates of Edinburgh; after which he became successively an advocate-depute and solicitor-general. In 1775, when Sir James Montgomery was appointed lord chief baron, Mr Dundas succeeded him in the office of lord advocate, which situation he continued to occupy until 1783. In March 1777, he was appointed joint keeper of the Signet for Scotland.

From the period of his appointment to the office of lord advocate, Mr Dundas in a great measure abandoned the ordinary practice of the bar, and devoted himself to public business. In 1774 he became a member of parliament, having been elected representative for the county of Edinburgh. Some years afterwards he resigned the representation of the county, and was chosen member for the city of Edinburgh, which he continued to represent until his advancement to the peerage. Although originally returned to parliament in opposition to the ministerial interest, he soon joined the party in power, and became a strenuous supporter of Lord North's measures during the American war. He frequently spoke in the House of Commons; and, notwithstanding the disadvantages of an ungraceful manner and a provincial dialect, he was always listened to with great attention, on account of the clearness of his statements and the weight of his arguments.

In 1782, Mr Dundas was admitted a member of the privy-council, and appointed treasurer of the navy, under the administration of the Marquis of Lansdowne, then Earl of Shelburne;—and he continued to fill that office, and to support the measures of government, until the dissolution of that ministry. During the short coalition administration he was out of place, and made a conspicuous figure in opposing the memorable East India bill, a measure which occasioned the overthrow of the ruling party. Upon that occasion he displayed a knowledge of the affairs of the East India Company, which was evidently the result of much study and laborious investigation. In December 1783, when Pitt became prime minister, Dundas was restored to the same office which he had previously held; and was appointed president of the board of control, under the new East India system. In 1791 he became a member of the cabinet, in consequence of his appointment to the office of principal secretary of state for the home department. The duties of this office he discharged with energy and ability. The volunteer system, which, undoubtedly, contributed much to rouse the spirit of the country during a period of peculiar difficulty and danger, has been ascribed to Dundas. On the accession of the Duke of Portland to the administration of Pitt, he resigned the home department, and became secretary at war. At this time he also held the offices of lord privy seal, and governor of the Bank of Scotland, and enjoyed an extent of patronage in his native country which has seldom or never fallen to the share of any individual, and has been considered by many as more exclusive than can be safely confided to the hands of any one man. For many years he was the intimate friend and coadjutor of Pitt, and took a leading part in all the important measures of his administration. The details of these measures, and Lord Melville's conduct in regard to them, belong to history. In the present article we must restrict ourselves to a general outline of the events of his life, and a short summary of the leading traits of his character.

Upon the resignation of Pitt in 1801, Dundas also resigned his political offices; and in 1802, under the administration of Mr Addington, afterwards Lord Sidmouth, he was elevated to the peerage, by the titles of Viscount Melville and Baron Dunira. The last public situation which he held in the government was that of first lord of the admiralty, to which he was appointed on Pitt's return to power, in the room of Lord St Vincent. It was in his administration of the affairs of the naval department that his lordship incurred the charge relative to the balances of public money remaining in his hands, which produced his celebrated impeachment. We conceive it unnecessary to dwell upon the proceedings of that well-known trial. It is sufficient to say that the House of Lords finally acquitted him of all the charges brought forward in the articles of impeachment exhibited by the Commons; but he had previously resigned all his offices in the administration.

Subsequently to his acquittal, Lord Melville was restored to his seat in the privy-council; but he did not return to office. He sometimes took a share in the debates in the House of Lords; and, in 1810, he brought forward a motion the object of which was to recommend the employment of armed troop-ships, instead of hired transports, for the accommodation of such troops as it might be found expedient to embark in furtherance of the public service. But the greater part of his time was spent in Scotland, where he died suddenly at the house of his nephew, the Right Hon. Robert Dundas, lord chief baron of the Exchequer, May 27, 1811, at the age of seventy-one. He appeared in his usual health for some time preceding, and his death is supposed to have been hastened by the affliction he felt for the loss of his old and valued friend the Lord President Blair, who died a few days before.

In his person Lord Melville was tall, stout, and well formed. In public life he was principally distinguished by his great capacity for business, by the unwearied attention which he paid to the details of all official measures, and by the manliness and decision of his conduct. For many years, as we have already observed, he was the steady friend and firm supporter of the measures of Pitt, to whom he proved a very powerful auxiliary. Whilst he held the offices of treasurer of the navy and first lord of the admiralty, his exertions are admitted to have been attended with great advantage to the public service. He devised several improvements in the details of that department, which have been found of great utility; and, in particular, the regulations with regard to the payment of seamen's wages, transmission of letters, and other matters connected with that branch of the public service, contributed much to the comfort of that class of men, and are highly honourable to the character of their author. In parliament he was a clear, acute, and argumentative speaker. His eloquence, however, was that of a man possessed of strong natural talents, wholly unadorned by literary taste or acquirements; and his speeches produced their effect from the solidity of his arguments, and the fearlessness with which he delivered his opinions, rather than from any powers of oratory or graces of style. The ornamental parts of eloquence, indeed, he seemed to despise, and was satisfied to bring his audience at once to the object he had in view. Political power was his passion, and the bustle of official life was the element in which he loved to move.

In private life his lordship was a most agreeable companion; easy, frank, and convivial; careless of money, even to a fault; always disposed to do kind offices; affectionate in his domestic relations, and greatly beloved by the numerous circle of his friends.

Lord Melville was twice married: first, to Miss Rannie, daughter of Captain Rannie of Melville, by whom he had one son and three daughters. His second wife was Lady Jean Hope, sister of the late Earl of Hopetoun, by whom he left no issue.

Although not, strictly speaking, a literary man, Lord Melville was the author of several pamphlets on political subjects, which were distinguished by his usual sense and knowledge of business. These are, 1. *The Substance of a Speech in the House of Commons, on the British Government and Trade in the East Indies, April* 23, 1793. London, 1813, 8vo. 2. *Letter to the Chairman of the Court of Directors of the East India Company, upon an open Trade to India.* London, 1813, 8vo. 3. *Letters to the Right Honourable Spencer Percival, relative to the Establishment of a Naval Arsenal at Northfleet.* London, 1810, 4to.

DUNDEE, a royal and parliamentary burgh and seaport town of Scotland, county of Forfar, 42 miles N.N.E. from Edinburgh; N. Lat. 56. 2.; W. Long. 3. 2. It is

Dundee. situated on the north side of the river Tay, about 12 miles from its mouth. Pop. (1851) 78,931; and as a considerable increase has since taken place, it may now be estimated at from 90,000 to 100,000. Dundee is thus the third town in Scotland in respect of population. The name applied to it by the earliest writers is Alectum or Taodunum. It was subsequently designated Deidonum, of which the present name is supposed to be a corruption. The early history of the town is involved in obscurity, but it appears to have been a place of importance as early as the twelfth century. Frequent mention is made of it in connection with the disputes regarding the succession to the crown of Scotland; and it was the scene of severe conflicts between the English forces, who invaded the country in the reign of Edward I., and the Scots, under the patriot Wallace, and the other supporters of Scottish independence. Those national feuds were finally extinguished by the union of the crowns in the person of James VI.; but during the protectorate of Oliver Cromwell, Dundee having refused to submit to the republican General Monk, was in 1651 taken by assault, and given up to plunder and massacre. A large booty fell to the republican soldiers, and sixty vessels laden with plunder were sent off to England, but suffered shipwreck, and were totally lost.

The early records of the town were destroyed during the civil wars; but it appears that the first charter constituting it a royal burgh was granted by William the Lion in 1210. Subsequent charters were granted by king Robert in 1327, and James IV. in 1511; and the privileges of the burgh were finally confirmed in 1651, and by act of the Scottish parliament passed in the same year.

The municipal government of the town is vested in a provost, 4 bailies, and 15 councillors, chosen by the parliamentary electors within the royalty. The Dean of Guild, who is elected by the merchant guild, or Guildry incorporation, is likewise a member of the town-council. The subordinate corporations are the Nine Trades, the Three Trades, the Fraternity of Maltmen, and the Trinity House or Fraternity of Masters and Seamen. Since the abolition of exclusive privileges in trading within burgh, the minor corporations have lost much of their importance; but most of them have the privilege of choosing members to represent them in the harbour trust and charitable institutions of the place. Previous to the passing of the Reform act in 1832, Dundee, along with Perth, Forfar, Cupar, and St Andrews, sent only one member to the imperial parliament. By that act the right of sending a representative of its own was conferred upon the town.

Dundee was at one time surrounded by strong walls, and portions of them are yet to be seen. The Cowgate port still stands, and is regarded with veneration as a memorial of George Wishart, the Reformer, who is said to have preached from it in the year 1544, when the plague prevailed in the town, the sick being placed on one side of the wall, and the healthy on the other.

The ground on which the town is built slopes gently towards the river, and is bounded on the north by the Law of Dundee, and the Hill of Balgay. The former rises to the height of 535 feet, and must in warlike times have been a strong position. The walls of a fortification are still to be traced on its summit. The town in general is irregularly built; but within the last 20 or 30 years several new and spacious streets have been opened up. The principal public buildings are the Exchange reading room; the Royal Arch erected by public subscription to commemorate the landing of Queen Victoria in 1844, at a cost of nearly L.8000; the Public Seminaries; and the New Baltic Exchange coffeeroom, a splendid specimen of the Flemish-Gothic style. Of the ecclesiastical buildings the finest are the Town churches, on the north side of Nethergate Street. These were originally reared by David earl of Huntingdon, during the twelfth century, in gratitude for his deliverance from shipwreck, and were dedicated to the Virgin Mary. A portion of the building was destroyed when Monk sacked the town, and a new church was erected upon the site of that portion in 1788. In 1841 the remaining portion of the ancient cathedral was accidentally destroyed by fire, and was replaced by two elegant churches in the pure Gothic style. The square tower or old steeple is the only part of the original edifice which still remains. It is a fine building of massive proportions, and 156 feet in height. Besides these, there are St Andrew's church, King Street, a neat building with a spire 139 feet high; St Paul's Free Church, on the south side of Nethergate Street, a fine structure, surmounted by a light and tasteful spire 160 feet high; and St Paul's Episcopal church, Castlehill, a very handsome edifice, adorned with a lofty spire about 210 feet in height. Some of the other places of worship are neat and tasteful buildings. The Established Church possesses 8 of these; the Free Church, 10; United Presbyterians, 6; Congregationalists, 4; Episcopalians, 2; Roman Catholics, 2; and the other religious bodies have about 10 places of worship.

Among the other public buildings deserving of notice are the Town-house surmounted by a spire of handsome proportions; the Custom-house; the New Infirmary, with accommodation for upwards of 300 patients; the county prison and bridewell; Dudhope Castle and barracks. The inhabitants enjoy the privilege of recreation on the top of the Law. Besides the Magdalen Yard, a fine pleasure-ground at the west end of the town, the bleaching green and barrack park have been lately opened as places of public recreation; and a new pleasure-ground has also been formed at the east end of the town, to which skating and curling ponds are attached.

The charitable and benevolent institutions are numerous. The principal of these are the royal infirmary and dispensary, the royal lunatic asylum, the orphan institution, and industrial or ragged schools. There are likewise several mortifications for purposes of education, and the support of aged and infirm persons.

Within a comparatively recent period a number of important public undertakings have been completed. The Dundee and Newtyle railway was opened for traffic in 1826; the Dundee and Arbroath railway in 1838; and the Dundee and Perth railway in 1847. By means of these railways, and of the Edinburgh, Perth, and Dundee railway, which joins the Dundee and Arbroath railway by means of a ferry and branch line at Broughty Castle, 4 miles east from the town, Dundee has direct communication with all parts of the kingdom. There are two gas-light companies, each of them with a capital of about L.50,000 invested in their works and apparatus. The Dundee water company was formed in 1846. Its capital is about L.130,000. Its reservoirs are situated in the parish of Monikie about 10 miles distant from the town; and from these an abundant supply of water has been procured.

The most important of the public works are the harbour and docks. Previously to 1815 the harbour was of very limited extent. In that year an act of parliament was obtained for enlarging it, and erecting a wet dock of $6\frac{1}{4}$ acres (King William's), a tide harbour of $4\frac{3}{4}$ acres, graving dock, and other accommodation suitable for the increasing trade of the port. The plan was afterwards greatly enlarged, embracing new docks (Earl Grey's of $5\frac{1}{4}$ acres, and Victoria dock of $14\frac{1}{2}$ acres), patent slip, careening-beach, and additional tide harbours. The Victoria dock, though for some years open to vessels, is not quite completed. The quays are wide, and afford convenient berthage for about 70 vessels. On the south quay of Earl Grey's dock is erected a large crane capable of raising 30 tons. It is used chiefly for lifting the boilers and heavy machinery of steam-vessels.

Dundee.

Besides the ordinary branches of shipbuilding, the building of iron vessels is carried on at the port. Owing to the increased burden of the vessels now employed in the trade of the place, and the greater depth of water required by them, additional works at the harbour are projected. The cost of the docks and harbour may be stated at L.600,000.

The number and tonnage of vessels entered at the harbour for the year ending 31st May 1854 was as follows:—

Vessels in foreign trade,	682	Register tonnage,	110,637
... coasting trade,	1755	...	158,334
... river trade,	633	...	28,262
Total,	3070		297,233

The following statement shows the progressive increase in the harbour and shipping dues. It was—

In 1780	L.305
1795	965
1805	1272
1815	4400
1835	11,908
1854	23,402

The staple trade of Dundee is the manufacture of linen and hempen fabrics, chiefly of the coarser descriptions. The manufacture of linens appears to have been introduced from Germany in the beginning of last century. Insignificant in extent at first, it gradually increased till the close of that century, when, machinery having been applied to the spinning of flax, a great impulse was given to it. Spinning mills were erected, and of these there are now about sixty in Dundee and its immediate neighbourhood. Handspinning has been entirely superseded by mill-spinning. The coarser fabrics are still woven in hand-looms; but there are now six or seven large power-loom factories, and some smaller ones. The chief articles of manufacture are sheetings, sail-cloth, drills, dowlas, sacking, and bagging. Nearly one-half of the quantity made is sent to London, Manchester, Glasgow, and Leeds, for home consumption. The remainder is exported either directly or indirectly to foreign countries. The manufacture of jute carpeting is also now carried on to a large extent. The number of persons employed in the linen trade of the place is estimated to be from 20,000 to 25,000.

The quantity of flax, hemp, codilla, and jute, imported for the year ending 31st May 1854, was as follows:—

At the harbour	54,341 tons.
By railway	11,406
Total,	65,747

The quantity of linen goods sent away for exportation and home consumption for the same period was as follows:—

Linens of all descriptions shipped at the harbour	421,432 pieces.
By railway	686,110
Total,	1,107,542 pieces.

Assuming the value of the material at L.30 per ton, its total value used in manufactures will be L.1,872,410.

Assuming the value of the goods manufactured to be 60s. per piece, their gross value will be L.3,322,626; and, on this assumption, the balance of L.1,450,216 represents the cost of the manufacture, including wages, the rents of premises and machinery employed in it, and the profits of the manufacturers.

From the foregoing statements, some idea may be formed of the rapid increase of the town in commerce, wealth, and population. Dundee is now the principal seat of the linen trade of the United Kingdom, and its fabrics are to be met with in all quarters of the world. In proof of the prudential habits of the people, it may be mentioned that a national security savings-bank, opened in 1838, now contains upwards of L.70,000, lodged by 4632 depositors.

Dundee was remarkable at an early period for its ardent attachment to the principles of the Reformation, and it was long designated the "Geneva of Scotland." Many eminent ministers of the gospel laboured here, amongst whom may be mentioned John Willison and Dr Robert Small. It is the native place of the Fletchers and Scrimgeours, of Admiral Viscount Duncan, and George Dempster of Dunnichen.

The country surrounding the town is fertile and well cultivated; and has shared largely in its prosperity, the rents having increased much, and the value of the land being augmented in proportion. With the natural advantages which it enjoys, and the energy and enterprise for which the inhabitants are distinguished, Dundee may be expected to maintain the position which it now holds among the commercial towns of the British empire.

Dunfermline.

DUNFERMLINE, a royal burgh of Scotland, situated in the western district of the county of Fife, 15 miles N.W. of Edinburgh, in W. Long. 3. 27. 11.; N. Lat. 56. 5. 3. The town is built on an extensive eminence, having a pretty steep and uniform declivity towards the south, and likewise declining into a ravine on the west, which divides the more ancient part of the town from the extensive suburb of Pittencrieff. This ravine is crossed by an earthen mound, on which an excellent street is built, and is equal to the second-rate streets of the metropolis, and surpasses in its uniformity, and the appearance of its shops, the principal streets of most country towns. The town is situated about 270 feet above the level of the sea, and about three miles distant from Limekilns, the nearest place on the coast. It may be described as consisting of one principal thoroughfare, and several parallel streets stretching from east to west, near the top of the eminence on which the town is built, which is intersected at right angles by streets running up and down the hill, terminating in a plain both at the top and bottom. From its elevated situation, the prospect all around is very extensive. Seen from the south or west, the town has a very noble appearance, principally from its irregular outline, and the many prominent objects, such as steeples and public buildings, with which the whole is adorned; and it is here and there interspersed with gardens and trees, which give it a very pleasing and picturesque appearance, flanked as it is on the west by the extensive parks of Pittencrieff, and on the east by the grounds of Viewfield and Comely Park. The building most worthy of notice is the Abbey Church, which has been erected on the site of the Church of the Holy Trinity, built by Malcolm Ceanmore, about the middle of the eleventh century. This was demolished by Edward I. on the 10th February 1304, and subsequently at the Reformation, on the 28th March 1560. However at the latter period, the nave escaped destruction, and was used as a place of worship till September 1821, when the new church was opened for divine service. It is a splendid edifice, in the Gothic style. Over the centre of the cross is erected a square tower ninety feet high, terminating in a flat roof, round the four sides of which, in open hewn work, are the words "King Robert the Bruce," in capital letters four feet in height, surmounted by royal crowns and lofty pinnacles on the four corners. The old church forms a very fine entrance to the new; and the extensive repairs recently made on it by the Commissioners of Woods and Forests have rendered it still more impressive. It is of various orders of architecture, accordant with the different ages in which it has been altered and repaired. The interior of the New Abbey Church is extremely elegant. Its tower and galleries are supported by magnificent piers, moulded on the solid mason-work with Roman cement, into small columns, which form the aggregate pier, the capitals of which are adorned with exquisite imitations of foliage. The ribs of the arches composing the different roofs and the central ornaments are in the purest style, and,

seen from any point, the effect of the whole is at once magnificent and pleasing. Exactly below the pulpit, which is of wainscot, and in the Gothic style, lie the remains of Robert Bruce; and in the north transept lie seven other kings, two queens, and numbers of the nobility. Besides the old church and steeple, the remains of the ancient buildings consist of the south-west wall of the palace, which hangs on the brink of a deep hollow, through which runs a small stream, a building over a gate, probably the principal entrance to the palace yard, the south wall of the Refectory or Fraters Hall, and a large window of elegant workmanship. There are likewise some slight traces of Malcolm Ceanmore's tower, which formed the original nucleus of the town. The Guildhall, which was erected in 1808, is an edifice of Roman architecture, with a spire 132 feet in height. It consists of a large hall intended for meetings of guildry. It has lately been acquired by the county, and is used for sheriff and justice-of-peace courts and other public offices.

The town-house is a narrow building. It now contains the burgh-court rooms, the council-hall, and chambers for the town-clerk, the prison having been removed and a superior modern prison built in the outskirts of the town. In the same locality there has also been erected a commodious and well arranged poor-house, with a fever hospital adjoining. The council-hall is adorned with some good paintings, and is surmounted by a spire.

The educational institutions of the town are numerous, consisting of the High School, under the patronage of the town-council, and partially endowed; the Commercial Academy, the property of the guildry; the Maclean Schools, built and endowed by bequest of the late Rev. Allan Maclean, a minister of the parish; the Free Abbey Church Schools, and several others—all well conducted; but for a complete educational course there is still wanting one good academy taught by several masters for the different branches.

A school of art has lately been instituted in connection with the Board of Trade Department of Science and Art, and for its accommodation a tasteful and appropriate building has been erected by public subscription.

The linen trade is of considerable antiquity in Dunfermline. It began originally with ticks and checks. The first table-linen manufactured here was a kind called huckaback; this was followed in course of time by damask, the richest and most ingenious kind of table-linen, which has been for the last century improving in quality and pattern, and is still continuing to be improved. The value of table-linens, diapers, and table-covers annually manufactured here is estimated at about L.450,000. Power looms for the weaving of all descriptions of diaper, and some varieties of damask, have been in use for several years. There are now two power-loom factories, employing about 700 hands.

At one period there were eight flax-spinning mills here; they have now dwindled to *one*, and that chiefly for the production of sewing thread; the yarns used in the trade being now imported from various places in England, Scotland, and Ireland, chiefly from the two latter. The decline of the flax-spinning trade is attributed to the want of facility for the importation of the bulky raw material. A proposal is now on foot for connecting Dunfermline by railway with a harbour at Queensferry, about 5½ miles distant. Were this scheme carried out it would give the town the advantage of a shipping port, and probably re-establish in it the trade of flax-spinning.

Extensive works are in operation in the immediate vicinity of the town for the manufacture of malleable iron. They were originally erected by a joint-stock company, and are now the property of the Weardale Iron Company.

This town is remarkable as having been the theatre in which the principal dissents from the Established Church have taken their rise; that, namely, of the Seceders under Ralph Erskine, and that of the Relief body under George Gillespie. It is amply supplied with places of worship in connection with the various denominations; there being three congregations of the Established Church, three of the Free Church, four of the United Presbyterian, and one each of the Independent, Baptist, Episcopalian, Morrisonian, Roman Catholic, and Rowite persuasions.

The population in 1851 was 8577 within the municipal boundaries; and 13,836 within the parliamentary bounds.

DUNGANNON, a municipal and parliamentary borough and market-town of Ireland, county Tyrone, standing on the acclivity of a hill, 8 miles from Lough Neagh. Pop. (1851) 3854. It consists of a square, with several diverging streets, and is generally well built. The chief public buildings are the parish church, Roman Catholic chapel, two Presbyterian, and two Methodist meeting-houses, court-house, bridewell, market-house, savings-bank, fever hospital, temperance hall, and an endowed school. Manufactures—chiefly linens and coarse earthenware. Market-day Thursday. Dungannon returns one member to parliament.

DUNGARVAN, a municipal and parliamentary borough and seaport-town of Ireland, county of Waterford, and 25 miles W.S.W. from the town of that name. It is situated in the bay of Dungarvan at the mouth of the Colligan, which divides the town into two parts, and is crossed by a bridge with a single arch. The eastern portion is called Abbey-side. The town generally has a neat appearance, and has recently been much improved by the exertions of the Duke of Devonshire. In summer it is resorted to for sea-bathing. The principal public buildings are the parish church, two Roman Catholic chapels, a convent, fever hospital, union workhouse, market-house, and an ancient castle now used as barracks. Pop. (1851) 6417, chiefly engaged in the fisheries. The principal exports consist of grain, butter, and cattle. Vessels of more than 250 tons burden cannot come to the quay. Market-day Saturday. The borough returns one member to the imperial parliament; constituency (1851) 314.

DUNKELD, a burgh of barony and market-town of Scotland, county of Perth, on the north bank of the Tay, 15 miles N.N.W. from Perth. The river is here crossed by a fine bridge of seven arches, built in 1809, and communicating with Little Dunkeld, a suburb on the opposite side of the river. Pop. (1851) 1104. The situation of Dunkeld is truly romantic, and the surrounding scenery highly picturesque. It stands in the centre of a valley surrounded by mountains of considerable elevation, which are wooded to the summit. With the exception of one new street, the houses are generally old and mean. The most striking object in the town is the ancient and venerable cathedral—an edifice partly Saxon and partly Gothic; the remains of which are both extensive and in good preservation. The centre of the nave is 120 feet by 60, the walls 40 feet high, and its aisles 12 feet wide. It is now roofless; but the choir was rebuilt and handsomely fitted up by the late Duke of Atholl, and is now used as the parish church. On the north side of the choir is the charter-house, built by Bishop Lauder in 1469; beneath which is the sepulchral vault of the Atholl family. In the porch of the church is the tomb of Alexander Stuart Earl of Buchan, better known as the Wolf of Badneoch, who died in 1384. Here, so early as 729, the Culdees had a monastery, which was converted into a cathedral by David I. in 1127. Among the bishops of Dunkeld were *Bruce's* bishop Sinclair, Gavin Douglas the translator of the *Æneid*, and Henry Guthrie author of "Memoirs of Scottish Affairs from 1637 to the death of Charles I." Immediately behind the cathedral stands the ancient mansion of the dukes of Atholl. A magnificent new mansion was commenced by the late duke, but at his death in 1830 its progress was suspended. The magnificent grounds of the ducal residence are not surpassed in extent and beauty by any in Scotland. The larch woods alone cover an area of 11,000 acres. The late duke

planted about twenty-seven millions of these trees, besides several millions of other kinds. The site of Birnam Wood, so famous for its connection with the fate of Macbeth, is about three miles S. of Dunkeld. The Braan, a mountain stream which falls into the Tay, nearly opposite to Dunkeld, forms a magnificent cascade of 80 feet in height, and known as the "Rumbling Brig," from a narrow bridge made by the fall of two rocks across the stream. The stream has a second fall which, but for the other, would be deemed superb.

DUNKERQUE, DUNQUERQUE, or DUNKIRK, a strongly fortified seaport-town of France, capital of an arrondissement in the department of the Nord, is situated on the E. shore of the Straits of Dover, 174 miles from Paris, and 50 miles from Lille; N. Lat. 51. 2.; E. Long. 2. 23. Pop. (1851) 26,886.

Dunkerque is a handsome and well-built town, with an air of great bustle and commercial prosperity. Its principal public squares, the Place Jean Bart and the Champ-de-Mars, are wide and spacious, planted with trees and adorned with statues. The public buildings worthy of notice are the church of St Eloi, a motley edifice, partly Gothic and partly Corinthian in architecture; the barracks and military magazines, the beffroi, the lighthouse, and the theatre. The trade of Dunkerque is already very considerable, and has increased with great rapidity ever since the town was made a free port in 1826. The chief articles of manufacture are soap, beet-root sugar, starch, and leather. There are also some important shipbuilding-yards and iron-foundries. The fisheries of the coast are valuable and extensive. Dunkerque possesses tribunals of first instance and of commerce, a chamber of commerce, a custom-house, and a school of navigation; and the consuls of various foreign countries reside in the town.

Dunkerque traces its existence as far back as the days of St Eloi, who is said to have founded on the site of the present town a chapel round which a small village speedily sprang up. In the tenth century Baldwin III., Count of Flanders, raised the village to the rank of a town: and in the sixteenth century Charles V. built a fort for the protection of the harbour, no traces of which, however, now exist. In 1558 the English, who had for some time held possession of the town, were expelled from it by the French, who in the ensuing year surrendered it to the Spaniards. In the middle of the seventeenth century it once more passed into the hands of the French, who, after a few years' occupation of it, again restored it to Spain. In 1658 it was retaken by the French and made over to the English. After the restoration, Charles II. was compelled by his extravagance to sell the town to the French king Louis XIV., who fortified it. In 1793 it was attacked by the English under the Duke of York, who, however, was compelled to retire from before its walls with severe loss.

DUNKERS (First-day or German Baptists), a sect founded by Alexander Mack in Schwarzenau about the year 1708. The origin of the name is unknown. Having been persecuted in Germany, they fled to Holland and thence to America, where they founded their first church in Germantown in 1723. They repudiate the practice of judicial oaths, mercantile interest, and warfare. Celibacy is not enjoined, but the sexes dwell apart, and have separate divine service. Their mode of life is simple, and they confine themselves to vegetable diet. They believe in the doctrines of human merit and works of supererogation; and get rid of eternal punishments by the hypothesis of periodical purgations. Their liturgy is simple. They celebrate the Lord's Supper at night with a love feast, the kiss of charity, washing the feet, and striking the hand as a pledge of mutual confidence. By their industry they are generally in comfortable circumstances, and have about 50 churches and 40 preachers. Dr Klose estimates their numbers at 30,000.

DUNMANWAY, a market-town of Ireland, county of Cork, on the Brandon, near the junction of the three streams which form that river, 33 miles W. by S. of Cork. Pop. (1851) 2222. It has two Episcopalian churches, a Roman Catholic and a Methodist chapel, and a bridewell. The linen trade, formerly rather flourishing, has declined; but tanning and brewing and the corn trade are actively carried on.

DUNMOW, GREAT, a market-town and parish in the county of Essex, on the river Chelmar, 38 miles from London. It is a town of very ancient date, supposed to be the Cæsaromagus of the Romans; and here remains of the road to Colchester, constructed by that people, are still visible. Pop. of parish (1851) 3235, chiefly engaged in the manufacture of sacking and coarse cloth. Market-day Saturday. Near it is Little Dunmow, remarkable for the ancient right which a happy couple have to demand a flitch of bacon at the end of a year from their marriage.

DUNNAGE, in *Commercial Navigation*, denotes loose wood, boughs, or other materials, laid above the ballast of a ship, to preserve the cargo from injury.

DUNNING, JOHN, LORD ASHBURTON, an eminent English lawyer, was the second son of Mr John Dunning of Ashburton, Devonshire, an attorney. He was born at Ashburton Oct. 18, 1731, and was educated at the free grammar-school of his native place, where he soon distinguished himself in classical literature and mathematics. On leaving school he was taken into his father's office, where he remained until the age of nineteen, when he was sent to the Temple. At the bar he came very slowly into practice. In 1762 he was employed to draw up *A Defence of the United Company of Merchants of England trading to the East Indies, and their Servants, particularly those at Bengal, against the Complaints of the Dutch East India Company to His Majesty on that subject;* and the masterly style which characterized the document procured him at once reputation and emolument.

In 1763 he distinguished himself as counsel on the side of Wilkes; and his professional business from that period gradually increased to such an extent, that in 1776 he is said to have been in the receipt of nearly L.10,000 per annum. In 1766 he was chosen recorder of Bristol, and in December 1767 he was appointed to the office of solicitor-general. This latter appointment he held till May 1770, when he retired, along with his friend Lord Shelburne. In 1771 he was presented with the freedom of the city of London. From this period he was considered as a regular member of the opposition party, and distinguished himself by many able speeches in parliament. He was first chosen member for Calne in 1768, and continued to represent that burgh until he was promoted to the peerage. In 1782, when the Marquis of Rockingham became prime minister, Dunning was appointed chancellor of the duchy of Lancaster; and about the same time he was advanced to the peerage, by the title of Lord Ashburton. He died while on a visit to Exmouth, Aug. 18, 1783.

The person of Lord Ashburton was by no means agreeable or prepossessing. He was a short, thick man, with a sallow countenance, a constant shake of the head, and a hectic cough, which frequently interrupted the stream of his eloquence. His oratory, however, was at once fluent, elegant, and argumentative, and he possessed a sound knowledge of the laws, and of the theory of our constitution. His language was pure and classical, yet peculiar to himself; and he had a great fund of wit and humour. His disposition was originally timid, but this defect he overcame by practice, as he became more familiar with forensic habits. Of the great extent of his practice some notion may be formed from the fortune he left behind him, which was all earned by his own exertions, and amounted to no less a sum than L.180,000.

Sir William Jones has pronounced a splendid eulogium

on the character of Lord Ashburton. "His language," says that accomplished scholar, "was always pure, always elegant; and the best words dropped easily from his lips into the best places, with a fluency at all times astonishing, and, when he had perfect health, really melodious. His style of speaking consisted of all the turns, oppositions, and figures, which the old rhetoricians taught, and which Cicero frequently practised, but which the austere and solemn spirit of Demosthenes refused to adopt from his first master, and seldom admitted into his orations, political or forensic. That faculty, however, in which no mortal ever surpassed him, and which all found irresistible, was his wit. This relieved the weary, calmed the resentful, and animated the drowsy; this drew smiles even from such as were the objects of it; scattered flowers over a desert; and, like sun-beams sparkling on a lake, gave spirit and vivacity to the dullest and least interesting cause. He was endued with an intellect sedate yet penetrating, clear yet profound, subtle yet strong. His knowledge, too, was equal to his imagination, and his memory to his knowledge."

Besides the *Answer to the Dutch Memorial*, Lord Ashburton is supposed to have assisted in writing a pamphlet on the law of libel, and to have been the author of *A Letter to the Proprietors of East India Stock, on the subject of Lord Clive's Jaghire, occasioned by his Lordship's Letter on that Subject*, 1764, 8vo. His lordship was at one time suspected of being the author of the celebrated *Letters of Junius*. (See Chalmers's *Biog. Dict.*, and Sir W. Jones's *Works*, vol. iv.)

DUNOON, a favourite watering-place in Argyleshire, on the Firth of Clyde, 9 miles W. of Greenock. It has an excellent pier, and many well-built houses and elegant villas. Numerous steamers from Glasgow and other places touch there. The castle was once a royal residence and a strong fortress, of which no remains except a wall are now visible. Pop. (1851) 2229.

DUNS, JOHN (commonly styled Duns Scotus), a schoolman of the highest reputation, is said to have been born in the year 1274, but the place of his birth has been long and much disputed. Dempster has asserted the claims of Scotland by twelve arguments;[1] but a less formidable number might perhaps have been sufficient. The designation *Scotus*, which is commonly added to his name, evinces him to have been a native either of Scotland or of Ireland; but the pretensions of the latter country cannot be supported by the authority of a single early writer. Wadding and other Irish authors who claim him as their countryman, persuade themselves that he was born at *Dunum*, or Downpatrick, and must thence have derived the name of Duns;[2] but this is obviously a mere conjecture, unsupported by tradition, and carrying with it no great plausibility. Leland claims him as an Englishman, on the authority of certain manuscript copies of his works, preserved in the library of Merton College, and bearing a colophon which describes him as born at the village of Dunstane in the county of Northumberland.[3] But if this had been the place of his birth, his surname ought to have been Dunstane. It apparently belongs to the class of local surnames, or those derived from places of birth or habitation; and we have little or no hesitation in supposing him to have been a native of Dunse in the county of Berwick. This surname is still to be found in Scotland. He is mentioned as a native of Scotland by Trithemius,[4] and likewise by Paulus Jovius, Sixtus Senensis, Possevin, and many other writers of various countries. We are told that when a boy he became accidentally known to two Franciscan friars, who, finding him to be a youth of very extraordinary capacity, took him to their convent at Newcastle, and afterwards persuaded him to become one of their fraternity. From thence he was sent to Oxford, where he became a fellow of Merton College, and professor of divinity; but it appears that he had likewise studied at Paris. His lectures were frequented by a prodigious concourse of students. His fame was now become so universal, that the general of his order removed him to Paris, that the students of that university might also have the benefit of his lectures. He went to Paris in the year 1304, where he is said to have been honoured first with the degree of bachelor, then of doctor of divinity, and in 1307 to have been appointed regent of the divinity schools; but as he had taught divinity at Oxford, he must previously have taken at least one degree in that faculty. During his residence at Paris arose the famous controversy about the immaculate conception of the Virgin Mary. Albertus Magnus maintained that she was born in original sin. Scotus advanced two hundred arguments in support of the contrary opinion, and convinced the university of Paris that she was really conceived immaculate. This important nonsense, however, continued to be disputed till 1496, after the council of Basel, when the university of Paris made a decree, that no student who did not believe the immaculate conception should be admitted to a degree. Duns had not been above a year at Paris, when the same general of the Franciscans ordered him to remove to Cologne, where he was received with great pomp and ceremony by the magistrates and nobles of that city, and where he died of apoplexy soon after his arrival, in 1308, in the thirty-fourth year of his age. Some writers have reported that he was buried in an epileptic fit, and that, upon removing his bones, he appeared to have turned himself in his coffin; or, according to another account, to have gnawed the flesh from one of his arms. The genius of this renowned schoolman, who obtained the appellation of *Doctor Subtilis*, or the Subtle Doctor, reflects no inconsiderable lustre on the nation to which he belonged: he maintained a reputation almost unrivalled till the scholastic theology and scholastic philosophy were finally exploded. His followers, who were called Scotists, opposed the opinions of the Thomists, or followers of St Thomas Aquinas. An edition of his works, accompanied by a life of the author by Luke Wadding, was published at Lyon in 12 volumes folio. See SCOTISTS, and SECOND PRELIMINARY DISSERTATION to this work, § iii.

DUNSE, a burgh of barony and market-town of Berwickshire, Scotland, 15 miles W. from Berwick, and 44 miles S.E. from Edinburgh. Besides the town-house, a modern Gothic building, it contains a parish church, a Free church, 3 United Presbyterian chapels, and chapels for Episcopalians and Independents. There are fairs for cattle in June, August, and November; for wool in July; and for sheep in March, May, July, and September. The sheriff-courts for the county are held here. Dunse was the birth-place of Duns Scotus; and in the parish were born the Rev. Thomas Boston and Dr M'Crie. Near it is Dunse Law, which still retains vestiges of its occupation by General Leslie in 1639. Pop. (1851), 2567.

DUNSTABLE, a market-town of Bedfordshire, in the parish of Dunstable, and hundred of Manshead, 33 miles N.W. from London (47½ by N.-Western railway), and 18 miles S.S.W. from Bedford. It is situated on the ancient Watling and Icknield streets, and is generally supposed to have been the *Magiovinium* of the Romans. It rose into importance after the erection (by Henry I.), in 1131, of a priory of black canons, of which the present parish church formed part. The present building presents a remarkable

[1] Dempsteri Asserti Scotiæ Cives esse sui; S. Bonifacius rationibus ix. Joannes Duns rationibus xii. Bononiæ, 1621, 4to.
[2] Wadding Scriptores Ordinis Minorum, f. 201, a. Romæ, 1650, fol. [3] Lelandus de Scriptoribus Britannicis, tom. ii., p. 317.
[4] Trithemius de Scriptoribus Ecclesiasticis, f. 76, a. Basil. 1494, fol.

Dunstan. fine front in the mixed Norman style; and, besides several ancient brasses, contains the "Last Supper" by Thornhill. There are also chapels for Baptists and Wesleyan Methodists, and several schools and almshouses. Many of the females are engaged in the manufacture of straw-plait. There is a weekly market on Saturday, besides quarterly fairs principally for sheep. The neighbouring chalk downs furnish a breed of larks of unusual size. Pop. (1851) 3589.

DUNSTAN, Saint, a famous archbishop of Canterbury. He was descended from a noble family in Wessex, and educated in the abbey of Glastonbury, where he studied so hard that he was seized with a violent fever, which brought him to the very point of death. When the whole family were standing about his bed, dissolved in tears, and expecting every moment to see him expire, an angel came from heaven in a dreadful storm, and gave him a medicine which restored him to perfect health in a moment. Dunstan immediately started from his bed, and ran with all his speed towards the church to return thanks for his recovery; but the devil met him by the way, surrounded by a great multitude of black dogs, and endeavoured to obstruct his passage. This would have frightened ordinary boys, but it had no effect whatever upon Dunstan, who, having pronounced a sacred name, and brandished his stick, put the devil and all his dogs to flight. The church doors being shut, an angel took him up in his arms, conveyed him through an opening in the roof, and set him softly down on the floor, where he performed his devotions. After his recovery, he pursued his studies with the greatest ardour, and soon became a perfect master in philosophy, divinity, and music; painting, writing, and sculpture; besides working in gold, silver, brass, iron, and other metals. Whilst still young he entered into holy orders, and was introduced by his uncle Athelm, archbishop of Canterbury, to King Athelstan, who, being charmed with his person and accomplishments, retained him at his court, and employed him in many great affairs. At leisure hours he used to entertain the king and his courtiers with playing on the harp, or some other musical instrument; and now and then, by way of variety, he wrought a miracle, which gained him great admiration. But his old enemy the devil was much offended at this, and prompted some envious courtiers to persuade the king that his favourite was a magician; a story which that prince too readily believed. Dunstan, however, having discovered by the king's countenance that he had lost his favour, resolved to resign rather than be dismissed, and accordingly retired from court to another uncle, who was Bishop of Winchester. This good prelate prevailed upon his nephew to forsake the world and become a monk; and Dunstan retired to a little cell built against the church wall of Glastonbury. Here he slept, studied, prayed, meditated, and sometimes amused himself with forging several useful things in brass and in iron. One evening as he was working very busily at his forge, the devil, putting on the appearance of a man, thrust his head in at the window of his cell, and asked him to make something or other for him. Dunstan was so intent upon his work that he made no answer, upon which the devil began to swear and to talk obscenely. This betrayed the lurking fiend. But the holy blacksmith was prepared for all casualties; so putting up a secret ejaculation, he pulled his tongs, which were red hot, out of the fire, and seizing the devil by the nose, squeezed the Satanic organ of smell with a degree of energy which caused his infernal majesty to bellow and scold at such a rate that he awakened and terrified all the people for many miles around. Thus far the legend.

However ridiculous these fictions may seem, they served, in those times of ignorance, to procure Dunstan a reputation which has been confirmed by the authority of several succeeding historians. It appears that this extraordinary person was called to court in 941 by King Edmund, who bestowed upon him the rich abbey of Glastonbury, which for his sake he honoured with many peculiar privileges. Dunstan enjoyed in a very high degree the favour of this prince during his short reign of six years; but he stood much higher in the grace of his brother and successor King Edred, to whom he was confessor, chief confidant, and prime minister. During this period of court favour he employed all his influence in promoting the interest of the monks of the Benedictine order, to which he belonged, and of which he was a most active and zealous patron. Having the treasures of these two princes, especially of the last, at his command, he lavished them away in building and endowing monasteries for these monks, because almost all the old monasteries were in the possession of secular canons; and not contented with this, he persuaded Edred to bestow, by his last will, such immense treasures on the churches and monasteries, that the crown was stripped of its most valuable possessions, and left in a state of indigence. This conduct of Dunstan, whilst he was in power, rendered him very odious to Edwy, who succeeded his uncle Edred in 955; and his rude behaviour to the king himself, and his beloved queen Elgiva, raised the resentment of that prince to such a height that he deprived Dunstan of all his preferments, and drove him into exile. The banishment of Dunstan, the great patron, or, as Malmsbury calls him, the prince of monks, was a severe blow to that order, who were in consequence expelled from several monasteries. But their sufferings were not of long continuance; for Edgar, the younger brother of Edwy, having raised a successful rebellion against his brother, and usurped all his dominions on the north side of the Thames, recalled Dunstan, and in 957 conferred on him the bishopric of Worcester. From this moment he was the chief confidant and prime minister of King Edgar, who in 959 became sole monarch of England, by the death of his elder brother Edwy. In the following year Dunstan was raised to the archiepiscopal see of Canterbury; and being thus possessed of the primacy and assured of the royal support and assistance, he prepared to execute the grand design which he had long meditated, of compelling the secular canons to put away their wives and become monks, or, in case of resistance on their part, of driving them out, and introducing Benedictine monks in their stead. With this view he procured the promotion of Oswald to the see of Worcester, and of Ethelwald to that of Winchester, two prelates who were monks themselves, and animated with the most ardent zeal for the advancement of their order; and these three great champions of monachism found means, by their arts and intrigues, in the course of a few years, to fill no fewer than 48 monasteries with Benedictines. But on the death of Edgar in 957 they received a check. The sufferings of the persecuted canons had excited much compassion; and many of the nobility, who had been overawed by the power and zeal of the late king, now espoused their cause and promoted their restoration. Elferc duke of Mercia drove the monks by force out of all the monasteries in that extensive province, and brought back the canons, with their wives and children; whilst Elfwin duke of East Anglia, and Brithnot duke of Essex, raised troops to protect the monks in these countries. In order to allay these commotions, several councils were summoned, and Dunstan was so hard pushed by the secular canons and their friends, that he was obliged to practise some of his holy stratagems; but finally, by dint of miracles, he overcame all opposition.

St Dunstan died in 988, in the sixty-fourth year of his age; having held the bishopric of London, together with the archbishopric of Canterbury, about 27 years. As this prelate was the great restorer and promoter of the monastic institutions, the grateful monks, who were almost the only historians of those dark ages, have loaded him with the most extravagant praises, and represented him as the

greatest wonder-worker and highest favourite of Heaven that ever lived.

DUNSTER, a market-town of Somersetshire, situated in a beautiful vale, at the foot of the Quantoch Hills, about a mile from the Bristol Channel. It consists chiefly of two streets, one running north and south, and the other branching off towards the west. The principal buildings are the castle and the parish church, the latter a spacious and handsome edifice with a tower. Pop. of parish (1851) 1184.

DUNUM, a Celtic term denoting a hill or eminence, which frequently enters into the composition of the ancient names of towns, to indicate their elevated situation as places of strength or citadels. See DUN.

DUNWICH, in Suffolk, 26 miles N.E. of Ipswich, the Domoc or Dunmoc of the Saxons, and the capital of East Anglia, was formerly an important seaport-town, and the seat of an extensive trade. Its harbour and the greater part of the town have been destroyed by encroachments of the sea, and it is now only a poor fishing village with 294 inhabitants.

DUODECIMO (abbreviated 12mo) is applied to a book of which each sheet is folded into 12 leaves.

DUODENUM, the commencement of the intestinal canal; the first of the small intestines. See ANATOMY.

DUPIN, LOUIS ELLIES, doctor of the Sorbonne, and professor of philosophy in the Royal College, one of the greatest ecclesiastical critics of his time, was born at Paris in 1657. When he published the first volume of his *Bibliothèque Universelle des Auteurs Ecclésiastiques*, in 1686, the liberty with which he discussed the merits of some ecclesiastical writers gave so much offence that, at the instigation of Bossuet, M. de Harlay, archbishop of Paris, compelled Dupin to make a retractation, and to suppress the work. He was, however, afterwards permitted to continue it, by altering the title from *Bibliothèque Universelle* to *Bibliothèque Nouvelle*. This great undertaking was ultimately brought to a close in 47 vols., and several translations of it appeared almost immediately. Dupin was a man of prodigious reading, and had an easy, happy way of writing, with a singular talent for analysis; a quality which renders his *Bibliothèque* very valuable. He was for some time editor of the *Journal des Sçavans*. He was banished for a time from his chair in the Royal College for having subscribed the famous *Cas de Conscience*, and thus identified himself in some measure with the Jansenists. He afterwards, however, withdrew his subscription, and was restored to office. He corresponded with Archbishop Wake in regard to the proposed union of the English and French Churches, and is said to have been consulted by the czar of Russia in regard to a similar union of the French with the Greek Church. Dupin died in 1719.

DUPLE (Lat. *duplus*), double. Duple ratio is that of 2 to 1. Thus the ratio of 8 to 4 is duple, or as 2 to 1.

Sub-duple ratio is the reverse, or as 1 to 2, 4 to 8, 6 to 12, &c.

DUPLICATE, a copy or transcript of anything; as of a deed, letter, bill of exchange, &c.

DUPLICATION, the act of doubling; the multiplication of a number by 2. Also a folding; a fold.

DUPLICATION OF THE CUBE, a celebrated problem of the ancient geometry, by which it was required to construct a cube whose solid contents should be double the solid contents of a given cube. See MATHEMATICS.

DUPLICATURE, a doubling; a fold. In *Anatomy*, the folds of a membrane or vessel.

DUPONDIUS, in *Antiquity*, a weight of two pounds, or money of the value of two asses. See AS; LIBRA; POUND.

DUPPA, BRIAN, a learned English bishop, was born in 1589, at Lewisham, Kent, where his father was then vicar. In 1634 he was constituted chancellor of the church at Sarum, and soon afterwards made chaplain to Charles I. He was appointed tutor to Charles prince of Wales and his brother James duke of York in 1638; and in the same year nominated to the bishopric of Chichester. In 1641 he was translated to the see of Salisbury, but received no benefit from this preferment, owing to the suppression of episcopacy. Charles I. held him in high esteem, and is said to have derived assistance from him in composing the *Eikon Basilike*. After the Restoration he was made bishop of Winchester, and lord high almoner. Duppa died at Richmond in 1662, aged seventy-three, and was buried in Westminster Abbey. He published a few sermons and tracts on practical religion.

DUPUIS, CHARLES FRANÇOIS, an eminent French writer, and member of the Institute, was born of poor parents at Trye-Château, between Gisors and Chaumont, Oct. 26, 1742. His father, who was a teacher, instructed him in mathematics and land-surveying. The Duke de la Rochefoucault, who accidently became acquainted with young Dupuis, took him under his protection, and gave him a bursary in the College of Harcourt.

Dupuis made such rapid progress in his studies, that at the age of twenty-four he was appointed professor of rhetoric at the college of Lisieux. In his hours of leisure he applied himself to the study of the law, and in 1770 was admitted an advocate before parliament. He was charged by the rector of the university with the task of delivering the customary discourse at the distribution of prizes; and he was also employed in the name of the university to compose the funeral oration of the Empress Maria Theresa of Austria. These two works having been printed, they were admired on account of their elegant Latinity, and laid the foundation of the author's fame as a writer.

The mathematics having been the object of his early studies, he now devoted his more serious attention to that science; and for some years he attended the astronomical lectures of Lalande, with whom he formed an intimate friendship. In 1778 he constructed a telegraph on the principle suggested by Amontons; and employed it in keeping up a correspondence with his friend M. Fortin in the neighbouring village of Bagneux, until the Revolution rendered it necessary that he should destroy his machine to avoid the danger of suspicion.

Much about the same time, Dupuis formed his ingenious theory with respect to the origin of the Greek months. In the course of his investigations upon this subject, he composed a long memoir on the constellations, in which he endeavoured to account for the dissimilarity of the groups of stars in the heavens with their representations even on the most ancient planispheres, by supposing that the zodiac was, for the people who invented it, a sort of calendar at once astronomical and rural. It seemed only necessary, therefore, to discover the clime and the period in which the constellation of *Capricorn* must have arisen with the sun on the day of the summer solstice, and the vernal equinox must have occurred under *Libra*. It appeared to Dupuis that this clime was Egypt, and that the perfect correspondence between the signs and their significations had existed in that country for a period of between fifteen and sixteen thousand years before the present time; that it had existed only there; and that this harmony had been disturbed by the effect of the precession of the equinoxes. He therefore ascribed the invention of the signs of the zodiac to the people who then inhabited Upper Egypt or Ethiopia. This was the basis on which Dupuis established his mythological system, and endeavoured to explain the curious subject of fabulous history, and the whole system of the theogony and theology of the ancients.

Persuaded of the importance of his discoveries, which, however, were by no means entirely original, Dupuis published several detached parts of his system in the *Journal*

des Sçavans for the months of June, October, and December 1777, and of February 1781. These he afterwards collected and published, first in Lalande's *Astronomy*, and then in a separate volume in 4to, 1781, under the title of *Mémoire sur l'Origine des Constellations, et sur l'Explication de la Fable par l'Astronomie.* The theory propounded in this memoir was refuted by M. Bailly, in the fifth volume of his *History of Astronomy;* but, at the same time, with a just acknowledgment of the erudition and ingenuity exhibited by the author.

Condorcet proposed Dupuis to Frederick the Great of Prussia as a fit person to succeed Thiébault in the professorship of literature at Berlin; and Dupuis had accepted the invitation, when the death of the king put an end to the engagement. The chair of humanity in the college of France having at the same time become vacant by the death of M. Bejot, it was conferred on Dupuis; and in 1788 he became a member of the Academy of Inscriptions. He now resigned his professorship at Lisieux, and was appointed by the administrators of the department of Paris one of the four commissioners of public instruction.

At the commencement of the revolutionary troubles Dupuis sought an asylum at Evreux; and having been chosen a member of the national convention by the department of the Seine-et-Oise, he distinguished himself by the moderation of his speeches and public conduct. In the third year of the republic he was elected secretary to the assembly, and in the fourth he was chosen a member of the council of Five Hundred. After the memorable 18th *Brumaire* he was elected by the department of Seine-et-Oise a member of the legislative body, of which he became the president. He was afterwards proposed as a candidate for the senate; and here terminated his political career.

In 1794 he published his large work, entitled *Origine de tous les Cultes, ou la Religion Universelle*, 3 vols. 4to, with an atlas, or 12 vols. 12mo. This work made a considerable sensation at first; it gave umbrage to many, was attacked and defended with warmth, at length ceased to be read, and fell into utter neglect. In 1798 he published an abridgment of this work in one volume 8vo, which met with no better success. Another abridgment of the same work, executed upon a much more methodical plan, was published by M. de Tracy. The other works of Dupuis consist of two memoirs on the *Pelasgi*, inserted in the *Memoirs of the Institute;* a memoir *On the Zodiac of Tentyra*, published in the *Revue Philosophique* for May 1806; and a *Mémoire Explicatif du Zodiaque Chronologique et Mythologique* published the same year, in one volume 4to. It was from the perusal of the poem of *Nonnus*, which he once thought of translating into French, and of which a fragment was printed in the *Nouvel Almanach des Muses* for 1805, that Dupuis caught the first idea of his astronomical system.

Dupuis died at Is-sur-Til, Sept. 29, 1809, leaving behind him several manuscripts on subjects connected with the works which he had published during his life. He was a member of the Legion of Honour; and his character was that of an honest man and a paradoxical writer. He was sprung from poor parents, and never acquired any fortune. M. Dacier, secretary to the third class of the Institute, delivered his *Eloge;* and an historical account of his life and writings was published by his widow. (See also *Biographie Universelle.*)

DUPUYTREN, GUILLAUME, BARON, one of the most distinguished of French surgeons, was born October 6, 1777, at Pierre Buffière, a small town of Limousin. He was sprung from poor parents, and was furnished with the means of receiving an ordinary education at the Collége de la Marche, by some charitable persons to whom he had been introduced. At the Ecole de Médecine, he began the study of medicine with invincible ardour, and was appointed prosector of the faculty when only 18 years of age. When only 26 he succeeded Peletan as head surgeon at the Hôtel-Dieu; and he was appointed professor of surgery at the age of 33. At the same time he became inspector of the university, a chevalier and afterwards an officer in the Legion of Honour, chevalier of St Michel, baron, member of the Institute, and first surgeon to the king.

Dupuytren's energy and industry were alike remarkable. He visited the Hôtel Dieu morning and evening, performing at each time several operations, lectured to vast throngs of students, gave advice to his out-door patients, and fulfilled the duties consequent upon one of the largest practices of modern times. By his indefatigable diligence and activity, he amassed a fortune of L.300,000, the bulk of which he bequeathed to his daughter, but deducting considerable sums for the endowment of the anatomical chair in the Ecole de Médecine, and the establishment of a benevolent institution for distressed medical men.

Dupuytren's writings are by no means numerous. The most important of them is his *Treatise on Artificial Anus*, in which the principles laid down by John Hunter are happily applied. In his operations he was remarkable for the skill and dexterity with which he overcame the numerous difficulties incidental to so extensive a practice as he enjoyed. Instead of attempting to introduce new methods of procedure, he commonly limited himself to modifying and adapting to his particular exigencies the established laws of surgery. In private life, Dupuytren was cold and reserved; his brow, furrowed with wrinkles, betrayed the weight of cares with which he was burdened; and it was seldom that a smile, except one of irony or disdain, played about his lips. His unsocial coldness was further heightened by his constant struggle against a consumptive tendency, which ultimately carried him off, 8th February 1835.

After death Dupuytren's head was opened, and his brain taken out and weighed. Its weight was found to be exactly the same with that of Dr Abercrombie, viz. 64 ounces.

DURA MATER, the outer enveloping membrane of the brain, overlying the *pia mater*, and adhering to the inner surface of the cranium. See ANATOMY.

DURANCE (the ancient *Druentia*), a river in the south of France, rising in Mont Genèvre, in the department of Hautes-Alpes, and falling into the Rhone 4 miles below Avignon, after a course of about 160 miles. It flows at first southward, through the departments of the Alps; and then, turning westward, forms the boundary between the departments of Vaucluse and Bouches-du-Rhône. Its chief affluents are the Buech and the Verdon. The current of the river is rapid, and large quantities of timber are floated down from the mountains, but no part of its course is navigable.

DURANDUS, GULIELMUS (1237–1296), one of the most learned lawyers of the thirteenth century, was born at Puymoisson, in Provence. He was a pupil of Henry of Susa, and taught canon law at Modena. He was afterwards made chaplain and auditor of the sacred palace, legate of Gregory X. at the council of Lyons, and in 1286 was raised to the see of Mende. His works are, 1. *Speculum Juris*, Rome, 1474, folio, whence he derived the name of *Speculator;* 2. *Rationale Divinorum Officiorum*, Mentz, 1459, folio, scarce; 3. *Repertorium Juris*, Venice, 1496, folio.

DURANGO, a province of Mexico. See MEXICO.

DURANGO, or GUADIANA, a city of Mexico, capital of the province of the same name, is situated in a wide plain 6847 feet above the level of the sea. Lat. 24. 25. N., Long. 105. 55. W. It was originally founded in 1559 by the viceroy Velasco, as a military post for the control of the Chichimecas. Its present importance is owing to the mineral wealth of the vicinity. As late as 1783 it contained not more than 8000 inhabitants, but its present population is estimated at from 30,000 to 40,000. The town is regularly built with many fine streets, and an elegant *plaza* or square. Among its public buildings are the cathedral, theatre, and

mint. Its chief manufactures are woollen and cotton stuffs, glass, leather, and tobacco. In the vicinity are rich iron mines.

DURAZZO (the ancient *Epidamnus* and *Dyrrachium*), a seaport-town of Albania, European Turkey, in Lat. 41. 17. N., Long. 19. 27. E. It stands on the S. side of a projecting tongue of land, and has a safe harbour for vessels of small size, but larger vessels must anchor about a mile from the town. It has an active import trade in British goods by way of Triest, and an export trade in tobacco and corn to Italy. Pop. probably about 6000. See EPIDAMNUS.

DUREN (the ancient *Marcodurum*), a town of Rhenish Prussia, capital of a cognominal circle on the Roër, here crossed by a stone bridge, and on the Cologne and Aix-la-Chapelle railway, 18 miles E. by N. of the latter city. Pop. (1849) 8054. It has several Roman Catholic and Protestant churches, a Roman Catholic gymnasium, and three nunneries. The manufactures are extensive, and include cotton and woollen stuffs and cassimeres, cutlery, nails, wire, and other hardware goods; soap, leather, paper, and brandy. Charlemagne held two diets here in 775 and 779, when on his way to attack the Saxons. It afterwards became an imperial city, and was taken by assault and burned by Charles V. in 1543. In 1794 it fell into the hands of the French, and was made the capital of the department of Roër, but was ceded to Prussia in 1814.

DURER, ALBRECHT, one of the best engravers and painters of his age, was descended of a Hungarian family, and born at Nuremberg in May 1471. He was the son of a goldsmith, but early relinquished his father's trade for the study of art under Michael Wohlgemuth. After obtaining his mastership, Dürer travelled in Holland and Italy, where he gained the friendship of Raphael. He was appointed painter to Maximilian I. and Charles V. He was a man of letters and a philosopher, and an intimate friend of Erasmus, who revised some of the pieces which he published. He was a man of business also, and for many years the leading magistrate of Nuremberg. Though not the inventor, he was one of the first improvers of the art of engraving; and he also wrought in wood, on which he engraved the life and passion of Christ in thirty-six pieces, which were highly esteemed. In many of those prints which he executed on copper, the engraving is exceedingly elegant. His Hell scene particularly, engraved in 1513, is as highly finished and as happily executed a print as ever was engraved. In his wood prints too, it is surprising to find so much meaning in so early a master; the heads being well marked, and every part admirably executed. His composition is often pleasing, and his drawing generally good; but he knew very little of the management of lights, and still less of grace. Yet his ideas are purer and more elegant than might have been expected from the awkward archetypes which his country and education afforded. Albert Dürer was certainly a man of great natural genius; and, as Vasari remarks, he would have been an extraordinary artist if he had had an Italian instead of a German education. His prints are very numerous, and were much admired and eagerly bought up in his own lifetime. He was rich, and chose rather to practise his art as an amusement than as a business. He died at Nuremberg, April 6, 1528; and the well-known discomforts of his marriage have induced his countrymen to attribute his death principally to domestic misfortune. He was interred in St John's Church, where a public monument was erected to his memory. He is sometimes regarded as the inventor of woodcuts and etching. Besides his artistic productions, Dürer wrote several books in German, which were translated into Latin by other persons, and published after his death. Among these we may mention, 1. *De Symmetria Partium in rectis formis Humanorum Corporum*, Nuremberg, 1532, Paris, 1557, fol.; 2. *Institutiones Geometricæ*, Paris, 1532; 3. *De Urbibus, Arcibus, Castellisque condendis et muniendis*, Paris, 1531; 4. *De Varietate Figurarum, et flexuris Partium, et gestibus Imaginum*, Nuremberg, 1534. (See *Reliquien von Albrecht Dürer, seinen Verehrern geweiht, Taschenbuch für Deutschland's Kuntsfreunde, zu Albrecht Dürer's dritter Secular-feier*, Nürnberg, 1828.)

DURESSE (*duritas, hardness*), is used in law to denote such constraint, either by illegal imprisonment, or by threats occasioning a reasonable fear for personal safety, as renders invalid a legal act (as the execution of a deed, &c.) performed by the person suffering such constraint. Duresse by threats (*per minas*) is interpreted to mean such as occasion fear of life or limb.

D'URFEY, THOMAS, more generally known by the familiar name of Tom d'Urfey, an English satirist and song-writer, was descended from a family of French Protestant refugees, and was born at Exeter. He was originally bred to the law, which he forsook for the more congenial employment of writing plays and songs. His humour both in writing and singing the latter procured him access to the highest circles, and made him a favourite even at court. A writer in the Guardian (No. 67) relates that he remembered more than once to have seen Charles II. leaning on Tom d'Urfey's shoulder and humming over a song with him. His dramatic pieces were equally well received, but are too licentious to be reproduced upon the stage. D'Urfey, by imprudence and extravagance, became poor as he grew old; and having prevailed on the managers of the playhouse to act his comedy of the *Plotting Sisters* for his benefit, Addison wrote the above-mentioned paper in the Guardian, with another (No. 82) giving a humorous account of his eccentricities, in order to procure him a full house. He died at an advanced age, in 1723. His collected works, under the title of *Pills to Purge Melancholy*, command a high price.

DURHAM, COUNTY PALATINE OF, one of the shires of England. Before the arrival of the Romans it was included in the British principality of the Brigantes; and after their arrival it made part of the province of *Maxima Cæsariensis*. During the heptarchy it formed part of the kingdom of Northumberland, the fifth established, which began in 547, and ended in 827, having been governed by thirty-one kings. It was not mentioned by Alfred in his division of counties, being at that time considered as a part of Yorkshire. At present it is included in the northern circuit, in the province of York, and is a diocese and principality under the government of its own bishop, being a county palatine, the second in rank, and the richest in England. It is bounded on the N. by Northumberland, on the S. by Yorkshire, on the E. by the North Sea, and on the W. by Cumberland. It extends over 973 square miles, and contains one city of the same name, fourteen market-towns, and above 330 villages and hamlets. It is divided into four wards. Until the passing of the Reform act, it returned two members to the House of Commons for the county and two for the city. The county has been formed by that law into two divisions, for the purpose of parliamentary elections; each of which returns two members. The northern division comprehends the wards of Chester and Easington; and the polling places are Durham, Sunderland, Lancheton, Wickham, Chester-le-Street, and South Shields. The southern division comprehends the wards of Darlington and Stockton; and the polling places are these two towns, and Bishop-Auckland, Stanhope, Middleton-in-Teesdale, Barnard Castle, and Sedgefield. Durham city and Sunderland return two members each. The following places within the county have by the same law obtained the privilege of electing one member each, viz. Gateshead and South Shields; the whole number returned amounting to ten. The population in 1851 was 390,997—an increase of 160 per cent. in 50 years. The number of inhabitants to a square mile was 399; to a house 6. The total number of houses was

Durham. 68,341; 64,977 being inhabited, 2794 uninhabited, and 570 in the course of erection.

This is one of the county palatines remaining in England, and it is called *palatine* (*a palatio*) because the owners thereof had, in this county, the authority to use the royal prerogative, as fully as the king had in his palace. These privileges were granted to this county probably on account of its bordering upon the inimical kingdom of Scotland, in order that the inhabitants, having justice administered at home, might not be obliged to go out of their county, and leave it open to an enemy's incursions; and that the owners might be the more watchful in its defence. There is a court of chancery in this county, and the bishop is at the head of the administration of justice.

The western angle of the county of Durham is hilly and mountainous, with black, naked, and barren regions, crossed by a ridge of high hills, from which issue numerous streams flowing to the sea. There are some beautiful and fertile valleys in the eastern and central parts, pleasantly varied with hill and dale, and alternately appropriated to corn and pasture. About 1200 to 2000 acres, principally in the western part of the county, are waste, but rich in minerals.

In the southern districts many acres have been inclosed and cultivated within the last few years. The common fields are now but few; for the land belonging to the townships has been inclosed for above a century. There is a great portion of wet ground still remaining, although draining is carried on to a great extent.

Near the river Tees, and in some spots bordering on the other rivers, the soil is loam or a rich clay. At a farther distance from these rivers the soil is of an inferior quality, and marshy, with patches of gravel interspersed. The hills between the sea and an imaginary line from Barnard Castle on the Tees to Alansford on the Derwent, are covered with a dry loam, the fertility of which varies with its depth. From this line westward the summits as well as the sides of the hills are moorish wastes.

The woodlands of Durham are not of very considerable extent, trees being chiefly confined to the parks and seats of the nobility and gentry; but many plantations have been made of late years. The banks of the rivers and brooks, however, particularly in the vicinity of Durham, are fringed with wood of long growth and much value.

The port of Stockton-upon-Tees is well situated for commerce. Hartlepool, situated on a promontory, nearly encompassed by the German Ocean, which on the south side of the town forms a capacious bay, is advantageously placed for the reception of vessels, and communication with the Continent; and South Shields sends out many ships.

Mines. The mineralogical substances found in Durham are numerous and valuable. The coal mines are some of the most extensive and productive in the kingdom, and the quantity of this important article is so great as to exceed all calculation. At Sunderland the coal trade furnishes employment for 520 vessels, independently of the *keels* which convey the coal from the staiths to the ships, which are 492 in number. This coal is chiefly conveyed to the metropolis, though great quantities are sent to the different ports of the Baltic, and also of late years to France and Holland. The whole quantity annually exported from Sunderland alone amounts to about 315,000 Newcastle chaldrons, each chaldron being equal to 53 cwt. The number of persons dependent on this trade is very great. The seams or strata now worked are five in number, extending horizontally for many miles, and are from twenty to one hundred fathoms beneath the surface; while each stratum is from three to eight feet thick. Below these are several other seams of coal; and many parts of the county, besides those where the pits are now open, abound with this substance.

The principal lead mines of Durham are in the districts of Teesdale and Weardale. Those of the former place have not been very productive, but the produce of the latter is of considerable value. The general method of working them is similar to that pursued in other mining counties. The ore of Weardale is melted by the blast-hearth; but in Teesdale air-furnaces have been introduced with much success.

Ironstone is found in the neighbourhood of Swalwell and Winlaton, where there are extensive iron works.

Some excellent quarries of slate for buildings have been opened in different parts of the county. A beautiful black spotted limestone is dug up near Walsingham, and made into hearths, chimney-pieces, and other ornaments. This neighbourhood abounds also with fine millstones. The Newcastle grindstones are procured at Gateshead Fell; and firestone of high estimation, for building ovens, furnaces, and the like, is obtained in various parts of Durham, and exported in considerable quantity.

Several extensive works for manufacturing salt from sea-water have long been established in the neighbourhood of South Shields; but owing to the discovery of a very singular salt spring at Birtley in this county, that process is not now so much attended to. This water rises at the depth of seventy fathoms, in an engine pit constructed for drawing water out of coal mines. It has for many years produced 20,000 gallons per day, four times more strongly impregnated with salt than any sea-water. In consequence of the discovery of this spring, a large and extensive manufactory of salt has been established near the spot, the quality of which is excellent. At Butterby, near Durham, is another salt spring, which issues from a rock in the river Wear, but is only visible when the water is low. It contains more of the sulphate of magnesia or Epsom salt, than the spring at Birtley. Within a few yards of the Watergate, on the south side of the town of Hartlepool, is a chalybeate spring, covered every tide by the sea. It is impregnated slightly with sulphur, which evaporates very quickly, leaving a sediment with salt of tartar. A gallon will yield 120 grains of sediment, two parts of which are nitrous, and the rest limestone.

No county in England presents a closer net-work of railways than Durham. The York, Newcastle, and Berwick trunk line enters a few miles south of Darlington, and continues due north until at Gateshead it crosses the Tyne and enters Northumberland. From this main line a great many lines diverge to the ports and mineral fields. There are not less than 160 miles of rail for mineral produce between the mines and ports.

Improvements in agriculture have been pursued with considerable spirit and success in the environs of Darlington, chiefly through the patronage of a society of county gentlemen, who hold their meetings in the town, and bestow premiums upon merit. On some spots of gravelly soil, turnips and barley are grown in almost perpetual succession, a crop of clover being sometimes interposed. The produce of wheat on good land is from twenty to thirty bushels per acre; the produce of barley is from thirty to forty; of oats, from twenty to forty. The manures are chiefly lime and the produce of the fold-yard; and though abundance of sea-weed might be collected on the coast, the farmers make but little use of it. The farms are of a middling size, few of them exceeding 200 acres. The largest portion of each farm is appropriated to tillage, but towards the western extremity of the county the whole is applied to pasture. The leases seldom exceed six years, and are too frequently rendered of little value by injudicious restrictions. The leases held of the see of Durham are generally for life, or for twenty-one years, renewable every seven years on payment of a fine. The farm-houses are well situated and commodious; and improvements in farming and farming machinery become more and more common.

The cattle of Durham are at present in great repute; as, in point of form, weight, produce of milk, and quickness of fattening, there are none better. The individual known as "the Durham Ox," when slaughtered, weighed, including tallow and hide, 197 stone, 2 lbs. The cows yield from from 25 to 30 quarts of milk daily. The sheep also, particularly the Tees-Water breed, stand high in estimation It is the largest breed in the island; the legs being longer, finer boned, and supporting a thicker and more firm and heavy carcass than the Lincolnshire. They are also much wider on the backs and sides, and afford a fatter and finer-grained mutton. The weight per quarter, in two-years-old wethers, is from twenty-five to thirty-five ponnds, and in particular instances fifty-five pounds or more. The wool is shorter and lighter than some other English breeds. The Weardale sheep are small, but the meat is finely flavoured. When fat, the quarters seldom weigh more than fourteen or eighteen pounds each. The stock of sheep is about 230,000, yielding 7000 packs of wool.

Durham, taking its dimensions into consideration, is inferior to no county in Great Britain for its numerous manufactures. It has cast-metal founderies, iron manufactories, potteries, glass-houses, copperas works, coal-tar and salt-works, quarries of marble, &c.; besides linen and woollen manufactories.

At the distance of about three miles from Darlington, at Oxenhall, are cavities in the earth, denominated Hell Kettles, to the origin of which are attached many fabulous conjectures. The diameter of the largest is not less than 114 feet, and that of the least 75. About five miles from Hartlepool is one of the most singular and romantic clusters of rocks in the north of England, called Black Halls, formed by the force and constant action of the waves, which have separated enormous masses from the coast, washing some entirely away, but leaving others standing, like the vast towers of a cathedral. In some places the rock is perforated so as to resemble a fine pointed archway.

Near the north wall of the churchyard at Ryton is a large barrow, about 20 feet in perpendicular height, now planted with trees. A similar one, near Bradley Hall, in the same parish, inspected some years ago, was found to contain a square cavity, formed by stones placed edgewise, in which a human body had been interred. Between one and two miles north of Brancepeth is Brandon Hill, a lofty eminence, on the summit of which is a remarkable tumulus, of an oblong form, 120 paces in circumference at the base, and about 24 feet in perpendicular height. One mile north of Eggleston is an ancient structure called the Standing Stones. This originally consisted of a cairn in the centre, surrounded by a trench, and that again encompassed by a circular arrangement of rough stones, many of which have been removed and broken, to repair the roads. Near a brook, at a small distance, is a large barrow, crossed from east to west by a row of stones.

On Fullwell Hill, a gigantic skeleton and two Roman coins were discovered some years ago, together with a small urn of unbaked clay. Several copper coins have been found at the village of Whitburn. Some coins of the Emperor Hadrian were found while widening the road near Gateshead, which is supposed to have been a Roman station.

South Shields was the *ad finem* of Richard of Cirencester's itinerary, as appears from the Roman altars, coins, and other relics found there. Evchester, a small irregular village, is supposed to be the *Vindomara* of Antoninus; many Roman inscriptions, and an urn of uncommon form, nearly a yard high and seven inches wide, with a small cup in the centre, having been found there. Chester-le-Street has been supposed to be the *Condercum* of the Romans, situated on the military way leading to Newcastle. Glanibanta, near the village of Lanchester, is another Roman station, which has hitherto been left untouched in the course of improvements, and is one of the most perfect in the kingdom. It occupies a fine eminence, and is of an oblong figure, being 174 paces from north to south, and 160 from east to west, within the vallum. In some parts the wall still remains perfect; the outside is perpendicular, twelve feet in height, and built of ashler work in regular courses, each stone being about nine inches thick and twelve long. The site of the prætorium is clearly distinguishable. Binchester, the seat and manor of the Wren family, is the site of the Roman station called *Vinovium* by Antoninus. Its figure and extent seem nearly similar to those of the station just mentioned; but the walls have been destroyed, and the area inclosed and cultivated. A military way, it is supposed, issued from it, leading towards Chester-le-Street. Innumerable fragments of Roman remains have been discovered here.

The most ancient part of Durham Castle is the keep, now a mere shell; the magnificent hall is fast going to decay. Hilton Castle, an ancient baronial residence of the Hyltons, is situated in a pleasant vale on the north side of the Wear, about three miles from Wearmouth: its present form is that of an oblong; the interior consists of five stories; the rooms are small, and exhibit every symptom of neglect and decay. Ravensworth Castle, the seat of Lord Ravensworth, occupies part of the site of an ancient castle, which seems to have formed a quadrangle, having a square tower at each angle, connected by a curtain wall. Two of the towers are built up in the offices, the others are partly in ruins. Lumley Castle, about a mile to the east of Chester-le-Street, is one of the seats of the Earl of Scarborough. It forms a quadrangle, with an area in the centre; at each angle are projecting turrets of an octangular form; it is a grand model of the taste of its age. Brancepeth Castle, an irregular but stately pile, was erected about Stephen's reign, by the family of Bulmers. The original building has had many modern improvements effected on it by the present proprietor. The castle of Bishop-Auckland stands on the north angle of the town, and, together with its courts and offices, covers about five acres of ground. Raby Castle, the magnificent seat of the Duke of Cleveland, owes its splendour to the Earl of Westmoreland, who enlarged a more ancient castle which stood here prior to the year 1379. The present mansion of Streatham Castle was erected on the foundation of the old castle at the beginning of the last century, and several of the apartments are retained in it. Barnard Castle is situated on the southern acclivity of an eminence, rising with a steep ascent from the river Tees; its ruins cover an extensive plot of ground.

Kepier Hospital, near Durham, was founded in 1112; but the only part of the monastic buildings now standing is the gateway, a strong and not unhandsome piece of masonry with pointed arches. The ruins of a monastery for gray friars may be seen at Hartlepool. Several remains of monastic buildings occur near the church at Monk-Wearmouth. The monastery of Jarrow may still be traced in its ruins on the summit of an elevated ridge near the church. On the east side of the main street of Gateshead are the ruins of St Edmond's Monastery, which appears from Bede to have been established before the year 653. Finchall Priory was beautifully situated in a vale on the banks of the Wear; the ruins cover an extensive plot of ground, but are so much dilapidated that the original appropriation of their respective parts can be traced only with great difficulty. The remains of a chapel at Bear Park are most perfect, and display some neat ornamental architecture. There are at Walsingham the ruins of a considerable building, inclosed with a deep moat, supposed by some to have been a part of a monastery.

The ecclesiastical buildings now remaining, and most worthy of notice, are, the Cathedral of Durham, begun in 1093, in the Saxon and Norman style: Sedgefield Church,

in the Saxon style; Bishop-Wearmouth Church, supposed to have been founded very soon after the restitution made by Athelstan; and the parish church of Brancepeth, an ancient structure of the conventual form, but apparently of different ages.

Annual value of real property assessed L.1,679,938. Places of worship belonging to Church of England 169, sittings 68,958; other denominations 452 places of worship, sittings 112,874: day schools 837, scholars 49,231; Sunday schools 490, scholars 47,771.

Durham, the capital of the above county, is a city of great antiquity. About the end of the tenth century the monks of Lindisfarne rested here with the remains of St Cuthbert; and soon afterwards a church was built by Bishop Aldun, and dedicated to that saint, whose remains were enshrined in it. Durham suffered severely from the cruelties of William the Conqueror, who repeatedly laid waste the surrounding country with fire and sword. In 1072 a strong castle was built here; and Walcham, a Norman, was appointed to the bishopric, and assumed the title of Count Palatine. In 1093 the old church built by Aldun was pulled down, and the present magnificent edifice commenced by King Malcolm, Carilepho the bishop, and Targot the prior. Durham figured conspicuously in all the great transactions that have agitated the north. It frequently suffered from the invasions of the Scots; and was often the headquarters of Edward III. and other monarchs and commanders in their excursions against Scotland. Durham is governed by a mayor, 6 aldermen, and 18 councillors, and returns two members to parliament. Pop. (1851) 13,188. The city is irregularly built on a rocky eminence, and is nearly surrounded by the river Wear. The cathedral and castle occupy the highest part of the eminence, and are fully 80 feet above the bed of the river. The cathedral was founded in 1093, and is one of the noblest edifices in the kingdom. The successive additions which have been made to it afford a striking illustration of the gradual changes in the English style down to the beginning of the fifteenth century. This remarkable edifice has been admirably delineated in Billings' *Architecture of Durham Cathedral.* It is 507 feet in length, by 200 in extreme breadth, with a central tower 214 feet in height, and two smaller ones 138 feet high at the west end. The Galilee or western chapel was built by Bishop Pudsey between 1153 and 1195, and contains the remains of the Venerable Bede. In the chapel of the Nine Altars are the remains of St Cuthbert, brought to light in 1827. The cathedral library contains a number of curious and interesting works, MSS., and relics. The castle of Durham, which stands opposite the cathedral, was erected by William the Conqueror, and till recently was the residence of the bishops of the Palatinate. It is now appropriated to the uses of the university, with the exception of a suite of rooms reserved for the use of the bishop when he visits the city. A university was founded here by Cromwell in 1657, but on the Restoration it was dissolved. The present university was opened in 1833; an account of it will be found under the head Universities. The see of Durham was long the richest bishopric in England. At an average of the three years ending 1831, it yielded a nett revenue of L.19,066 a-year. The total revenue of the dean and chapter during the seven years ending 1834 amounted to L.36,937 a-year. On the demise of the incumbent in 1836, at the recommendation of the ecclesiastical commissioners the income of the bishop was fixed at L.8000 per annum—the surplus revenues of the see being reserved to form a fund for augmenting the incomes of the poorer bishops. Besides the cathedral, Durham has six parish churches, and places of worship for Independents, Methodists, Quakers, and Roman Catholics. The grammar-school connected with the cathedral has four exhibitions of L.25 each for the sons of clergymen, and of L.50 each at either of the English universities, besides several scholarships at Peterhouse, Cambridge. There are also a diocesan training school, a blue coat, national, infant, charity, and other schools. Durham likewise possesses a mechanics' institute, savings-bank, subscription library, news-room, assembly rooms, theatre, infirmary, alms-houses, and various charities. The banks of the river are ornamented with gardens and plantations, forming an agreeable public promenade. The district called the North and South Bailies, between the precincts of the cathedral and the river, is occupied chiefly by houses of a superior class. The principal shops are in the old town, which also contains the market-place, with a fountain in the centre. The suburbs extend on both sides of the river. On the west side is Framwellgate, with a detached suburb called Crossgate; while on the east side is the suburb Elvet, which contains the magnificent new county gaol and court-house, erected in 1809, and some of the best houses in the place. These suburbs are connected with the town by several bridges. The town-hall is a spacious and handsome edifice in the Tudor baronial style. The manufactures, consisting chiefly of hats, woollens, paper, leather, and brass and iron wares, are not important. There are extensive coal mines in the neighbourhood, as well as some saline, chalybeate, and sulphurous springs. About three-quarters of a mile from the city is the site of the Maiden Castle—a fortress ascribed to the Romans—as well as some remains of the Iknield Street. One mile to the west of Durham is Neville's Cross—erected by Ralph Lord Neville to commemorate the defeat and capture of David II. of Scotland. Market-day Saturday. The Great North of England railway connects this city with Newcastle-on-Tyne, 14 miles distant.

DURLACH, a town in the grand duchy of Baden, circle of the Middle Rhine, on the Pfinz, 3 miles east of Carlsruhe, with which it is connected by an avenue of poplars. It was formerly the residence of the margraves of Baden-Durlach, whose castle, on a contiguous height, is now in ruins, but the garden contains some Roman antiquities. Durlach has manufactures of porcelain ware and tobacco, and some trade in wine, fruit, corn, and other agricultural produce. Pop. about 5000.

DUROTRIGES, an ancient British people, established in Dorsetshire, and the west of Somersetshire. Their name is derived from the two British words, *dur*, water, and *trigo*, to dwell; which corresponds to the situation of their country, which lies along the coast. It is not certain whether they formed an independent state, or were united with their neighbours the Damnonii, since they were reduced by Vespasian at the same time as the latter, and never afterwards revolted. The peaceable disposition of the inhabitants was probably the reason why the Romans had so few towns, forts, and garrisons in this part of the island. Their chief town was Dunium, now Dorchester. Many Roman coins have been found at Dorchester. The military way, called Jeening Street, passed through it; and some vestiges of the ancient stone wall with which it was encompassed, and of the amphitheatre with which it was adorned, are still visible. The country of the Durotriges was included in the Roman province called *Flavia Cæsariensis.*

DURRESTEIN, a town of Lower Austria, capital of the circle of Upper Manhartsberg, on the left bank of the Danube, 3 miles west of Krems. Pop. about 400. Above the town are ruins of the castle in which Richard Cœur-de-Lion was imprisoned on his return from the Holy Land.

DURSLEY, a market-town in the hundred of Berkeley, county of Gloucester, and 14 miles S.S.W. of the town of that name. It is situated at the base of a steep hill, and contained (1851) 2617 inhabitants, chiefly engaged in the manufacture of cloth. Market-day Thursday.

DURY, John, a Scotch divine of the seventeenth century, who laboured with great zeal to reunite the Lutherans

with the Calvinists. He published his earliest work on this subject in 1634, and prosecuted his scheme at the Frankfort assembly, in Sweden, Denmark, Holland, Germany, and Switzerland. He was present at the London assembly of divines in 1641. His discouragements in this scheme started another still more impracticable, namely to reunite all Christians by means of a new explication of the Apocalypse, which he published at Frankfort in 1677. He afterwards retired to the country of Hesse; but the time of his death is unknown. His letter to Peter du Moulin, concerning the state of the churches of England, Scotland, and Ireland, was printed at London in 1658, under the superintendence of Du Moulin, and is extremely curious.

DUSSARA, a fortified town of Hindustan, province of Gujerat, containing about 1300 houses, which are chiefly possessed by Kurbatties; the remainder of the population being Coolees, Rajpoots, and other castes, besides a few Banyans. This place, with 25 surrounding villages, is shared among several chiefs (members of the same family), called the Maliks of Dussara, who pay an annual tribute of L.1200 to the British government. Lat. 23. 18.; Long. 71. 52.

DUSSAULX, Jean, a French writer, best known as the translator of *Juvenal*, was born at Chartres, Dec. 28, 1728. He studied first at La Flèche, and afterwards at Paris; and having obtained the situation of a commissary in the *gendarmerie*, he served under the Marshal de Richelieu, in Hanover, during the seven years' war. At the age of twenty-one he was admitted a member of the academy at Nancy; and in 1770 he published his translation of *Juvenal.* This work procured him admission into the Academy of Inscriptions; and he was also appointed ordinary secretary to the Duke of Orleans.

For some years he quietly prosecuted his literary occupations at Paris; but, upon the breaking out of the Revolution, his enthusiastic disposition led him to adopt its principles: and he took part in the debates of the legislative assembly. He spoke and voted, however, at all times for moderate measures; and, on several occasions, he was employed to calm the passions of the people during public tumults. At the memorable sitting of the convention 15th Jan. 1793, he voted that the king should be detained in custody during the war, and banished on the return of peace. It is rather remarkable, that when the committee of public safety wished to send him to the scaffold, his pardon was obtained by Marat, who represented him as an old dotard, incapable of becoming dangerous. He became president of the council of ancients in July 1796, but left it in 1798. At the sitting of 27th April, he took leave of the assembly in a speech which was ordered to be printed. He died March 16, 1799, after a long and painful illness.

Dussaulx was a man of considerable literary attainments, and amiable, upright, and disinterested in his conduct. His translation of *Juvenal* is esteemed the best version of that poet in the French language. His other works are, *Mémoires sur les Satiriques Latins; Lettres et Réflexions sur la fureur du Jeu, auxquelles on a joint une autre Lettre Morale*, Paris, 1775; *Discours sur la Passion du Jeu dans les différents Siècles; De la Passion du Jeu, depuis les temps anciens jusqu'à nos jours*, 1779, 8vo; *Vie de l'Abbé Blanchet*, prefixed to the *Apologues and Tales* of that author, Paris, 1784, 8vo; *De l'Insurrection Parisienne, et de la prise de la Bastille*, Paris, 1790; *Lettre au Citoyen Fréron*, 1796, 8vo; *Voyage à Barrège, et dans les Hautes-Pyrenées*, Paris, 1796, 2 vols. 8vo; *De mes Rapports avec Jean-Jacques Rousseau*, &c., Paris, 1798, 8vo, a curious work, which throws considerable light on the character of that celebrated man. Marie-Jeanne Lieutau, the widow of Dussaulx, published memoirs of his life, which are exceedingly interesting. See also Palissot, *Mémoires sur la Litterature;* and *Biographie Universelle.*

DÜSSELDORF, formerly capital of the duchy of Berg, but now of a cognominal government in Rhenish Prussia. It is situated at the confluence of the Düssel with the Rhine, 22 miles north from Cologne. The old town of Düsseldorf existed previously to 1288, when it became a municipal town. In 1815 it was annexed with the whole duchy to the Prussian dominions. It was at one time a considerable fortress, but after having been bombarded by the French in 1794, the fortifications were destroyed at the peace of Luneville in 1802. One of the wings of the old castle, however, has been rebuilt, and contained down to 1805 the collection of paintings which is now at Munich. It is divided into three quarters, viz. the Altstadt, Neustadt, and Carlstadt; the last deriving its name from Charles Theodore, the elector Palatine, who projected a variety of improvements in the town. The streets are generally spacious, and the suburbs are laid out in ornamental pleasure-grounds. The Hof-garten is one of the finest in Germany. In the market-place is an equestrian statue of Johann Wilhelm the elector; and a marble statue of the same individual adorns the courtyard of the old electoral palace. The principal public buildings of Düsseldorf are the governor's palace, the town-hall, courts of law, observatory, library, and churches. Of these last the oldest is St Andrew's. In it, and in the church of St Lambert, are monuments of the former princes of Düsseldorf. A native school of art has arisen since 1828, and is peculiarly vigorous in the department of historical painting. Düsseldorf derives its mercantile importance from its position on the Rhine, and serves as a port to the various manufacturing districts of the duchy. Manufactures—woollens, cottons, leather, ironware, jewellery, &c. Its principal trade is in raw produce, coals, and timber. It has constant communications by steamers on the Rhine, and also by railways, with various parts of Germany. Pop. (1851) 27,762.

DUST, or Dustee, a river of Persia, flowing from the interior through the province of Mekran, from the southern shore of which it falls into the Indian Ocean. Its course is supposed to extend, under different appellations, about 1000 miles.

DUTCH Gold, the commercial name of a coarse imitation of gold leaf, made of copper, of brass, or of bronze. It is chiefly used for ornamenting toys.

DUTENS, Louis, a French writer of some celebrity, was born at Tours, of Protestant parents, Jan. 15, 1730. In his youth he devoted himself to poetry; and in 1748 he repaired to Paris and composed a tragedy, entitled *The Return of Ulysses to Ithaca*, which he showed to the comedian Lanoue, requesting him to bring it on the stage. The latter, however, returned the piece, advising the author to retouch it. Irritated at this advice, Dutens went to Orleans, where he got his play represented with great applause; but he soon became sensible of the faults of his work, and abandoned a species of composition in which he found he was not destined to excel. He soon afterwards went to England. Before leaving France, he accidentally became acquainted with Miss Pitt, sister to the Earl of Chatham, who gave him a letter to her brother; but after a short stay in London he returned to France. Not long afterwards, he was recalled to London by one of his uncles, to accompany a young English nobleman on his travels. Soon after his arrival, the young nobleman changed his intention; but, at the same time, he procured for Dutens the situation of a tutor in a private family. The father of the pupil was a man of considerable literary and scientific attainments, who instructed Dutens in those branches of knowledge in which he was deficient. In this manner he learnt Greek and mathematics; and he at the same time applied himself to the oriental languages, and to Italian and Spanish. At the end of three years his pupil died; but one of his sisters being deaf and dumb, her education was entrusted to Dutens. His young pupil, however, having become enamoured of her instructor, Dutens deemed it a matter of delicacy and of duty to leave the house.

About this time he was appointed chaplain and secretary to the Honourable Stuart Mackenzie, the English minister

at the court of Turin, and left England in October 1758. In 1760, when Mr Mackenzie returned to England, the secretary remained at Turin as chargé d'affaires. Dutens came to England in 1762, and attached himself to the family of Lord Bute, who, before retiring from office in 1763, procured him a pension. He again went to Turin as chargé d'affaires; and during this second mission he undertook the task of collecting and publishing a complete edition of the works of Leibnitz, and wrote his work on the *Discoveries of the Ancients*. He afterwards quitted Turin, returned to Britain, and attached himself to the Duke of Northumberland, who procured him a living in the north of England. He accompanied the duke's son, Lord Algernon Percy, in his travels through France, Italy, Germany, and Holland; and while at Paris he was chosen a member of the Academy of Inscriptions. In 1776 he returned to England, and soon afterwards accompanied Mr Mackenzie and his wife on a tour to Naples. On his return he was invited by Lord Mountstuart, who had been appointed envoy extraordinary, to accompany him to Turin; and Dutens found himself for the third time chargé d'affaires at that court, during a short absence of the envoy. From Turin, which he left on account of some unpleasant circumstances, he went to Florence, and thence to Rome. He was in Paris in 1783, and returned to London the following year. The revenue he derived from his living of Elsdon, amounting to L.800 per annum, together with a considerable legacy left him by Mr Mackenzie, and estimated at L.15,000, enabled him to pass the remainder of his life in affluence. He died at London, May 23, 1812.

Dutens was the editor of the works of Leibnitz, published at Geneva, 1769, in 6 vols. 4to; of the Greek pastoral romance of *Daphnis and Chloe*, by Longus, 1776, 12mo, and of Dacier's translation of the *Manual of Epictetus*, 1775, 18mo. He was also the author of the following works: *Le Caprice Poëtique*, a collection of poems, 1750, 16mo. *Recherches sur l'origine des Découvertes attribuées aux Modernes*, 1766, 2 vols. 8vo, 4th edition, 1812. *Poesies*, 1767, 12mo, and 1677, 8vo. *Le Tocsin*, Rome, 1769, 12mo, reprinted under the title of *Appel au bon Sens*, London, 1777, 8vo. This work was directed against the French philosophers, and was published anonymously. *Explication de quelques médailles de Peuples, de Villes,. et de Rois, Grecques et Pheniciennes*, 1773, 4to. *Explication de quelques médailles du cabinet de Duane*, 1774, 4to. *Trosième Dissertation sur quelques médailles Grecques et Pheniciennes, où se trouvent des observations, pour servir à l'étude de la Paléographie Numismatique*, 1776, 4to. Dutens at the same time published a more complete edition of the two preceding works. *Logique, ou l'Art de Raisonner*, 1773, 12mo, 1777, 8vo, and reprinted also in his miscellaneous works. *Du miroir ardent d'Archimède*, 1755, 1777, 8vo; *Des pierres précieuses et des pierres fines, avec les moyens de les connaître et de les évaluer*, 1776, 12mo, and reprinted at London and Paris. *Itinéraire des routes les plus frequentées, ou Journal d'un Voyage aux principales Villes d'Europe*, 1775, 8vo, and frequently republished with additions and improvements. *Lettre à M. D. B. (Debure) sur la réfutation du livre l'Esprit*, par J. J. Rousseau, 1779, 12mo, which contains some letters of Helvetius and Rousseau. *De l'Eglise, du Pape, de quelques points de controverse, et moyens de réunion de tous les Eglises Chrêtiennes*, 1781, 8vo; several times reprinted, and finally under the title of *Considérations Théologiques sur les moyens de réunir toutes les Eglises Chrêtiennes*, 1798, 8vo. *Œuvres melées*, 1784, 8vo. Under the same title almost the whole works of Dutens were collected and published at London, 1797, 4 vols. 4to. *L'Ami des étrangers qui voyagent en Angleterre*, 1789, 8vo, frequently reprinted. *Histoire de ce qui s'est passé pour le rétablissement d'une régence en Angleterre*, 1789, 8vo. *Recherches sur le tems le plus reculé de l'usage des Voutes chez les anciens*, 1795. *Mémoires d'un Voyageur qui se répose*, Paris, 1806, 3 vols. 8vo. The first two volumes contain the life of the author, written in a romantic style; the third bears the title of *Dutensiana*, and is filled with remarks, anecdotes, bon-mots, and so forth. Dutens is the author of the *Catalogue of Medals* in Swinburne's *Travels*, and of the French text to the second volume of the *Marlborough Gems*. There is a *Memoir* of his in the Collection of the Academy of Inscriptions; and he also published a small tract on the *Iron Mask*. He was a member of the Royal Society of London, and had the title of historiographer to the king. (See Memoirs of Dutens in the *Gentleman's Magazine for* 1812; Chalmers's *Biographical Dictionary;* and *Biographie Universelle.*)

DUTKA, or SCHWERAN, a very ancient Russian wind-instrument, consisting of two flutes of different lengths united together, and having one mouthpiece, and each flute three finger-holes.

DUTY, in *Commerce*. See EXCISE, and TAXATION.

DUUMVIRI (i.e. *the two men*), in *Roman Antiquity*, an appellation given to various magistrates, commissioners, and officers, where two were joined together in the same functions.

DUUMVIRI Capitales were the judges in criminal causes. From their sentence it was lawful to appeal to the people, who alone had the power of condemning a citizen to death. These judges were taken from the body of the decuriones, and had great power and authority: they were members of the public council, and had two lictors to walk before them.

DUUMVIRI Municipales were two magistrates in some cities of the empire, answering to the consuls at Rome. They were chosen out of the body of the decuriones, and their office commonly lasted five years, upon which account they were frequently termed *quinquinales magistratus*. Their jurisdiction was of great extent. They had officers who walked before them, carrying a small switch in their hands; and some of them assumed the privilege of having lictors carrying axes and the fasces or bundles of rods before them.

DUUMVIRI NAVALES were the commissaries of the fleet, first created at the request of M. Decius, tribune of the people, in the time of the war with the Samnites. The duties of their office consisted in giving orders for the fitting out of ships, and issuing their commissions to the marine officers, &c.

DUUMVIRI Sacrorum were magistrates created by Tarquinius Superbus for the performance of the sacrifices, and for keeping the Sibylline books. They were chosen from among the patricians, and held their office during life: they were exempted from serving in the wars, and from the offices imposed on the other citizens: and without them the oracles of the sibyls could not be consulted.

DWALE, in *Heraldry*, the herb deadly nightshade, used for sable or black by such as blazon with flowers and herbs instead of metals and colours.

DWARACA, a town and celebrated temple of Hindustan, province of Gujerat, situated at the south-west extremity of the peninsula of Kattywar. There are 21 villages belonging to Dwaraca, containing 2500 houses, and, on the most accurate calculation, 100,000 inhabitants. The inhabitants were formerly much addicted to piracy, but of late years have been restrained by a treaty with the British. The temple is fabled to have been the residence of Krishna, at which 15,000 pilgrims annually pay their devotions, which is an abundant source of wealth to the Brahmins. N. Lat. 22. 15.; E. Long. 69. 1. (E. T.)

DWARF (Sax. *dwerg, dweorg*), a general name for an animal or a plant greatly inferior in size to that which is usual in their several kinds. Thus there are dwarfs of the human species, dwarf dogs, dwarf trees, &c.

The Romans, in their admiration of dwarfs, whom they called *nani* or *nanæ*, sometimes employed artificial means to check the growth of children whom they designed for dwarfs, by the use of bandages, &c. Dwarfs were also held in high estimation during the middle ages, when they were employed to carry the messages of the knights, and to wait as pages on the feudal nobility. In France, in particular, they shared with the court-jesters the intimacy and favour of the reigning monarch. At Constantinople they are to this day held in much esteem in the seraglio. Augustus's niece, Julia, greatly prized a dwarf called Coropas, who was only two feet and a handbreadth in height, and Andromeda, one of her freed maids was of the same stature. But the most famous of all the ancient dwarfs was Philetus of Cos, who was remarkable, not only for his diminutive size, but in a far higher degree for his learning. He was

likewise distinguished as one of the best poets of his day, and his general character was so high, that he was chosen to superintend the studies of Ptolemy Philadelphus. His person was so light and tiny, that he was obliged to carry leaden weights in his pockets to prevent himself from being blown away by the wind. We have many other accounts of remarkable human dwarfs, but most of them have been deformed in addition. Many relations concerning dwarfs must necessarily be regarded as not less fabulous than those concerning giants. The following remarkable history, however, which there is reason to regard as authentic, is deserving of notice:—

Jeffery Hudson, the famous English dwarf, was born at Oakham in Rutlandshire, in 1619; and about the age of seven or eight, being then but 18 inches high, he was retained in the service of the Duke of Buckingham, who resided at Burleigh-on-the-Hill. Soon after the marriage of Charles I., at an entertainment given to the king and queen at Burleigh, little Jeffery was served up at table in a cold pie, and presented by the duchess to the queen, who retained him as her dwarf. From seven years of age till thirty he never grew taller; but after thirty he shot up to 3 feet 9 inches, and there remained fixed. Jeffery afforded much entertainment at court. Sir William Davenant wrote a poem called *Jeffreidos*, on a battle between him and a turkey-cock; and in 1638 was published a very small book called the *New Year's Gift*, presented at court by the Lady Parvula to the Lord Minimus, commonly called *Little Jeffery*, Her Majesty's servant, written by Microphilus, with a little print of Jeffery prefixed. Before this period Jeffery was employed on a negotiation of great importance—he was sent to France to fetch a midwife for the queen; and on his return with this gentlewoman and Her Majesty's dancing-master, and many rich presents to the queen from her mother Mary de Medicis, he was taken by the Dunkirkers. Jeffery, being thus made of consequence, began to think himself really an important personage. He had borne with little temper the teasing of the courtiers and domestics, and had had many squabbles with the king's gigantic porter. At last, being provoked by Mr Crofts, a young gentleman of family, a challenge ensued; and when Mr Crofts came to the rendezvous armed only with a squirt, the little creature was so enraged that a real duel was the consequence. The appointment was on horseback with pistols, to put them more on a level; and Jeffery, with the first fire, shot his antagonist dead. This happened in France, whither he had attended his mistress in the troubles of the times. He was again taken prisoner by a Turkish rover, and sold into Barbary. But he probably did not remain long in slavery; for at the beginning of the civil war he was made a captain in the royal army; and in 1644 he attended the queen to France, where he remained till the Restoration. At last, upon suspicion of his being concerned in the Popish plot, he was seized in 1682, and confined in the Gatehouse, Westminster, where he died in the sixty-third year of his age. This little hero cuts a considerable figure in Sir Walter Scott's novel of *Peveril of the Peak.*

In the *Memoirs of the Royal Academy of Sciences*, a relation is given by the Count de Tressau of a dwarf called *Bébé*, retained by Stanislaus, king of Poland, and who died in 1764 at the age of twenty-three, when he measured only 32 inches. At the time of his birth he measured only between 8 and 9 inches. Diminutive as were his dimensions, his reasoning faculties were not less scanty, appearing, indeed, not to have been superior to those of a well-taught pointer. But that the size and strength of the intellectual powers are not affected by the diminutiveness or tenuity of the corporeal organs, is evident from a still more striking instance of littleness, given us by the same nobleman, in the person of M. Borulawski, a Polish gentleman, whom he saw at Luneville. This miniature of a man, considering him only with reference to his bodily dimensions, appeared a giant with regard to his mental powers and attainments. He is described by the count as possessing all the graces of wit, united with a sound judgment and an excellent memory; so that we may with justice say of M. Borulawski, in the words of Seneca, and nearly in the order in which he has used them, *posse ingenium fortissimum ac beatissimum sub quolibet corpusculo latere.* His growth was at one year of age, 14 inches; at six, 17 inches; at twenty, 33 inches, and at thirty, 39 inches. He had a sister named Anastasia, so much shorter in stature than himself that she could stand under his arm. Borulawski visited many of the courts of Europe, and finally died in England in 1837 at the advanced age of ninety-eight.

There is preserved to this day in the Louvre at Paris a picture by Francesco Torbido of a favourite dwarf of Charles V. of Spain, by name Corneille. He is represented on foot, dressed in the costume of a knight, his left hand resting on the back of a large dog, which serves to indicate the stature of the dwarf.

Another remarkable dwarf was Jean d'Estrix, a native of Malines, who was exhibited to the Duke of Parma in 1592. He was at that time thirty-five years of age, and measured barely three feet in height. He did not, however, show any traces of the stupidity usually attributed to dwarfs, but was remarkable for his general intelligence, and especially for his skill in the languages of modern Europe. But the smallest of all the dwarfs of whom any record has been preserved, was an Englishman named Birch, who when full-grown measured only twenty inches.

DWIGHT, Timothy, D.D., one of the most distinguished Presbyterian divines that America has yet produced, was born in 1752, at Northampton, in the state of Massachusetts. From his mother, who was a daughter of Jonathan Edwards, he inherited those principles and that piety which he developed in his writings and manifested in all his actions. He studied at Yale College; which he had no sooner left than he was appointed teacher of a grammar-school at New Haven, where he remained for two years. At the early age of nineteen he was appointed tutor in Yale College, where he distinguished himself by the skill with which he taught the higher mathematics. In this same year he began his epic poem entitled the *Conquest of Canaan*, which was published in 1795. In 1777 he was licensed to preach the gospel, and accepted the office of chaplain to the forces; in which situation he remained till obliged by his father's death to return home and exert himself for the support of his family. Towards the close of the war of independence he was twice elected a member of the legislature. In 1783 he was ordained minister of Greenfield in Connecticut, when he opened an academy which speedily acquired a very high reputation, and attracted scholars from all parts of the Union. In 1795 he was elected president of Yale College, and by his judicious management restored that institution to the high place from which it had fallen before his appointment. Besides his *Travels in New England and New York*, written from notes taken in these countries during a series of journeys undertaken for the recovery of his health, Dr Dwight published a valuable treatise entitled *Theology Explained and Defended in a series of Sermons*, 5 vols. 8vo. It is upon this work that his fame as a theologian chiefly depends. After a long and honourable career, Dr Dwight died in the ninetieth year of his age. In 1827 two additional volumes of sermons (a small portion, however, of the MSS. which he left behind) were published, and were exceedingly well received in England as well as the United States.

DWINA, or Dvina, two rivers of Russia. See Russia.

DYEING.

History.

Is the art of communicating a new and permanent colour to any substance whatever; but it is usually confined to the art of giving colours to wool, silk, feathers, cotton, or flax, or the thread or cloth formed of any of these substances. To this more limited signification we shall restrict ourselves in the following treatise. For dyeing or staining *paper, wood, bone, leather, marble,* &c. the reader is referred to these articles. We shall divide this article into six chapters. In the first we shall give a rapid sketch of the history of the art; in the second we shall treat of the nature and properties of wool, feathers, silk, cotton, and flax, of which the fabrics to be dyed are composed; in the third chapter we shall treat of *mordants*, or the substances by means of which the colours are fixed on the cloth or thread. The fourth chapter will be occupied with the mode of dyeing the simple colours, or *red, yellow, blue, black,* and *brown.* The object of the fifth chapter will be the compound colours, or the different shades of *green, purple, orange,* and *gray.* The sixth chapter will be occupied with a sketch of the processes of calico-printing. The first five chapters were written by the late Thomas Thomson, professor of chemistry in the University of Glasgow, and the sixth, embracing all the latest improvements, by Professor F. Crace Calvert, Royal Institution, Manchester.

CHAPTER I.

HISTORY OF DYEING.

Nature has implanted in man a sense of pleasure which he derives from beholding lively colours properly displayed and contrasted. And this sense receives ample gratification from the gay plumage of the feathered tribes, and the endless variety displayed in the blossoms of the vegetable kingdom. The diversity in the colours of flowers must have early attracted the attention of man, and he could scarcely avoid feeling a desire to employ them to adorn his person; but their fading nature fitted them only for a temporary ornament. It would naturally occur to attempt to transfer some of the most lively colours of the vegetable kingdom either to the skin of the naked savage, or to the different articles of dress with which he covered himself up from the cold, or with which he decorated his person.

A few trials would speedily show that the gay colours of most flowers could not be transferred to any article of dress, at least without a great diminution of their splendour; but a considerable difference would be observed depending upon the colour of the flower. The *red* flowers would either lose their colour altogether, as they would communicate to cloth, not a *red,* but a *blue* colour. The yellow coloured berries, on the other hand, would be found in some instances to communicate a very lively and beautiful, though not a permanent colour.

By multiplying trials, various roots, barks, and fruits would be found capable of communicating certain colours to cloth. These facts would be treasured up, and thus a beginning would be made of the art of *dyeing.* Accordingly we find this art practised to a greater or smaller extent in the most remote ages, and among the most savage and barbarous nations. Even the lowest of the American tribes, in point of civilization, understood how to communicate several very fine colours, and considerable improvements in dyeing were borrowed from the Americans.

Produced early in Egypt.

It would be in vain, therefore, to attempt to discover to whom the art of dyeing is indebted for its origin, as the practice of it precedes the origin of history. From the writings of Moses, who led the Israelites out of Egypt about 1555 years before the commencement of the Christian era, it is obvious that the art of dyeing had in his time made great progress in Egypt. He mentions blue, and purple, and scarlet, and badgers' skins dyed red.[1] There are some reasons for believing that what is translated in the Old Testament *fine linen* was in reality a cloth made of cotton wool. Indeed it is certain that cloth made of cotton was used in India and Egypt in the most remote ages. Cotton wool would naturally attract the attention of mankind in those countries where the plant which yields it grows. Now we know that the cotton plant is a native of India. India and Egypt are countries in which the processes of dyeing are as likely to have originated as any other; for they constitute the cradle of the human race, and civilization appears to have made earlier progress in them than in any other.

Tyrian dye.

The art of dyeing was brought to a considerable degree of perfection at a very early period in Phœnicia. It appears that it was in Tyre where the method of dyeing woollen cloth *purple* was first discovered; and this discovery, there is reason to believe, is at least as old as the time of Moses. The purple was communicated by means of several species of univalve shell-fish, which no doubt abounded on the coast of Phœnicia. Pliny, in the thirty-sixth chapter of his sixth book, gives us an account of two species of shell-fish from which the purple was obtained. The first species was called *buccinum,* doubtless from some resemblance to a hunting horn; the second was called *purpura.* A single drop of the dyeing liquor was obtained from each fish by opening a vessel situated in the throat of the animal. The liquor, when extracted, was mixed with a considerable portion of salt, to prevent putrefaction. It was then diluted with five or six times as much water, and kept moderately hot in leaden or tin vessels, for the space of ten days, during which the liquor was frequently skimmed, to separate all impurities. After this, the wool, being first washed, was immersed and kept in the liquor for five hours. It was then taken out, carded, and again immersed and kept in the liquor till all the colouring matter was extracted. To produce particular shades of colour, carbonate of soda, urine, and a marine plant called *fucus,* were occasionally added. Several of these colours are particularly described by Pliny, though it is difficult to form an accurate conception of his meaning. The *purple* itself seems to have been similar to the colour of blood.

Pliny says the Tyrians first dyed their wool in the liquor of the *purpura,* and afterwards in that of the *buccinum.* We find allusions to this practice in several passages of the Old Testament. Doubtless Horace alludes to the same process when he says,

> .... te bis Afro
> Murice tinctæ
> Vestiunt lanæ.
>
> *Od.* ii. 16, line 35.

[1] Exodus, xxv. 4 and 5.

History.

The shell-fish employed in this process were found abundantly both on the European and African shores of the Mediterranean. They still exist on these shores, and have been also met with abundantly on the coasts of England and France.

Purple.

The purple mentioned in Exodus was probably that dyed by the Tyrians. Ezekiel, who wrote about 593 years before the Christian era, in his prophecy against Tyre, says, "Fine linen with broidered work from Egypt, was that which thou spreadest forth to be thy sail; blue and purple from the isles of Elishah, was that which covered thee."[1] By Elishah it is generally supposed that Elis, on the west side of the Greek Peloponnesus, was meant. Hence it would appear that the Tyrians in Ezekiel's time drew their supply of shell-fish for dyeing purple from the coast of Greece.

From Herodotus it appears that purple was worn in Greece 559 years before the Christian era. It gradually made its way to Rome, and was purchased with avidity, notwithstanding its high price. After the establishment of the emperors upon the ruins of Roman liberty, the use of the purple was limited to the emperor, people of inferior rank being prohibited from wearing it, on pain of death. This of course sadly diminished the extent of the manufactory. It continued to languish for some centuries, and then became extinct; and the mode of dyeing the Tyrian purple was lost for many ages, but was again revived during the seventeenth century by Mr Cole of Bristol, and during the eighteenth century by M. Reaumur of France. But by this time finer colours had been discovered, and cheaper processes brought into use. It was not therefore thought advisable by the dyers to resume the methods followed by their Tyrian predecessors.

With the exception of the processes followed in the dyeing of purple, we are ignorant of the practices of the ancient dyers, or of the degree of progress which this *art* had made. Pliny, under whose province an account of dyeing naturally came, has passed it over in silence, and has assigned as a reason for his conduct that it was not reckoned among the liberal arts. *Nec tingendi rationem omisissemus, si unquam ea liberalium artium fuisset.*

Dyeing introduced into Greece.

The fine colours given in India to cotton cloths are universally known. The methods practised are no modern inventions, but were in common use when India was visited by Alexander the Great, and probably many ages before. These colours, which are both beautiful and permanent, prove that the methods of fixing gaudy colours on cotton were pretty far advanced. But these methods, as they have been described by Beaulieu and Bancroft, are so complicated, tedious, and imperfect, that they could be followed only where the wages of labour are exceedingly low, and never would answer in any part of Europe. There is reason to believe that the processes of dyeing cotton and linen were introduced into Greece only after the expedition of Alexander the Great into India.

The common people in Athens were very idle and very poor, spending their time in the public places, and receiving a daily pension of three oboli, or about fourpence halfpenny. But this sum would have purchased as much corn as three times the amount would do in this country; so that the income of a common Athenian citizen was equivalent to about thirteen pence halfpenny of our money. They went barefooted, and were dressed in garments which never had been dyed, but which were occasionally washed. The rich citizens wore garments which had been dyed; and the most common colour was *scarlet*, communicated to the cloth by *kermes*, a dyestuff still in use, and which we shall describe in a subsequent part of this treatise. This colour, as Pliny informs us, was scarcely less esteemed than the Tyrian purple. Cloths of the scarlet colour were worn by the emperors; and scarlet and purple seem to have been often confounded together.

The modes of dyeing black, blue, yellow, and green, were brought by Alexander the Great into Greece from India, as Pliny informs us.

Among the Romans, new-married women wore a *yellow* veil, and this colour was reserved for the women. In the circus the four different factions were distinguished by four different colours, one belonging to each faction. These were the green (*prasinus*), the orange (*rufatus*), the blue (*venetus*), and the white. These factions, with their colours, were transferred to Constantinople, and long distracted that city.[2] We are ignorant of the dyestuffs by means of which these colours were given to cloth.[3]

The want of soap, which was unknown to the Greeks, and only known to the Romans in Pliny's time as a pomatum for the hair, must have greatly cramped the processes of the ancient dyers; nor have we any evidence that *alum* was known to them, though they must have employed some substitute, otherwise the red colour of the kermes could not have been fixed upon the cloth. Alum appears to have been well known to Geber, who wrote in the eighth century. He mentions different manufactories of it, and talks of it as a substance familiarly known in his time. Is it not possible that the mode of making it had been known to the Tyrian dyers, but kept by them as a profound secret? The purple and scarlet dye was still in use during Geber's time, and even continued to be practised in the eleventh century. Alum, then, was certainly used by the Tyrian dyers before their manufactory was finally extinguished; but even if we admit that the ancients were unacquainted with *alum*, yet it is obvious, from Pliny's account of *alumen*, that it was a substance found native; that there were different species of it, for he enumerates four or five, and one of these may have been a native combination of sulphuric acid and alumina, which (if pure) would doubtless answer all the purposes of a mordant.

The ancient dyeing processes, such as they were, continued to be practised in Constantinople as long as the Greek empire lasted. It was during the crusades that the republics of Venice and Genoa reached the highest summit of their power. They were trading and manufacturing communities, and made a point of making themselves acquainted with the different arts at that time practised in Greece. Dyeing was not neglected by them; but the art and trade of the dyers of Constantinople were transferred by them to Italy.

Discovery of archil.

About the year 1300 a merchant of Florence accidentally discovered the method of making *archil*. He observed that a certain species of lichen (*lichen roccellus*), when macerated in urine, acquired a fine purple colour. This led him to try various experiments, which terminated in the discovery of archil, and in the application of it to the art of dyeing.

First treatise on dyeing

In the year 1429 the first collection of processes employed in dyeing was published in Venice, under the title *Mariegola dell' arte dei Tentori*. A second edition of this book, with many additions, was published in 1510. Giovan Ventura Rosetti formed the project of making this

---

[1] Ezekiel, chap. xxvii. ver. 7.

[2] See Gibbon's Decline and Fall, vii. 78.

[3] Berthollet has given a catalogue of the dyestuffs of the ancients, after Bischoff, *Elements de l'Art de la Teincture*, i. 14. We do not consider it as worth transcribing, because it is altogether conjectural.

History.

work more complete and more useful. He travelled into those parts of Italy and the neighbouring countries where attention was paid to the processes of dyeing, in order to acquire the requisite information. The result of his acquisitions was published under the name of *Plictho dell arte de' tentori, che insegna tenger panni, tele banbasi e sede, si per l'arte magiore, come per la commune.* It was published at Venice in the year 1548.

Introduction of indigo and cochineal.

In the Plictho no notice is taken either of cochineal or indigo. Hence we may conclude that, in 1548, neither of these important dyestuffs had made their way into Europe. Pliny mentions indigo under the name of *indicum;* but it appears to have been used by the Greeks and Romans only as a paint; yet there can be little doubt that in India it had been employed from time immemorial as a dyestuff. Cochineal could not be known till after the discovery of America. It was used by the Mexicans as a dyestuff. In 1523 Cortes received orders from the court of Spain to multiply this precious insect, to collect it, and send it to Spain.

Cochineal by itself gives only a *crimson* colour; it dyes *scarlet* when mixed with a solution of tin. This fact was discovered accidentally by Cornelius Drebbel about the year 1630. He communicated his observation to his son-in-law Kuffelar, who was a dyer at Leyden. He soon brought the process to perfection, kept it a secret, and brought the scarlet colour into fashion. Soon after, the same process was discovered by a German chemist called Keffler, who carried his secret to London in 1643. A Flemish dyer called John Kloeck got information of the process in 1647, and it gradually made its way through every country of Europe.

Indigo, though a much more important dyestuff than cochineal, did not make its way into general use without the greatest difficulty. The use of it was prohibited in England during the reign of Elizabeth; and the prohibition was not taken off till the time of Charles II. It was equally prohibited in Saxony, where it was styled in the prohibition a corrosive substance, and called food for the devil. Restrictions on the use of indigo in dyeing were imposed also in France, though it was not altogether prohibited, as it had been in England and Saxony.

Improvements in France.

The improvements in dyeing which took place in France may be dated from the administration of Colbert, who paid particular attention to the different branches of manufacture which were carried on by the French. In the year 1672 he caused a book of instructions for dyers to be published in Paris. This book was republished in 1708 under the following title: *Le teincturier parfait, ou instruction nouvelle et générale pour la teincture des laines et manufactures de laine de toutes couleurs, et pour la culture des drogues ou ingredients qu'on y emploie.*

But Colbert's encouragement of dyeing was clogged with restrictions and prohibitions which would have been fatal to the art, had it not been for the facility with which they were evaded. The revocation of the edict of Nantes in the year 1685 was a fatal blow to the pre-eminence of France in manufactures. The most industrious and skilful workmen and artists were driven out of the country, and carried their knowledge and dexterity into Great Britain, Holland, and Prussia. Succeeding administrations endeavoured as far as possible to correct the fatal policy of Louis XIV. The art of dyeing in particular drew their attention, and the most eminent chemists which the country possessed were placed as a kind of superintendents of the art of dyeing. Their business was to endeavour to improve the processes, and to bring the art to a state of perfection. Dufay, Hellot, Macquer, and Berthollet, successively filled this important office; and each of these eminent men contributed somewhat to the improvement of the theory of dyeing. Dufay first formed tolerably accurate notions of the nature of colouring matters, and of the forces which made them attach themselves to cloth. Hellot published a well-arranged treatise on dyeing woollen cloth, such as it was practised in the best dyeing establishments in France; and Macquer gave an equally detailed account of the processes followed by the silk dyers.

Substances to be coloured.

Berthollet, who was named his successor as superintendent of dyeing, published an excellent treatise under the title of *Elements de l'Art de la Teincture,* a second edition of which appeared in the year 1804.

Scarcely any work upon dyeing deserving the name of a scientific treatise appeared in the English language till Bancroft published his *Experimental Researches concerning the Philosophy of Permanent Colours, and the best means of producing them by dyeing, calico-printing,* &c., in 1794.

Great improvements have been made of late years in calico-printing, which will be noticed at the conclusion of this article.

CHAPTER II.

OF THE NATURE AND PROPERTIES OF THE SUBSTANCES TO WHICH COLOURS ARE COMMUNICATED.

There has been much speculation among philosophical dyers respecting the nature of the colouring matters, and the way in which the different colours are induced by dyeing; but these speculations have not led to any information of much value. There is reason for believing that the colouring matters employed as dyestuffs are all transparent, and that the colour is produced by their action on the light transmitted through them from the white fibres of the cloth. Those colouring matters that transmit all the rays equally leave the cloth white; if the blue ray be transmitted and the rest absorbed, the colour of the cloth will be *blue,* and so on. This is all that we know about the mechanical nature of the dyestuffs.

Silk and wool dye better than cotton and linen.

With respect to the aptitude of being dyed, and the brilliancy of the colours thus communicated, there is found to be very great difference in different tissues. Animal substances are much more easily dyed than vegetable substances. Of animal substances, *silk* receives colour and the shades given are brighter and more beautiful than those which can be imbibed by any other tissue. Woollen cloth is also very fit for being dyed, and receives very brilliant colours with avidity; though in this respect it is inferior to silk. Cotton and linen are much more difficult to dye, and cannot be made to imbibe such brilliant colours as silk or woollen. Thus the rich scarlet given to cloth by the combined action of cochineal and the oxide of tin, has never been communicated to cotton cloth or linen. The Turkey-red dye, which is by far the finest and most permanent red that has ever been communicated to cotton cloth, is a crimson, or rather a crimson with a shade of brown. It has not the least approach to a scarlet.

SECT. I.—*Of Wool.*

Structure.

Wool, which is well known as the covering of sheep, derives its value from the length and fineness of its filaments. The filaments of wool are considerably elastic, for they may be drawn out beyond their usual length, and when the force is removed they recover it again. The surface of the filaments of wool or hair is not perfectly smooth; for although no roughness or inequality can be discovered by the microscope, yet they seem to be formed of small laminæ placed over each other in a slanting direction, from the root of the filament towards its point, resembling the arrangement of the scales of a fish, which cover each other from the head of the animal to its tail; or perhaps they consist of zones placed over each other.

Substances to be coloured.

as is observed in the horns of animals. This peculiarity of structure of the filaments of hair and wool is proved by a simple experiment. If a hair be laid hold of by the root in one hand, and drawn between the fingers of the other hand, from the root towards the point, scarcely any friction or resistance is perceived, and no noise is heard; but if it be grasped by the point, and passed in the same manner between the fingers from the point towards the root, a resistance is felt, and a tremulous motion is perceptible to the touch, while the ear is sensible to a slight noise. Thus it appears, that the texture of the surface of hair or wool is not the same from the root towards the point, as it is from the point towards the root. This is further confirmed by another experiment. If a hair be held between the thumb and fore finger, and they are rubbed against each other in the longitudinal direction of the hair, it acquires a progressive motion towards the root. This effect depends not on the nature of the skin of the finger, or on its texture, for if the hair be turned, and the point placed where the root formerly was, the motion is reversed, that is, it will still be towards the root.

Felting.

On this peculiarity of structure, which was observed by M. Monge, depend the processes of felting and fulling, to which hair and wool are subjected for different purposes. In the process of felting, the flocculi of wool are struck with the string of the bow, by which the filaments are separately detached, and dispersed in the air. These filaments fall back on each other in all directions on the table, and when a layer of a certain thickness is formed, they are covered with a cloth, on which the workman presses with his hands in all parts. By this pressure the filaments of wool are brought nearer to each other; the points of contact are multiplied; the progressive motion towards the root is produced by the agitation; the filaments entangle each other; and the laminæ of each filament taking hold of those of the other filaments, which are in an opposite direction, the whole is retained in the state of close contexture.

Fulling.

Connected with this operation is that of fulling. The roughness on the surface of the filaments of wool, and their tendency to acquire a progressive motion towards the root, produce considerable inconvenience in the operations of spinning and weaving. These inconveniences are obviated by covering the filaments with a coat of oil, which fills up the cavities, and renders the asperities less sensible. When these operations are finished, the stuff must be freed from the oil, which would prevent it from taking the colour with which it is to be dyed. For this purpose it is taken to the fulling-mill, where it is beaten with large beetles, in a trough of water, through which clay has been diffused. The clay unites with the oil, which being thus rendered soluble in the water, is carried off by fresh portions of water, conveyed to it by proper apparatus. In this way the stuff is scoured; but this is not the sole object of the operation. By the alternate pressure of the beetles, an effect similar to that of the hands in the operation of felting is produced. The filaments composing a thread of warp or woof, acquire a progressive motion, are entangled with the filaments of the adjoining threads, those of the latter into the next, and so on, till the whole threads are felted together. The stuff is now contracted in all its dimensions, and, participating both of the nature of cloth and of felt, may be cut without being subjected to ravel; and, when employed to make a garment, requires no hemming. In a common woollen stocking web, after this operation, the stitches, when one happens to slip, are now no longer subject to run, and the threads of the warp and woof being less distinct from each other, the whole stuff is thickened, and forms a warmer clothing.

Importance of wool.

The various manufactures of which wool constitutes the basis are justly regarded as among the most important to man in civilized society. Accordingly, the production of fine wool, and the causes which retard or improve the breed of sheep from which it is obtained, have greatly occupied the attention of economists and philosophers in our own, as well as in other countries. The wool of different breeds of sheep, in different countries, it is well known, possesses very different qualities, both with regard to the fineness of the filament, and the colour. Some is of a white or yellow, and some of a reddish and black colour. Excepting the wool of the breed of sheep in Andalusia, the Spanish wool was formerly all of a brownish-black colour. This was preferred by the native Spaniards; and even at this day, the dress of some religious orders in Roman Catholic countries consists of cloth manufactured from this wool, and retaining its natural colour. But for the purposes of dyeing, white wool is now always preferred, because it is found susceptible of receiving better and more durable colours.

Scouring.

Wool is naturally covered with a kind of grease or oil, which is found to preserve it from insects or moths, and on this account this greasy matter is not removed, or the wool is not scoured, till it is to be dyed or spun.[1] The process for scouring wool is the following: It is put for about a quarter of an hour into a kettle, with a sufficient quantity of water, to which a fourth part of putrid urine has been added. It is then heated to such a degree as the hand can bear, occasionally stirred, and, after being taken out, is allowed to drain. It is then put into a basket, and exposed to a stream of running water, and moved about till the grease is so completely separated that it no longer renders the water turbid. After being drained, it is sometimes found to lose by this operation above one fifth of its weight. It is almost unnecessary to observe, that the more carefully and completely this process is performed, the better the wool is fitted to receive the colouring matter. Our chemical readers will readily perceive the nature of the changes which are effected in this process of scouring. The ammonia, or volatile alkali, which exists in the urine, combines with the oil of the wool, and forms a soap, which being soluble in water, is dissolved and carried off.

Dyeing.

Wool is either dyed in the fleece, or after it is spun into threads, or when it has been manufactured into cloth. For the purpose of forming cloths of mixed colours, it is dyed before it is spun; for the purposes of tapestry, it is dyed in the state of thread; but most commonly it is subjected to this process after it has been manufactured into cloth. In these different states the quantity of colouring matter which is taken up is very different. The proportion is largest when it is dyed in the fleece, because then the filaments being more separated, a greater surface is exposed to the action of the colouring particles. For a similar reason the quantity of colouring matter taken up is greater when in the state of thread or yarn, than when it is formed into cloth. But cloths themselves must vary greatly in this respect, according to their different qualities. Their different degrees of fineness, or closeness of texture, will produce considerable variations; and besides, the difference in the quantity and dimensions of the substances to be dyed, the different qualities of the ingredients employed in the process, and the different circum-

[1] According to an observation of Reaumur, rubbing any stuff with greasy wool is sufficient to preserve it from moths.

Substances to be coloured.

stances in which it is performed, should be a caution against trusting to precise quantities, regulated by weight or measure, which are recommended according to general rules. According to the fineness of the texture of the wool, and the nature of the colouring matter employed, it is found to be more or less penetrated with this matter. The coarse wool from the thighs and tails of some sheep receives colours with difficulty, and the finest cloth is never completely penetrated with the scarlet dye. The interior of the cloth appears always, when cut, of a lighter shade, and sometimes even white.

Sect. II.—*Of Silk.*

Origin.

Silk, which forms the basis of one of the richest and most splendid parts of dress among the wealthy and luxurious in civilized society, is the production of different species of insects. The *phalæna bombyx*, or silk-worm, which is a native of China, attracted the attention of mankind in that country from the earliest ages. The honour of having first collected and prepared silk from the cocoons or balls in which it is wound up by the insect, during its metamorphosis, is ascribed by the Chinese historians to the wife of an emperor. The *phalæna atlas*, Lin. which is also a native of China, is said to form larger cocoons, and to yield a stronger silk. The silk-worm was first carried from China to Hindustan, and afterwards to Persia. Silk seems not to have been known to the Greeks or Romans till the time of Augustus. Its nature and origin were little understood; and for many ages it was so scarce that it could only be purchased at a price which was equal to its weight in gold. The emperor Aurelian, it is said, from a principle of economy, resisted the urgent solicitations of his empress, who wished to have a silken robe, alleging the extravagance of the expense. About the middle of the sixth century, two monks returned from India to Constantinople, and brought with them a considerable number of silk-worms, with instructions for managing and breeding them, as well as for collecting, preparing, and manufacturing the silk. Establishments were thus formed at Corinth, Athens, and other parts of Greece. The crusades, which greatly contributed to the diffusion of different kinds of knowledge, by the intercourse which took place between different countries, proved useful in disseminating the knowledge of rearing the silk-worm, and preparing and manufacturing its valuable productions. Roger, king of Sicily, about the year 1130, returning from one of these frantic expeditions, brought with him from Athens and Corinth several prisoners, who were acquainted with the management of silk-worms and the manufacturing of silk. Under their superintendence manufactories were established at Palermo and Cagliari in Sicily. This example was soon adopted and followed in different parts of Italy and Spain. In the time of James I. an attempt was made to establish the silk-worm in England. For this purpose the culture of the mulberry-tree, on which the insects feed, was strongly recommended by that prince to his subjects; but the attempts which were made have been hitherto unsuccessful.

Scouring.

The fibres of silk are covered with a coating or natural varnish of a gummy nature. To this are ascribed its stiffness and elasticity. Besides this varnish, the silk which is usually met with in Europe is impregnated with a substance of a yellow colour; and for most of the purposes to which silk is applied, it is necessary that it should be deprived both of the varnish and of the colouring matter. On this account it must be subjected to the operation of scouring; but for silks which are to be dyed this process should not be carried so far as for those which are merely to be whitened; and different colours, it is observed, require different degrees of this operation. The quantity of soap constitutes the chief difference. A hundred pounds of silk boiled in a solution of twenty pounds of soap for three or four hours, adding new portions of water during the evaporation, are sufficiently prepared for receiving common colours. For blue colours, the proportion of soap must be increased; and scarlet, cherry colour, &c. require a still greater proportion, for the ground must be whiter for these colours.

Process when employed white.

Silk which is to be employed white must undergo three operations. In the first the hanks are immersed in a hot but not boiling solution of thirty pounds of soap to a hundred of silk. When the immersed part is freed from its gum, which is known by its whiteness, the hanks are shaken over, as the workmen term it, so that the part which was not previously immersed may undergo the same operation. They are then wrung out as the process is completed. In the second operation the silk is put into bags of coarse cloth, each bag containing twenty or thirty pounds. These bags are boiled for an hour and a half in a solution of soap prepared as before, but with a smaller proportion of soap; and, that they may not receive too much heat by touching the bottom of the kettle, they must be constantly stirred during the operation. The object of the third operation is to communicate to the silk different shades, to render the white more agreeable. These are known by different names, as China-white, silver-white, azure-white, or thread-white. For this purpose a solution of soap is also prepared, of which the proper degree of strength is ascertained by its manner of frothing by agitation. For the China-white, which is required to have a slight tinge of red, a small quantity of anotta is added, and the silk is shaken over in it till it has acquired the shade which is wanted. In other whites a blue tinge is given by adding a little blue to the solution of soap. The azure-white is communicated by means of indigo. To prepare the azure, fine indigo is well washed two or three times in moderately warm water, ground fine in a mortar, and boiling water poured upon it. It is then left to settle, and the liquid part only, which contains the finer and more soluble parts, is employed.

Some use no soap in the third operation; but when the second is completed, they wash the silks, fumigate with sulphur, and azure them with river water, which should be very pure. But all these operations are not sufficient to give silk that degree of brightness which is necessary, when it is to be employed in the manufacture of white stuffs. For this purpose it must undergo the process of sulphuration, in which the silk is exposed to the vapour of sulphur; for an account of which see Bleaching. But before the silk which has been treated in this way is fit for receiving colours, and retaining them in their full lustre, the sulphur which adheres to it must be separated by immersion and agitation for some time in warm water, otherwise the colours are tarnished and greatly injured.

Mode of extracting its colouring matter.

It has long been an object of considerable importance to deprive silk of its colouring matter, without destroying the gum, on which its stiffness and elasticity depend. A process for this purpose was discovered by Beaumé, but as it was not made public, others have been led to it by conjecture and experiment. The following account, given by Berthollet, is all that has transpired concerning this process. A mixture is made with a small quantity of muriatic acid and alcohol. The muriatic acid should be in a state of purity, and particularly should be entirely free from nitric acid, which would give the silk a yellow colour. In the mixture, thus prepared, the silk is to be immersed.

One of the most difficult parts of the process, espe-

Substances to be coloured.

cially when large quantities are operated upon, is to produce a uniform whiteness. In dyeing the whitened silk, there is also considerable difficulty to prevent its curling, so that it is recommended to keep it constantly stretched during the drying. The muriatic acid seems to be useful in this process, by softening the gum, and assisting the alcohol to dissolve the colouring particles which are combined with it. The alcohol which has been impregnated with the colouring matter may be again separated from it and purified, that it may serve for future operations, and thus render the process more economical. This may be done by means of distillation, with a moderate heat, in glass or stoneware vessels.

Aluming.

The preparation with alum is a very important preliminary operation in the dyeing of silk. Without this process few colours would have either beauty or durability. Forty or fifty pounds of alum, previously dissolved in warm water, are mixed in a vat with forty or fifty pailfuls of water; and to prevent the crystallization of the salt, the solution must be carefully stirred during the mixture. The silk being previously washed and beetled, to separate any remains of soap, is immersed in this alum liquor, and at the end of eight or nine hours is wrung out, and washed in a stream of water. A hundred and fifty pounds of silk may be prepared in the above quantity of liquor; but when it begins to grow weak, which may be known by the taste, twenty or twenty-five pounds of dissolved alum are to be added, and the addition repeated till the liquor acquires a disagreeable smell. It may then be employed in the preparation of silk intended for darker colours, till its whole strength is dissipated. This preparation of silk with alum must be made in the cold; for when the liquor is employed hot, the lustre is apt to be impaired.

Sect. III.—*Of Cotton.*

Origin.

Cotton is the down or wool contained in the pods of a shrubby plant, which is a native of warm climates. Of this genus of plants (*Gossypium*, Lin.) there are four species, one of which only is perennial; the other three are annual plants; but of these there are many varieties, occasioned by the difference of soil or temperature in which they are produced. The principal differences among cottons consist in the length and firmness of the filaments, and in their strength and colour.

Structure.

The peculiar structure of the fibres of cotton is now well known. According to the microscopic observations of Leeuwenhoeck, they have two sharp sides, to which are ascribed the irritation and inflammation of wounds and ulcers when they are dressed with cotton instead of lint. This peculiarity of structure, it is also supposed, may occasion some difference in the conformation and number of the pores, on which alone the disposition of cotton to admit and retain colours better than linen seems to depend. In this respect, however, it is inferior to wool and silk, because, on account of its vegetable nature, its affinity for colouring matter is less powerful.

Has a less affinity than wool for colouring matter.

It is well known that silk, cotton, and linen have a weaker affinity for colouring matter than wool. Le Pileur d'Apligny attempts to explain this by supposing that the pores of these substances are smaller than those of wool, and that the colouring particles enter them less easily and freely. But according to the observation of Dr Bancroft, the reverse of this seems to be the fact; for there is little difficulty in making silk, cotton, and linen imbibe colouring matter, even when it is applied cold, without any artificial dilatation of the pores, which is always necessary in the dyeing of wool. The only real difficulty is to make them retain the colours after the matter has been imbibed; because being admitted so readily into their undilated pores, the particles cannot be afterwards compressed and retained by the contraction of these pores, as is the case with wool. It requires double the quantity of cochineal which is necessary for wool to communicate a crimson colour to silk; a certain proof that it can take up a greater quantity, and consequently that the pores are sufficiently large and accessible. Unbleached cotton is always preferred for dyeing Turkey red, because in this state the colour is found to be most permanent; and this is ascribed to the pores or interstices being less open than after it has undergone the process of bleaching. The same thing is observed of raw or unscoured silk. It is found to combine more easily with the colouring matter, and to receive a more permanent colour in this state, than after it has been scoured and whitened. "The openness of cotton and linen," says Dr Bancroft, "and their consequent readiness to imbibe both colouring particles and the earthy or metallic bases employed to fix most of them, are circumstances upon which the art of dyeing and calico-printing is in a great degree founded."[1] But is not this too mechanical an explanation of the phenomenon? Might it not rather be alleged that it is owing to a difference of affinities which exists between the particles of colouring matter and the substance which is separated from the silk or cotton by the process of bleaching or scouring? This substance probably acts the part of a mordant; and having a stronger affinity for the stuff and for the colouring matter than the stuff has for the latter, the colour communicated is more durable when silk or cotton is dyed in the unbleached or unscoured state.

Preparations for dyeing.

To prepare cotton stuffs for receiving the dye, several operations are necessary. It must first undergo the process of scouring. By some it is boiled in sour water, or in alkaline ley. It should be kept boiling for two hours, then wrung out, and rinsed in a stream of water till the water comes off clear. The stuffs to be prepared should be soaked for some time in water, mixed with not more than $\frac{1}{50}$th part of sulphuric acid, and then carefully washed in a stream of water, and dried. In this operation the acid combines with a portion of calcareous earth and iron, which would have interrupted the full effect of the colouring matter in the process of dyeing.

Aluming

Aluming is another preliminary process in the dyeing of cotton. The alum is to be dissolved in the manner already described in preparing silk. Each pound of cotton stuff requires four ounces of alum. By some a solution of soda, about $\frac{1}{16}$th part of the alum, and by others a small quantity of tartar and arsenic, are added. The thread is to be impregnated by working it in small quantities with this solution. The whole is then put into a vessel, and the remaining part of the liquor is poured upon it. In this state it is left for twenty-four hours, after which it is removed to a stream of water, and allowed to remain for an hour and a half, or two hours, to extract part of the alum. It is then to be washed. By this operation cotton is found to gain an addition of about $\frac{1}{40}$th part of its weight.

Galling.

The operation of galling is another preparatory process in the dyeing of cotton stuffs. The quantity of astringent matter employed must be proportioned to its quality, and the amount of the effect required. Powdered galls are boiled for two hours in a proportion of water, regulated by the quantity of thread to be galled. This solution being reduced to such a temperature as the hand can bear, is

[1] *Philosophy of Permanent Colours*, p. 71.

Substances to be coloured.

divided into a number of equal parts, that the thread may be wrought pound by pound. The whole stuff is then put into a vessel, and the remaining liquor poured upon it, as in the former process. It is then left for twenty-four hours if it is to be dyed black, but for other colours twelve or fifteen hours are found sufficient. It is then wrung out and dried.

In the galling of cotton stuffs, which have already received a colour, the precaution should be observed of performing this operation in the cold, otherwise the colour is subject to injury.

Berthollet informs us, that cotton which had been alumed acquired more weight in the galling than that which had not previously undergone that process; for although alum adheres but in small quantities to cotton, it communicates to it a greater power of combining both with the astringent principle and with the colouring particles. This, we may add, may be considered as a good instance of the action of intermediate affinities, and of the advantage to be derived to the art of dyeing, from investigating and observing this action.

Sect. IV.—*Of Flax.*

Origin. Flax and hemp nearly resemble each other in their general properties: and, so far as relates to the process of dyeing, what is said of the one may be applied to the other. Flax or lint is obtained from the bark of *Linum usitatissimum*, and hemp from that of *Cannabis sativa.*

Watering. Before flax is properly prepared to receive the dye, it must be subjected to several processes. One of the most important is that of watering, by which the fibrous parts of the plant are separated, and brought to that state in which they can be spun into threads. As the quantity and quality of the product depend much on this preliminary operation, it becomes of the greatest consequence that it be properly conducted. During this process carbonic acid and hydrogen gas are given out. The extrication of these gases is owing to a glutinous juice, which holds the green colouring part of the plant in solution, and which is the medium of union between its cortical and ligneous parts, undergoing a certain degree of putrefaction. This substance seems to resemble the glutinous part, which is held dissolved in the juice obtained from plants by pressure; is separated from the colouring particles by means of heat; readily becomes putrid; and by distillation affords ammonia. But although it is held in solution with the expressed juice, it would appear that it cannot be separated from the cortical parts completely by means of water; and hence it happens that hemp or flax watered in too strong a current has not the requisite softness and flexibility. But, on the other hand, if the water employed in this operation be stagnant and in a putrid state, the hemp or flax becomes of a brown colour, and loses its firmness. In the one case the putrefactive process is interrupted; in the other it is continued too long and carried too far. This process, therefore, is performed with the greatest advantage in places near the banks of rivers, where the water may be changed so frequently as to prevent such a degree of putrefaction as would be injurious to the flax, as well as prejudicial to the workmen, from noxious exhalations; and at the same time not so frequently as to retard or interrupt those changes which are necessary for rendering the glutinous substance soluble in water.

By the process of watering flax, and by drying before and after that process, the green-coloured particles undergo a similar change to that which is observed in the green substance of the plants exposed to the action of air and light. The next part of the process, therefore, after watering, is to spread it out upon the grass, and thus expose it for some time to the air and sun. By this means the colour of the lint is improved, and the ligneous part becomes so brittle that it is easily separated from the fibrous part. This operation, as is well known, is usually performed by machinery.

Mordants.

Structure. The fibres of lint possess no perceptible degree of elasticity, and they appear to be perfectly smooth. No roughness or inequality can be detected by the feel, and no asperities can be perceived, even with the assistance of the microscope. Experience shows, that it produces no irritation on wounds or sores which are dressed with it, as is known to happen from a similar application of cotton stuffs.

Preparations for dyeing. Flax which is intended for dyeing must be subjected to a similar series of operations with cotton, in the different processes of scouring, aluming, and galling. A repetition of the mode of performing these operations is therefore unnecessary.

CHAPTER III.

OF MORDANTS.

Meaning of the term. The term mordant is applied by dyers to certain substances with which the cloth to be dyed must be impregnated, otherwise the colouring matters would not adhere to the cloth, but would be removed by washing. Thus the red colour given to cotton by madder would not be fixed, unless the cloth were previously steeped in a solution of a salt of alumina. It has been ascertained that the cloth has the property of decomposing the salt of alumina, and of combining with and retaining a portion of alumina. The red colouring principle of the madder has an affinity for this alumina, and combines with it. The consequence is, that the alumina being firmly retained by the cloth, and the colouring matter by the alumina, the dye becomes fast, or cannot be removed by washing the cloth with water, even by the assistance of soap, though simple water is sufficient to remove the red colouring matter from the cloth, unless the alum mordant has been previously applied.

The term *mordant* (from the Latin word *mordere*, to bite) was applied to these substances by the French writers on dyeing, from a notion entertained by them that the action of the mordants was mechanical; that they were of a corrosive or biting nature, and served merely to open pores in the fibres of the cloth, into which the colouring matter might insinuate itself. And after the inaccuracy of this notion was discovered, and the real use of mordants ascertained, the term was still continued, as sufficiently appropriate, or rather as a proper name, without any allusion to its original signification.

Alterants. The term *mordant*, however, is not limited to those substances merely which serve, like alumina, to fix the colours. It is applied also to certain substances, which have the property of altering the shade of colour, or of brightening the colour, as it is called. Thus *cream of tartar* is usually called a mordant, because when chloride of tin is used, as is the case in the red dye upon silk or woollen, the addition of cream of tartar is necessary, not merely to brighten the colour, but to cause its equable application upon the cloth; for when the tartar is omitted, we observe that the shade is very unequal upon different parts of the surface, some spots being much darker and some much lighter than others. We believe that tartar acts chiefly, if not entirely, by forming a double salt with the chloride of tin, from which the tin is not liable to be partially precipitated. The consequence of this is, the equal distribution of the tin through the whole liquid, and the consequent equality of its application on the cloth. For the

Mordants. depth of the shade depends upon the proportion of tin fixed upon the cloth. Berthollet has proposed to distinguish those substances which are employed to alter the shade of colour from the mordants strictly so called, by giving them the name of *alterants*.

The mordants employed by dyers are but few in number. Alumina, the oxides of tin, the protoxide of lead, the black oxide of copper, and the infusion of nutgalls, constitute almost the whole of them. The peroxide of iron and the sesquioxide of manganese have also a strong affinity for cloth, especially for cotton cloth, and are frequently employed; but they serve at once the purpose of mordants and colouring matters. We believe also that in one important process for giving a fine red to cotton, what is usually called *the Turkey-red dye*, the *manganate of potash* constitutes an indispensable mordant.

Let us take a view of these different mordants in succession.

1. *Alumina.*—This is a soft, white, tasteless powder, insoluble in water, but soluble in acids, and constituting sweet-tasted and astringent salts, which have the property of reddening vegetable blues. These salts are soluble in water, but very few of them are capable of crystallizing. Of all the salts of alumina, the most important is *alum*, the nature and properties of which have been described in another part of this work. See ALUM.

How used. It is a double salt, composed of three integrant particles of sulphate of alumina united to one integrant particle of sulphate of potash or sulphate of ammonia and twenty-five integrant particles of water. The ammoniacal alum is less soluble in cold water than the potash alum; but both kinds are sufficiently soluble in hot water. Such is the affinity of alumina for woollen or silk stuffs, that when they are plunged into a solution of alum, the alumina leaves the sulphuric acid with which it was united, and combines with the fibres of the cloth. The affinity of alumina for cotton or linen, though considerable, is not so great as its affinity for wool or silk. On that account the cotton dyers and calico printers find it requisite to combine the alumina, before using it as a mordant, with a weaker acid than the sulphuric. The *acetic* is the one which has been made choice of, and the acetate of alumina is prepared by the following process: Three parts of alum and one part of acetate of lead are dissolved in eight parts of hot water. There is then added one eighth of a part of potash and as much chalk. The reason of the addition of the potash and the chalk is, that one part of acetate of lead is not sufficient to decompose three parts of alum. These substances prevent the residual alum from crystallizing, by decomposing it. The proper quantities of these salts which the dyers ought to employ are six parts of alum and seven parts of sugar of lead. These proportions would just convert the sulphate of alumina of the alum into acetate of alumina, without altering the sulphate of potash.

The wool or silk is put into a hot solution of alum, and the cotton into a hot solution of acetate of alumina, and passed through the liquid till a sufficient quantity of the alumina has combined with the fibres of the cloth. It is then wrung out, washed, and dried. The alumina remains firmly adhering to the cloth, and cannot be removed by washing, bleaching, or any of the processes to which such cloths are usually subjected.

Quantity of alumina which adheres to cotton. In order to form some notion of the quantity of alumina fixed upon cloth by the aluming process, the writer of this article made the following experiments: A quantity of cotton cloth was procured, such as is sometimes used for making light dresses of Turkey red. Of this, 1000 grains were burnt, and the ashes being reserved and analyzed, were found to contain 0·4 grain of alumina. 1000 grains of the same cloth which had been dyed Turkey red, and of course subjected to the aluming process, were burnt, and the ashes subjected to a chemical analysis. The alumina contained in them weighed eight grains. Hence 7·6 grains of this matter had combined with the cloth in the process of aluming.

The length of 1000 grains of the undyed cotton cloth was one yard five and two-third inches, and its breadth thirty-three inches. The length of 1000 grains of the Turkey red cloth was one yard and six inches, with a breadth of thirty-three inches. The two pieces of cloth, therefore, were very nearly of a size. We see that the dyed cloth had been stretched a very little during the processes to which it had been subjected. Thus it appears that a surface of cloth amounting to 1386 square inches, or rather 2772 square inches (as both sides of the cloth had been equally subjected to the aluming process), had combined with 7·6 grains of alumina, or every square inch of the cloth had combined with 0·0027 grains ($\frac{1}{370}$th grain nearly) of alumina. Small as this quantity may appear, it was sufficient to fix the red colouring principle of madder, and to constitute a very deep and beautiful dye.

A very pale shade of red is sometimes given to a portion of the cloth, which has a beautiful effect when contrasted with the deep Turkey-red dye. This is produced by limiting the quantity of alumina applied to the parts which are to be light red. In fact, no alum mordant whatever is applied to the parts which are to be light red; but they get a little during the steps taken to remove the excess of aluminous mordant, which has been applied to the parts that are to get the deep-red colour.

To ascertain the quantity of alumina which was sufficient to fix the light-red colour, the writer of this article got a portion of the same cotton cloth formerly operated on, dyed of the light-red colour. 1000 grains of this cloth being burnt, and the ashes analyzed, were found to contain 0·8 grain of alumina. Subtracting the 0·4 grain of alumina which 1000 grains of the undyed cloth contained, there remains 0·4 grain for the quantity communicated during the aluming process. These 1000 grains of cloth constituted a length of one yard and ten two-third inches. The breadth was thirty-two inches. Its surface (reckoning both sides) constituted 2986$\frac{2}{3}$ square inches. So that every square inch of surface had combined with 0·00012 grains of alumina, or less than $\frac{1}{8000}$th of a grain. Yet this quantity of alumina, small as it is, was essential to the permanence of the dye; for when unalumed cloth was dyed with madder, the colour was speedily and easily washed out by water; but the light-red Turkey-red dye was perfectly fixed.

These facts are sufficient to show us the very small size of a particle of alumina. Were only 1000 particles of this substance fixed upon the square inch of surface of cloth, the weight of a particle of alumina would not exceed the millionth part of a grain. But that the number far exceeds 1000 is evident from this, that when we examine the surface of the cloth with a microscope, the red colour does not appear in spots, but is equally spread over the whole cloth. Many thousand particles of alumina upon the square inch would be requisite to produce this effect.

The aluming and the dyeing are sometimes given to the cloth together; but more frequently the aluming precedes, and the dyeing follows after the cloth has imbibed the mordant and been washed and dried.

2. *Tin.*—Of all the metallic oxides, those of tin are the most useful as mordants. They form, with acids, salts very easily decomposed; and the fibres of cloth have an affinity so strong for these oxides, that they readily withdraw them from their saline combinations, and unite with them. Tin forms two different oxides with oxygen. The protoxide is *black*, but the peroxide is yellow, and sometimes also white.

Mordants.

The tin mordants are formed by dissolving tin in muriatic acid. There are two chlorides of tin, as the combinations of that metal with chlorine are called. These are, the protochloride and the perchloride. The protochloride, when anhydrous, is a gray solid, with a pearly lustre; but when it is formed by dissolving tin in muriatic acid, it crystallizes in large oblique four-sided prisms, with one edge usually replaced by a tangent plane. The colour is white, with somewhat of the diamond lustre. The taste is acid, acrid, and disagreeable. When recently formed they dissolve in water; but when kept they dissolve imperfectly, leaving a white matter behind, which is an oxide of tin, and the quantity of this insoluble oxide increases with the age of the crystals.

How prepared as a mordant.

Calico-printers form their tin mordant by dissolving tin directly in muriatic acid; but the silk and woollen cloth dyers employ aqua regia for the purpose. Indeed tin for the dyers was originally dissolved in weak nitric acid; but when this method is followed, almost the whole tin precipitates in the state of an oxide in a few days. To prevent this precipitation, they added a little common salt or sal ammoniac to the nitric acid in which the tin was to be dissolved. Hellot informs us that Baron claimed the merit of having been the first person who employed aqua regia at Carcassone to dissolve tin. The object in view was to prevent the precipitation of the oxide, which always happens when nitric acid alone is used for that purpose.

The dyer's ordinary solution of tin is made with the kind of nitric acid called single *aqua fortis*. It is capable of dissolving about the eighth part of its weight of granulated tin. For each pound of aqua fortis it is usual to add about two ounces of common salt or sal ammoniac, and a little water to moderate the action of the acid. Those solutions which have been made most slowly, and with the least separation of fumes or vapours, have been found to succeed best; showing clearly that it is the protochloride of tin that constitutes the proper mordant. Two ounces of grain tin are usually allotted to every pound of aqua fortis. The metal should be added at different times, waiting till one part is nearly dissolved before another is added, otherwise too much heat may be evolved, which would cause the solution to go on too rapidly. The quantity of water added should be about one half of that of the aqua fortis used; so that the solution, when completed, should contain about one thirteenth of its weight of tin. About 20 lbs. of such a solution is required to die 100 lbs. of woollen cloth a full cochineal scarlet.

The process usually followed is this: Supposing 100 pounds weight of cloths intended to be died; ten pounds of cream of tartar are put into a suitable dyeing vessel of pure block tin,[1] with a sufficient quantity of clean soft water, and six or eight ounces of powdered cochineal. Immediately after this, ten or twelve pounds of the solution of tin are to be added, and when the mixture is nearly boiling hot, the cloth, previously completely wet, is put into the dyeing liquor, and turned through it by the winch, at first very rapidly, and afterwards slowly. This is to be continued for an hour and a half, after which the cloth is to be taken out and rinsed in clean water. By this first process the cloth has acquired a flesh colour. For the second or dyeing process the tin vessel is replenished with clean water. Five or six pounds of cochineal in powder are to be put into it, and well mixed by stirring it for a few minutes. After this the remaining part of the solution of tin is to be added; and the whole being well stirred, the cloth is to be put into the liquor, and turned very briskly through it, that both ends may receive an equal portion of the dye. After this it is turned more slowly for the space of half an hour, or until the dyeing liquor becomes exhausted, when the cloth is to be taken out, aired, and rinsed.

The process followed by the calico-printers for preparing the tin mordant is to dissolve tin in muriatic acid, by which a protochloride of tin is obtained. But Dr Bancroft found that, when a saturated solution of tin in muriatic acid was employed for dyeing woollen cloth scarlet, it had a corrosive effect on the cloth. He recommends a mixture of nitric and muriatic acid as a good solvent; and doubtless such a mixture would be cheaper and better than a solution of common salt or sal-ammoniac in nitric acid. Dr Bancroft found that a mixture of sulphuric and muriatic acid made a good solvent for the tin. Some farther experiments are still wanting to elucidate the best state of the tin mordant for the scarlet dye. We are of opinion that it is the protochloride of tin that constitutes the true mordant;[2] but some addition seems necessary to enable the fibres of the cloth to separate the oxide of the tin from the combination in which it exists, or rather to unite with the muriatic acid, when it is formed and disengaged by the decomposition of water, which obviously takes place, otherwise this acid, when evolved, will exert a corrosive action on the cloth.

The tartar is necessary to produce the scarlet colour. Without it the colour of the cochineal dye is crimson, or at most a rose colour. It doubtless acts principally by forming a double salt with the chloride of tin. But it must also convert a portion of the cochineal into a yellow dye; for scarlet is a compound colour, consisting of a great deal of red, mixed with a small quantity of yellow.

Used to fix chromic acid.

3. *Lead.*—We are not aware of the protoxide of lead being employed in any case as a mordant in dyeing silks or woollen cloth; but of late years it has been used as a mordant for cotton, to which the beautiful yellow given by means of chromic acid was to be communicated. For this purpose the lead is dissolved in nitric acid, or converted into nitrate of lead. This salt crystallizes in octahedrons, has a sweet and astringent taste, and dissolves readily in water. An aqueous solution of it thickened by gum is applied to those parts of the cloth which are to receive a yellow colour; or if the cloth has been already dyed red, a quantity of tartaric acid is mixed with the solution of nitrate of lead and gum, and after it has been applied and dried on the cloth, the piece is passed through water impregnated with a quantity of bleaching powder. The red colour is discharged; but the oxide of lead, which had united with the fibres of the cloth, still continues to adhere without alteration. The cloth is now passed through a solution of bichromate of potash. Those parts of it which contained the oxide of lead immediately decompose the bichromate; chromate of lead is formed and fixed upon the cloth, constituting a most beautiful and indelible yellow colour; or, by particular alterations in the process, this yellow colour may be changed to red, or to a very deep orange approaching red, and exceedingly beautiful.

4. *Copper.*—The black oxide of copper is employed as a mordant in giving a black colour to hats, or at least acetate of copper is employed in the process; and it is not easy to conceive any other purpose which such a salt can serve than contributing a portion of oxide of copper to act as a mordant.

5. *Galls.*—Nutgalls are excrescences which grow on

[1] Copper vessels are found to injure the colour, and therefore are not used.

[2] We do not mean that the protoxide of tin remains fixed on the cloth: it doubtless becomes peroxide. But the superior solubility of protochloride of tin fits it better for the purpose.

Mordants. Excrescences on oak.

the branches of some species of oak, in consequence of the puncture of an insect, the *cynips quercus folii*. The best kind come from the Levant. They are nearly spherical bodies, with protuberances on the surface. There is a cavity within where the insect lodged, and a round hole from that central cavity to the surface, by which the insect, after it was hatched from the deposited egg, eat its way out. These nutgalls have a very astringent and austere taste. When digested in water they give that liquid a brown colour, and the taste which they themselves have. When such an infusion is mixed with a solution of sulphate of iron, it strikes a deep blue or black colour. Nutgalls, besides a considerable portion of woody fibre, contain a notable quantity of two peculiar vegetable substances, to which they owe their value as dyestuffs or mordants. These are *tannin* and *gallic acid*. The latter of these substances is easily obtained in a state of purity; the former with difficulty.

Contains tannin.

The infusion of nutgalls contains scarcely any thing else than a solution of tannin and gallic acid. If we evaporate the solution in a gentle heat to dryness, and digest the residue in sulphuric ether or absolute alcohol, the gallic acid will be dissolved, and the tannin will remain in a state of tolerable purity, only coloured brown by the action of the air. Tannin, when pure, is white while moist. It becomes yellow when dried even *in vacuo*, and by subsequent exposure to the air it becomes darker coloured. Its taste is excessively astringent and harsh; and it is distinguished by the property of striking a deep blue or black with the salts of iron. Tannin is easily altered in its nature by heat. Its constitution, as determined by the most recent analyses, is,

$$\left.\begin{array}{ll} \text{Carbon} \ldots\ldots\ldots\ldots & 18 \text{ atoms} \\ \text{Hydrogen} \ldots\ldots\ldots & 5 \text{ atoms} \\ \text{Oxygen} \ldots\ldots\ldots\ldots & 9 \text{ atoms} \\ \quad\text{united with} & \\ \text{Water} \ldots\ldots\ldots\ldots & 3 \text{ atoms} \end{array}\right\} C_{18}\,H_5\,O_9 + 3\,HO.$$

Many modifications of it are found throughout the vegetable kingdom, all characterised by a harsh, astringent taste, and the property of giving a black, dark-blue, or brown colour with salts of iron, so that various shades of these colours can be produced by selecting the tannin of different plants, and employing it in dyeing along with copperas or other ferruginous compounds.

Distinctive names have been given to the varieties of tannin by scientific chemists, who rank them all among vegetable acids, of which, however, they form an imperfectly defined group; their general insusceptibility of crystallization preventing their ready purification, and their liability to undergo chemical changes on exposure to air interfering with their preparation in a state of purity. The tannin of the oak and its gall-nuts, which alone is referred to in what follows, has been distinguished by the name of *quercitannic acid.*

Tannin exists not merely in nutgalls, but in oak bark, in the wood of the oak, in the leaves, and in fact in every part of that tree; but the quantity of it is much greater in nutgalls than in any other part.

Tannin possesses the characters of an acid. It reddens vegetable blues, effervesces with the carbonates, and unites in definite proportions with the basis.

and gallic acid.

Gallic acid exists also as a constituent of nutgalls, and may be extracted from them by means of ether or absolute alcohol. Its colour is white, though it is apt, like tannin, to become yellow when exposed to the atmosphere, and seems indeed capable of being converted into tannin by exposure to too high a temperature. It is not nearly so soluble in water as tannin, and is distinguished by an acid taste instead of an astringent one. Like tannin, it strikes a black with the salts of iron. But the gallate of iron is readily distinguished from the tannate. The former is an exceedingly fine black powder, which precipitates very slowly, while the latter is a deep blue, which precipitates rapidly, has a coarse appearance, and becomes black when dry. The constituents of gallic acid are,

$$\left.\begin{array}{ll} \text{Carbon} \ldots\ldots\ldots\ldots & 14 \text{ atoms} \\ \text{Hydrogen} \ldots\ldots\ldots & 5 \text{ atoms} \\ \text{Oxygen} \ldots\ldots\ldots\ldots & 9 \text{ atoms} \\ \quad\text{united with} & \\ \text{Water} \ldots\ldots\ldots\ldots & 1 \text{ atom} \end{array}\right\} \text{or } C_{14}\,H_5\,O_9,\ HO.$$

Gallic acid has recently been prepared in considerable quantity and of great purity by the pharmaceutical chemists of this country and the Continent, who can now furnish it beautifully crystallized. In the state of crystals it is employed by medical men as a valuable internal remedy in several disorders. It is turned to some account also by the photogenic artist; and analytical chemists prepare from it another and allied acid called the *pyrogallic*, which is highly serviceable in effecting the analysis of air. The dyer, however, uses it uncrystallized.

How used as a mordant.

The great use to which the infusion of nutgalls is put in dyeing is to give a black colour when mixed with solution of sulphate of iron. When used in this way it perhaps is improperly named a mordant; for the oxide of iron is known to have a strong affinity for the fibres of cloth, and the tannin and gallic acid have a strong affinity for the oxide. Hence probably the way in which the black dye is fixed on silk and woollen cloth. There can be no doubt that the tannin, which is by far the most abundant ingredient, is the principal agent in striking the black with the sulphate of iron. But the gallic acid probably adds to the lustre, and improves the beauty of the colour.

In the Turkey-red process for giving a fixed red colour to cotton cloth by means of madder, steeping the cloth in infusion of nutgalls is an important part of the process, as without this the colour would be apt to want equality of shade in different parts of the cloth. In this process there can be no doubt that tannin acts the part of a mordant. The galling, in preparing the cloth for the Turkey-red dye, always precedes the alumina process. Whether it has the property of making the alumina more fixed on the cloth than it otherwise would be, or what other purpose it may serve, is not very well understood; but it is certain that the boiling of the cloth in a pretty strong infusion of galls is important. The infusion of galls is made by boiling twenty-five pounds of nutgalls in forty gallons of water, till four or five gallons are boiled or evaporated. The specific gravity of the infusion is 1·020; or sometimes the process is twice repeated, employing each time only twelve and a half pounds of nutgalls in forty gallons of water. The specific gravity of each infusion in that case is only 1·010.

Such is an account of the mordants at present employed in dyeing, and the way of using them. It is not always necessary to employ mordants in dyeing; some colouring matters adhere to the cloth without the presence of any intermediate substance. This is the case with the oxides of iron and manganese. It is the case also with indigo, and it was the case also with the colouring matter from the buccinum and purpura employed by the ancient Phœnician dyers in dyeing the celebrated purple, of which an account has been given in the first chapter of this treatise. To those colouring matters which adhere to the cloth of themselves Bancroft has given the name of *substantive* colours, while he distinguishes those that require a mordant by the name of adjective colours.

Mordants.

Effects of mordants on the colour

Mordants have a very considerable effect on the colour; and by varying the mordant, very different colours, and a great variety of shades, may be obtained from the same colouring matter. Some mordants themselves may be considered as communicating a colour, without the addition of any colouring substance; and although, when the latter is added, a new set of affinities is brought into action, yet there is little doubt that the mordant also has a considerable share in fixing the shades of colour. Let us take an example in dyeing with cochineal. When the aluminous mordant is employed, the colour produced is crimson; but when the oxide of iron is substituted for the alumina, the colour obtained is black. The effect is obviously produced by a change in the action of the affinities between the colouring matter and the mordant, and the colouring matter and light. In the use of mordants, therefore, it is necessary to attend to their combined effects with the colouring matter employed, and, to be able to communicate particular colours to stuffs with any degree of certainty, to know the amount of that effect.

Even in the mode of applying mordants, the variety of shades may be greatly multiplied. Different effects, for instance, are produced by previously impregnating the stuff with the mordant, or by mixing it with the bath. Different effects also arise from using heat, or as the stuff is more or less rapidly dried; and this must appear to be the case, if we consider the different affinities which are in action, and the change on the action of these affinities in these different circumstances, as well as in others which can scarcely be appreciated. The combination of these substances which have an affinity for the stuff, and the decompositions which are the result of that combination, are greatly facilitated by the evaporation of the water or other liquid which held these substances in solution; because by its affinity, which is opposed to the action of the affinity between these substances and the stuff, the affinity of the latter produces a more limited effect. But in dyeing, the process should proceed slowly, that the substances may not be separated before their mutual affinities have begun to operate.

Considerable differences must be observed in the mode of employing the mordant, as the force of affinity between the stuff and the colouring matter is greater or less. When this affinity is strong, the mordant and the colouring substance may be mixed together; the compound thus formed immediately enters into combination with the stuff. But if the affinity between the stuff and the colouring particles be weak, the compound formed of the latter and the mordant may separate, and a precipitation take place, before it can be attached to the stuff; and hence it is in these cases that the mordant, which is to serve as the medium of union between the stuff and the colouring matter, must be combined with the former, before the application of the latter. It is from these differences that different processes must be followed in fixing colouring matters on animal and vegetable productions; as, for instance, in dyeing wool or silk black, or with cochineal.

In estimating the effects of mordants, and in judging of the most advantageous manner of applying them, it is necessary to attend to the combinations which may be formed, either by the action of the ingredients of which they are composed, or by that of the colouring matter and the stuff. It is necessary also to take into consideration the circumstances which may tend to bring about these combinations with more or less rapidity, or that may render them more or less perfect. The action which the liquor in which the stuff is immersed may have, either on its colour or texture, must also be considered; and, to be able accurately to judge of the extent of this action, we must know the proportions of the principles of which the mordant is composed; which of these principles remains in an uncombined state in the liquor; and the proportion or quantity which is thus separated.

Simple Colours.

CHAPTER IV.

OF THE MODE OF DYEING SIMPLE COLOURS.

Dyers have divided colours into two classes, namely, *simple* and *compound* colours. The *simple* are produced by a single dyeing process, and cannot be obtained by mixing together different colours. The compound colours are obtained by mixing together any two of the dyestuffs which produce the simple colours. By this means two colours are given to the cloth at once; and the shade depends upon the proportions of each dyestuff employed.

The simple colours are five in number; namely, *red*, *yellow*, *blue*, *black*, and *brown*. The last of these may be considered also as a compound colour, as it may be formed by mixing the dyestuffs for two simple colours together. The compound colours are *orange*, *green*, *purple*, and *gray*. We shall in this chapter confine ourselves to the mode of dyeing the simple colours, dividing it into five sections, in each of which we shall treat of a simple colour.

SECT. I.—*Of Red.*

In treating of the red dye, the simplest method seems to be to give an account, in the first place, of the dyestuffs employed for dyeing red; and in the second place, to describe the methods followed by the dyer to give a red colour to silk, wool, cotton, and flax.

I.—*Description of the Dyestuffs.*

The principal colouring matters used in dyeing red are *madder*, *cochineal*, *kermes*, *lac*, *archil*, *carthamus*, *Brazil wood*, and *logwood*.

1. *Madder* is the root of a plant, the *rubia tinctorum*, which is cultivated in the south of Europe. There are two varieties, the *rubia cordifolia* and the *rubia peregrina*. It is this last which is cultivated in the south of Europe, and comes to us from the Levant. The roots are wiry, and very much branched. They have a red colour externally, but are yellow within. This plant was cultivated by the Greeks and Romans, and was employed in medicine, and also in dyeing, as Dioscorides and Pliny inform us. It was called *erythrodamus* and *vœrantia* by the Greeks, and *rubia* by the Romans. From the last Greek name is derived the French word *garance*, by which madder is distinguished in that language.

Contains two colouring matters

It is the woody portion of madder that is useful in dyeing: the bark and pith are comparatively of little value. Madder has been examined by many chemists; but Robiquet and Colin alone have succeeded in separating the red colouring matter, and in determining its properties. They have distinguished it by the name of *alizarin*, an appellation derived from *alizari*, by which madder is distinguished in the Levant.

Madder contains two colouring matters; one, which is yellow, is soluble in cold water; the other, the alizarin, is soluble only in boiling water. To the yellow colouring matter Kuhlmann has given the name of *xanthin*. This matter considerably injures the colour of the alizarin; hence the reason why cloth dyed with madder has at first a dull brownish-red colour, which it loses in proportion as the xanthin is removed.

Alizarin how obtained.

To obtain *alizarin*, Robiquet and Colin recommend the following process. Mix pounded madder with two thirds or with its own weight of concentrated sulphuric acid, and

Simple Colours.

set the mixture aside for two or three days, taking care that heat is not evolved. All the other constituents of the madder, except the alizarin, are converted into charcoal; and should heat have been evolved, even the alizarin itself will be charred. Wash the black matter thus formed, to extract from it all the acid. What remains is a mixture of charcoal and alizarin. Let it be dried and digested with a portion of cold alcohol, which will dissolve a fatty matter which it contains. Let it now be digested in boiling alcohol till all the alizarin is dissolved. Mix the alcoholic solutions with water, distil off the alcohol, and filter the residual liquor. The alizarin remains upon the filter in a state of purity. Various other processes for extracting alizarin have been given by Robiquet and Colin, and by Kuhlmann and Zenneck.[1] But for these we refer to the respective publications of these chemists. The process which we have given we consider as of easiest execution.

Its properties.

Alizarin is insipid, and destitute of smell. According to Zenneck, it possesses weakly acid properties; but Colin and Robiquet consider it as perfectly neutral. It sublimes easily in long flexible capillary needles, having an orange colour; but unless the subliming vessels be very low and flat, much of the alizarin is decomposed during the process. Two watch-glasses applied to each other, for example, answer very well as a subliming vessel. During the process the alizarin gives out an aromatic odour like that of benzoin. It is almost insoluble in cold water; but it is moderately soluble in boiling water, to which it communicates a rose-red colour. At the temperature of 54°, 212 parts of alcohol, of the specific gravity 0·83, dissolve one part of alizarin. At the same temperature sulphuric ether, of specific gravity 0·73, dissolves $\frac{1}{160}$th part of its weight of it. The alcoholic solution is red, that of ether yellow or orange. It is slightly soluble in bisulphide of carbon, oil of turpentine, naphtha, and the fat oils, communicating to these bodies a reddish-yellow colour. Chlorine has little action on it, yet it injures the colour a little, and makes it incline to yellow. Sulphuric acid dissolves it, and acquires at the same time a blood-red colour. Nitric and muriatic acid dissolve it, and slightly alter the shade of its colour. These acids, when dilute, do not dissolve it. With alkalies it forms soluble combinations, having a violet-red colour, which do not afford crystals. The alkaline carbonates dissolve it, assuming a violet colour. With the alkaline earths it forms precipitates, having a violet or lilac colour; with alumina a precipitate which is red or reddish-brown. With the metallic oxides it forms insoluble combinations, having a violet or reddish-brown colour.

It has a marked affinity for various animal matters. It dissolves in the white of an egg diluted with water; and if we coagulate the albumen by heat, the alizarin combines with it, leaving the liquid portion tinged yellow. Albumen, containing a portion of alizarin in solution, is precipitated by a solution of chloride of calcium; yet this salt does not precipitate uncombined albumen diluted with the same quantity of water. Phosphate of lime appears also to have a marked affinity for the colouring matter of madder. Indeed this is obvious, from the well-known fact, that the bones of animals which have taken for some time a quantity of madder mixed with their food, are tinged red.

Urine, when left in contact with madder, extracts from it the alizarin, and acquires a red colour, even when quite recent and acid. Milk is coloured yellow by madder, and red coagulated curd is deposited upon the madder. The solution of animal gelatin does not precipitate the red colouring matter of madder.

Simple Colours.

We are not aware that madder is employed in dyeing silk or wool, but it constitutes one of the most beautiful and fixed red dyes for cotton and linen, and for dyeing these substances it has been in use probably at least two thousand years. As the yellow colouring matter or *xanthin* is not used in dyeing, it seems unnecessary to give any account of it in this place.[2] It gives a very beautiful yellow colour, and might be employed in calico-printing, were it not that the extraction of it would cost too much money.

Nature of cochineal.

2. *Cochineal* is the name given to a small insect that inhabits the *cactus coccinilifera*, and three or four other species of cactus, upon which it remains immoveable, drawing its nourishment from the juices of the plant. The insect is called by entomologists *coccus cacti*. It is the female insect (which is without wings) that constitutes the dyestuff. The insect is small, having a kind of hemispherical back, crossed by numerous wrinkles, and of a dark reddish-brown colour.

This insect is a native of Mexico, and had been employed by the natives as a red tinging matter. When the Spaniards entered that country in 1518 it drew their attention; and in 1523 Cortes received orders from the court of Spain to procure it in as great quantity as possible. He left the cultivation of the insect to the natives, who prosecuted it so successfully that great quantities of it were imported into Europe. The earlier Spanish writers described it as an insect, but at a later period it came to be considered as the seed of a plant; and this opinion continued the prevalent one, till the contrary was proved by Melchior de Ruuscher, about the beginning of the eighteenth century. This man, who was a native of Holland, affirmed in a society, from oral information which he had obtained in Spain, that cochineal was a small animal. Another person, whose name has not been made known, maintained the contrary with so much heat and violence, that the dispute at length ended in a bet. Ruuscher charged a Spaniard, one of his friends, who was going to Mexico, to procure for him in that country authentic proofs of what he had asserted. These proofs, legally confirmed in October 1725, by the court of justice in the city of Antiguera, in the valley of Oaxaca, arrived at Amsterdam in the autumn of the year 1726. Ruuscher caused this evidence to be published under the following title: *The History of Cochineal proved by authentic documents*.[3]

The fact that cochineal is an insect had been suspected before. In a very crude and unsatisfactory paper on cochineal, published in the *Philosophical Transactions for* 1668,[4] this is distinctly stated as an undoubted fact. In 1672 Dr Lister, in a paper inserted also in the *Transactions*, throws out a conjecture that the cochineal insect may be a sort of kermes; which conjecture is now known to be well founded. Leeuwenhoeck is said to have examined cochineal microscopically in 1703, and to have ascertained it to be an insect. About the beginning of the year 1757 Mr Ellis obtained some of the joints of the plant on which the

---

[1] See Kuhlmann, *Ann. de Chim. et de Phys.* xxiv. 225; Zenneck Poggendorf's *Annalen.* xiii. 261; Robiquet et Colin. *Jour. de Pharmacie*, xii. 407; and *Ann. de Chim. et de Phys.* xxxiv. 225.

[2] For an account of it we refer the reader to the *Jour. de Pharmacie*, xiv. 354.

[3] *Natuerlyke Historie van de Couchenille, beweezen mit authentique documenten.* Amsterdam, 1729, 8vo, 175 pages.

[4] No. xl. p. 796.

Simple Colours.

insects breed, from South Carolina, and presented them the same year to the Royal Society. These specimens, Mr Ellis observes, were full of the nests of this insect, in which it appeared in its various states, in the most minute, when it walks about, to the state when it becomes fixed, and wrapt up in a fine web which it spins about itself. With the assistance of the microscope, Mr Ellis discovered the true male insect in the parcels which had been sent to him from America; and in August 1756, in consequence of Mr Ellis's discovery, Dr Garden caught a male cochineal fly, which, he observes, is rarely to be met with. He supposes that there may be 150 or 200 females for one male. These discoveries proved indisputably that the cochineal is an animal production.

Cochineal has been subjected to a chemical examination by various individuals; but the most successful analysis of it is by Pelletier and Caventou in 1818, which was published in the eighth volume of the *Annales de Chimie et de Physique*, p. 250. They found it to contain about half its weight of the peculiar colouring matter to which they applied the name *carmine;* but we prefer the name cochinealin, already given to this substance by John, who was the person that first obtained it and described its properties. Cochinealin may be obtained by the following process:—

Contains cochinealin.

Digest cochineal in alcohol, as long as it communicates a red colour to that liquid. The alcoholic solution being left to spontaneous evaporation, lets fall a crystalline matter of a fine red colour. Dissolve these crystals in strong alcohol, and mix the solution with its own bulk of sulphuric ether. The liquid becomes muddy, and gradually deposites the cochinealin, which constitutes a purple crust on the bottom of the vessel.

Properties of cochinealin.

Cochinealin has a fine purple-red colour, is granular, and consists of small crystals. When left exposed to the air, it undergoes no sensible alteration. At 122 degrees it melts; and if the heat be increased, it swells up and is decomposed, yielding carburetted hydrogen gas, a great deal of oil, and a little water having a slightly acid taste. It furnishes no traces of ammonia.

It is very soluble in water. The aqueous solution has a fine carmine colour, and, how much soever concentrated, does not deposite crystals. It dissolves also in alcohol; but the solubility diminishes in proportion to the strength of the alcohol. In sulphuric ether it does not dissolve. The weak acids dissolve it, probably in consequence of the water which they contain. When the cochinealin is pure, no acid throws it down from its aqueous solution; but they precipitate it when in combination with the peculiar animal matter of cochineal. They produce a sensible change upon its colour, causing it gradually to assume a tint of yellow. This is the reason why cochineal will not dye scarlet, unless when mixed with bitartrate of potash. The concentrated acids decompose it altogether.

Alkalies also alter the colour of solutions of cochinealin. It first becomes violet, and at last yellow; and the original colour cannot be again restored. Lime-water occasions a precipitate when poured into an aqueous solution of this substance; but barytes and strontian water occasion no precipitate, though they change the colour to yellow. Alumina has a strong affinity for cochinealin. When newly precipitated alumina is agitated in an aqueous solution of it, the liquid is rendered colourless, and the alumina converted into a beautiful *lake*. The pigment called *carmine*, accidentally discovered by a Franciscan monk about the middle of the sixteenth century, and the process for obtaining which was published by Homberg in 1656, consists essentially of a combination of cochinealin and alumina.

Simple Colours.

Most of the saline solutions alter the colour of the aqueous solution of this substance; but few of them are capable of producing a precipitate in it. Acetate of lead, however, throws down a copious violet sediment from the decoction or infusion of cochineal; and by decomposing this sediment by means of sulphuretted hydrogen, the cochinealin may be obtained in a state of purity. The chloride of tin throws down a violet precipitate, and the perchloride strikes a fine scarlet colour, but precipitates nothing. When gelatinous alumina is added to this mixture, we obtain a fine red precipitate, which is not altered by boiling.

Cochineal was at one time used in great quantity in Europe, chiefly for dyeing fine scarlet cloth. When Bancroft published his work on colours in 1794, he informs us that the annual European consumption was about 3000 bags, or 600,000 lbs., of which about 240,000 lbs. were consumed in Great Britain. The demand has since that time very much diminished; and the price has in consequence sunk from about thirty shillings to about nine shillings and sixpence per pound. This diminution is chiefly owing to the substitution of the lac dye for cochineal. Cochineal, however, is still used for the dyeing of fine scarlet cloth.

3. *Kermes.*—This is also the female of an insect which inhabits a species of oak. The tree, which is a native of the countries bordering on the Mediterranean and Asia, is called by Linnæus *quercus ilicis*, and the insect *coccus ilicis*. This substance was known to the ancients, though they were ignorant of its nature. Dioscorides calls it *κοκκος*, and Pliny *coccum* and *granum*. It was used in medicine; and there can be no doubt that it was employed in Asia at a very early period as a dyestuff. There is reason to suspect that the *scarlet* cloth mentioned by Moses to adorn the tabernacle was dyed by means of kermes. If this conjecture has any foundation, the kermes dye must have been known in Egypt before the time of Moses.

Similar to cochineal.

The word *kermes* or *alkermes* is at present in the East the common name for the animal which produces the dye, as well as for the dye itself. Probably it comes from the Arabic. If the kermes dye was known in Egypt and Phœnicia in the time of Moses, there is some difficulty in explaining how it was altogether unknown to the Greeks and Romans till the time of the Emperor Aurelian, who began his short reign in the year 270 of the Christian era. Vopiscus informs us that the king of Persia sent to that emperor, besides other articles of great value, some woollen cloth, which was of a much costlier and brighter purple than any that had been ever seen in the Roman empire, and in comparison of which all the other purple worn by the emperor and the ladies of the court appeared dull and faded. Vopiscus goes on to say that this cloth had been dyed in India, and that the assertion of the king of Persia, *sume purpuram qualis apud nos est*, was false; for Aurelian, Probus, and Diocletian, had sent dyers into the East on purpose to get information respecting this precious dye; but that their attempts utterly failed of success.[1]

From this passage it would appear that the use of kermes in dyeing had been known at a very early period in India, from which it gradually made its way into Persia, and afterwards into Europe. And as the colour which it yielded was more beautiful than the celebrated Phœnician dye, it may have contributed to put an end to the monopoly of the Phœnician dyers. The term *scarlet*, the

[1] Vopiscus in *Vita Aureliani*, cap. 29.

Simple Colours.

origin of which is unknown, but which was certainly employed early in the twelfth century, was applied to the colour given to cloth by the kermes dye.

Kermes is gathered chiefly in Languedoc, Spain, and Portugal. The insects are collected in the months of May and June, when the female, which alone is useful, is distended with eggs. To destroy the young insects, the kermes is exposed to the steam of vinegar for about half an hour, and afterwards dried. It is in the form of small grains of a reddish-brown colour. Kermes, as appears from the experiments of Lassaigne,[1] contains the very same colouring matter as cochineal; but its quantity is not so great, and of course it is mixed with a greater proportion of animal matter. The introduction of cochineal greatly diminished the consumption of kermes. It is seldom used in this country, yet it gives a very fixed and beautiful colour to woollen cloth.

Also similar to cochineal.

4. *Lac.*—This is an animal production which has been long known in India, and used for dyeing silk and other purposes. It is the *nidus* of the *coccus lacca*, Linnæus, and is generally produced on the small branches of the *croton lacciferum*. Three kinds of lac are well known in commerce:—1. Stick lac is the substance or comb, in its natural state, forming a crust on the small branches or twigs. 2. Seed lac is said to be only the above separated from the twigs and reduced into small fragments. Mr Hatchett, who has examined this substance with his usual skill and precision, found the best specimens considerably deprived of their colouring matter.[2] According to the information which he received from Mr Wilkins, the silk dyers in Bengal produce the seed lac by pounding crude lac into small fragments, and extracting part of the colouring matter by boiling. 3. Shell lac is prepared from the cells, liquefied, strained, and formed into thin transparent laminæ. There is also a fourth kind, called *lump lac*, which is obtained from the seed lac by liquefaction, and afterwards formed into cakes. The best lac is of a deep red colour: when it is pale and pierced at the top, the value is greatly diminished; for then the insects have left their cells, and it can no longer be of use as a dyestuff.

Unverdorben has likewise examined lac, but his experiments throw no light upon the nature of the colouring matter. Being derived from a coccus, as well as the colouring matter of cochineal and kermes, the probability is that it is of the same nature. In the state in which it comes to this country (that of a purple powder), it dissolves readily in boiling hot water. In this way it is employed by the dyers. Being much cheaper than either cochineal or kermes, it has in some measure superseded these dyestuffs, except when a very fine scarlet is wanted, in which case cochineal is still employed.

5. *Archil.*—This substance, called *orseille* by the French, is a violet-red paste, of which there are two varieties, one, which is the best, made in the Canary Islands, the other manufactured in the south of France. It is made from two species of lichens, the roccella and the parellus. Berthollet, who has copied Hellot, who again copied Micheli, has given the following description of the mode of preparing it. The plant is reduced to a fine powder, which is afterwards passed through a sieve, and slightly moistened with stale urine. The mixture is daily stirred, each time adding a certain proportion of soda in powder, till it acquire a clove colour. It is then put into a wooden cask, and urine, lime-water, or a solution of sulphate of lime (*gypsum*), is added in sufficient quantity to cover the mixture. In this state it is kept; but to preserve it any length of time, it is necessary to moisten it occasionally with urine. We suspect that soda is not employed in the preparation of this dyestuff; at least it is not employed in the manufacture of cudbear, the preparation of which, being a manufacture of this country, we have often witnessed.

How prepared.

If we adopt the opinion of Tournefort, the preparation of archil was known to the ancient Greeks. He thinks that the purple of Amorgos, one of the Cyclades, the colour given to the famous tunics of that country, was formed by a dyestuff made from the lichen roccella.[3]

Cudbear how prepared.

What is called in this country *cudbear*, and in Germany *persio*, is prepared from the lichen *tartareus*, and *omphalodes*, by a process quite similar to that employed for making archil. The lichen is steeped and left for some time in flat vessels moistened with ammonia distilled from putrid urine. When the purple colour is sufficiently developed, the whole is dried in the open air, and reduced to a fine powder. The manufacture of this dyestuff was begun about the year 1777, at Leith, by Mr Mackintosh and Dr Cuthbert Gordon, from which last the British name of *cudbear* (originally *Cuthbert*) is derived. Leith was found an improper place for the manufacture; but Mr Mackintosh transferred it to Glasgow, and manufactured cudbear during the rest of his life with success. He left it to his son Charles Mackintosh, Esq., who continued the manufacture. The lichens used were at first collected in the Highlands of Scotland; but the rocks of that country being stript of their covering, the manufacturers had recourse to Sweden and Norway, and likewise to Sardinia, from which countries prodigious quantities of the lichens were brought. Cudbear is now prepared largely in England, and lichens are imported from all parts of the world.

Neither archil nor cudbear are capable of giving fast colours to cloth; but they are considered as indispensable by the dyers, because they greatly improve the brilliancy of some of the colours.

Contains erythrin.

The nature of the substance in the lichen roccella, which furnishes the colouring matter of archil, has been investigated by Heeren, who has distinguished it by the name of *erythrin*. It may be obtained from the lichen by the following process: Digest the lichen for some time in alcohol, taking care not to raise the heat to the boiling point, because at that temperature a portion of the erythrin is decomposed. The alcoholic solution has a green colour. Filter it while hot, and mix it with twice its bulk of water, which will render it muddy. Raise the liquid to the boiling temperature, and introduce into it chalk in powder, until the precipitate, which was at first dispersed through the liquor, collects in flocks. This precipitate consists chiefly of *roccellate of lime*.[4] The liquid must be filtered while boiling hot. During the cooling it deposites erythrin in the state of a fine powder, of a brown colour. Dissolve it in hot alcohol, digest the solution with ivory black, filter, and mix it with one and a half times its bulk of boiling water. The liquor remains at first clear, but during the cooling the erythrin precipitates nearly white.

The following process for extracting erythrin from the lichen roccella is easier than the preceding. Pour on the lichen a small quantity of concentrated ammonia, and digest for some time, stirring well, but without the application of heat. Dilute the muddy and reddish solution thus obtained with water; and then add to it some dilute solution of chloride of calcium. Roccellate of lime precipitates, and the filtered liquid has a reddish colour. Add to it a slight excess of muriatic acid. The erythrin precipitates instantly, and gives the liquid the aspect of a yellowish jelly. When we

---

[1] *Ann. de Chim. et de Phys.* xii. 102. [2] *Phil. Trans.* 1804. [3] Tournefort's *Voyage*, i. 248, English translation.
[4] Roccellic acid is an acid discovered by Heeren in the lichen roccella.

Simple Colours.

heat to the boiling temperature, the erythrin is again dissolved, and it is precipitated in powder during the cooling of the liquid. It may be deprived of its brown colour by ivory black.

Its properties.

Erythrin is a soft powder, having usually a slight shade of red, and a slightly crystalline aspect, when obtained from a weakly acid liquid. When pure it is perfectly white. It has neither taste nor smell. At a temperature a little above 212°, it melts into a transparent liquid, which becomes hard and brittle during the cooling. If the heat be raised still higher, it froths, is partly volatilized, and partly charred; but not the least trace of ammonia can be observed to be formed. Hence we may conclude that erythrin contains no azote. When held to the flame of a candle it burns like a resin. It is scarcely soluble in cold water, and requires 170 times its weight of boiling water to dissolve it. At the temperature of 53° it dissolves in twenty-two and a half times its weight of alcohol, of specific gravity 0·825. It is soluble in 2·29 times its weight of the same alcohol at the point of ebullition. When this last solution cools, the whole is converted into a mass of the consistence of mortar. It is insoluble in ether, and little soluble in oil of turpentine. Muriatic acid has no action on it, but acetic acid dissolves it with facility when boiling hot, but lets it fall again on cooling. Both nitric acid and concentrated sulphuric acid dissolve it, but they alter its nature. The aqueous solutions of the alkalies, or their carbonates, dissolve it with facility, and the solutions are colourless. By the continued action of the alkalies, the erythrin is decomposed. When this action takes place in close vessels, an extractive substance is formed, which is soluble in water, having a bitter taste, and which Heeren on that account has called *bitter of erythrin.* When the action is continued in vessels to which the air has access, the red or rather violet substance is formed which constitutes the colouring matter of archil.

During the conversion of erythrin into the red matter three different substances are obtained, namely, the *red colouring* matter, a *yellow* substance, and a *wine-red* substance. They are first mixed or combined; but the red colouring matter may be separated by dissolving the compound substance in alcohol, evaporating the solution to dryness, and digesting the residue in ammonia. The red colouring matter remains when this solution is evaporated.

It is little soluble in water. Alcohol dissolves it, and the solution has a crimson-red colour. It is quite insoluble in ether. The alkalies and their carbonates dissolve it, and the solution has a fine deep colour. The acids throw it down from these solutions under the form of carmine red powder, but they do not precipitate it from its solution in alcohol. Heeren has shown that alcohol has the property of altering erythrin, and of converting it into a snow-white substance, to which he has given the name of *pseudo-erythrin,* because it does not yield the red colouring matter, but only the wine red. The colouring matters of the lichens have, however, been very recently made the subject of extensive chemical investigation by Kane, Stenhouse, Schunk, and others, and considerable difference of opinion still prevails as to the number and nature of the substances possessing dyeing properties which may be extracted from them; and we may further refer the reader to an interesting prize essay, published in the Edin. Phil. Journal for October 1854 and January 1855, entitled "*Experiments on the Dyeing Properties of Lichens,*" by Dr W. Lauder Lindsay; but the substances used in dyeing will be more fully alluded to in the chapter on calico-printing.

Colouring matter of cudbear.

The colouring matter of cudbear is obviously very nearly the same as that of archil. It has been slightly examined also by Heeren, who has pointed out some distinctive characters which it possesses.

In France, besides the lichen parellus, the lichen dealbatus is employed, and the archil is obtained by treating the lichens with putrid urine and lime. Robiquet has subjected the lichen dealbatus to a chemical analysis, and has extracted from it the matter which yields the red dye, and which he has distinguished by the name of *orcin.* It constitutes white crystals, having a sweetish and nauseous taste, melts when heated, and may be distilled over without decomposition. It dissolves both in water and alcohol. It is obvious that its properties are quite different from those of erythrin; yet the process for converting it into the red dyestuff is nearly the same as for archil and cudbear.

6. *Carthamus,* or *Safflower.*—This is the petals of the blossoms of the carthamus tinctorius, a plant formerly cultivated in Germany and France; but now the dyestuff comes usually from Egypt and the countries round the eastern part of the Mediterranean, and from India.

The method of preparing the flowers of carthamus in Egypt, as it is described by Hasselquist, is the following. After being pressed between two stones, to squeeze out the juice, they are washed several times with salt water, pressed between the hands, and spread out on mats in the open air to dry. In the day time they are covered, that they may not dry too fast with the heat of the sun, but they are left exposed to the dew of the night. When they are sufficiently dry, they are put up, and kept for sale under the name of *saffranon.* Care should be taken afterwards not to keep it in too dry a place; for unless it is a little moist, its properties are considerably impaired.

Its colouring matters

Carthamus contains two colouring substances, a yellow substance, which is soluble in water; and as it is of no use, it is extracted by the process mentioned above, by squeezing the flowers between stones till no more colour can be pressed out. The flowers become reddish in this operation, and lose nearly one half of their weight. The other colouring matter, which is red, is soluble in alkaline carbonates, and it is precipitated by means of an acid. A vegetable acid, as lemon juice, has been found to produce the finest colour. Next to this, sulphuric acid produces the best effect, provided too great a quantity, which would alter and destroy the colour, be not employed. The juice of the berries of the mountain-ash, or *rowan-tree* (*sorbus aucuparia,* Lin.), is recommended by Scheffer as a substitute for lemon juice, and it is thus prepared. The berries are bruised in a mortar with a wooden pestle, and the expressed juice, after it has been allowed to ferment, is bottled up. The clear part, which is most acid, becomes fitter for use the longer it is kept; but this operation requires a period of some months, and can only be conducted in summer.

Rouge.

From the colouring matter extracted by means of an alkali, and precipitated with an acid, is procured the substance called *rouge,* which is employed as a paint for the skin. The solution of carthamus is prepared with crystals of soda, and precipitated with lemon juice which has stood some days to settle. After being dried on delft plates with a gentle heat, the precipitate is separated, and ground accurately with talc which has been previously reduced to a very subtile powder; and on the fineness of the talc depends the difference between the cheaper and dearer kinds of *rouge.*

Carthamus furnishes about five per cent. of this matter (abstracting the talc), which is the true red colouring matter. It reddens vegetable blues while moist, whether from the acid employed in throwing it down, or from its own acid properties, has not been determined. It is insoluble in water and dilute acids, but slightly soluble in

alcohol. The solution has a rose-red colour, but when boiled becomes yellow. Ether is still a worse solvent of *rouge* than alcohol. It is insoluble in oils, both volatile and fixed; but it dissolves readily, and with a yellow colour, in alkaline leys, or alkaline carbonates. According to Dobereiner (who considers it as an acid, which he calls *carthamic*), soda saturated with it crystallizes in fine colourless needles, having a silky lustre, which become instantly red when an acid is added to them.

As a dyestuff, safflower affords only a fugitive colour, destroyed by exposure to the sun, and removed by washing. It is used, however, occasionally to give a red colour to silk.

7. *Brazil Wood.*—This wood comes from Brazil, and from Pernambuco; and in the former case is said to be the wood of the *cæsalpina sapan*, *cæsalpina crista*, and *cæsalpina vesica;* in the latter, of the *cæsalpina echinata.* These trees are large, and rich in colouring matter. The wood is very hard, and is said to sink in water. When fresh cut it is pale, but becomes reddish by exposure to the air. Its taste is sweetish. The red colouring matter of Brazil wood is very easily acted on by chemical agents, acids rendering it *yellow*, and alkalies *violet.* Chevreul has given us the following process for extracting this colouring matter in a state of purity. Digest the raspings of the wood in water till that liquid has dissolved all the colouring matter, and evaporate the infusion to dryness, to get rid of a little acetic acid which it contains. Dissolve the residue in water, and agitate the solution with litharge, to get rid of a little fixed acid which it contains. Evaporate again to dryness. Digest the residue in alcohol: filter and evaporate to drive off the alcohol. Dilute the residuum with water, and add to the liquid solution of gelatine, till all the tannin which it contains is precipitated. Filter again, evaporate to dryness, and digest the dry mass in alcohol, which will leave undissolved the excess of gelatine that may have been added. This last alcoholic solution being evaporated, the pure colouring matter of Brazil wood remains behind.

Colouring matter how obtained.

Its properties.

It is soluble in water and in alcohol, but its fine red colour does not appear till all the acid which it naturally contains is saturated. Acids give it a yellow colour. The sulphuric, nitric, and muriatic acids, give it a pale dirty yellow. Fluoric acid gives it at first a yellow colour, which is gradually altered to grayish green; while the phosphoric and citric give it a fine permanent yellow colour, which might be employed for dyeing silk and wool. For these facts we are indebted to Bonsdorf. A very minute quantity of alkali gives the infusion of Brazil wood a violet colour; it is therefore a delicate re-agent for alkalies. When neutral salts, with an alkaline base, are dissolved in the infusion of Brazil wood, it assumes a rose-red colour. Acetates act most decidedly in producing this effect. When newly precipitated alumina is agitated in this infusion, it assumes a carmine-red colour.

When Brazil wood is boiled in water, we obtain a rose-coloured solution, and the undissolved wood becomes black, but still yields to alcohol a dark-red colour. When an acid is poured into the decoction, a red precipitate falls, and the filtered liquid is yellow. Ammonia gives the decoction a purple colour, and throws down a purple precipitate. The carbonates of potash and soda render it carmine red, and throw down a precipitate of the same colour. Alum throws down an abundant carmine precipitate, but the liquid retains the same colour. The protochloride of tin gives a rose-red precipitate, and renders the decoction colourless.

Forms red ink.

Brazil wood is the substance from which red ink is prepared. The colour which it communicates to cloth has very little permanence; yet it is occasionally employed in dyeing cotton what are technically called *chemical colours*, by which is understood colours that will not resist washing. The decoction of Brazil wood, which is called juice of Brazil, is found to answer better for the process of dyeing when it has been kept some time, and has even undergone some degree of fermentation, than when it has been fresh prepared. The colour by keeping becomes of a yellowish red.

Simple Colours.

Within the last five or six years, Brazil wood has been nearly superseded by a wood imported from Africa, to which our dyers give the name of *camwood.* It is richer, and gives a finer colour, than any of the varieties of Brazil wood. It is not so much affected by alkalies, nor so liable to assume a violet shade; and the yellow colouring matter with which it is mixed gives the red a more lively appearance. We have not learned the botanical name of the tree which yields this wood.

8. *Logwood.*—This wood is usually, on the Continent, called *Campeachy wood.* It is the wood of the *hematoxylon Campeachianum*, a tree which grows to a considerable size in Jamaica, and on the eastern shore of the Bay of Campeachy. Its specific gravity is greater than that of water; it has a fine grain, and is susceptible of a fine polish. Besides the colouring matter to which it owes its value, logwood contains resin and oil, which are soluble in water; acetic acid and salts, consisting of potash and lime, combined with a vegetable acid, which are soluble in water saturated with chloride of potassium. It contains also sulphate of lime, oxalate of lime, a little alumina, and some peroxide of iron and oxide of manganese. Chevreul, to whom we are indebted for a chemical examination of logwood, has given the following process for extracting its colouring matter, which he has distinguished by the name of *hematin.*

Yields hematin.

How obtained.

The raspings of the wood are digested in water of a temperature from 122° to 131°, till every thing soluble is taken up. Evaporate the aqueous solution to dryness by a gentle heat, and treat the residue with alcohol of the specific gravity 0·843, which dissolves the colouring matter, leaving a brown residue still containing colouring matter in chemical combination. Filter the alcoholic solution, and distil it till what remains becomes of the consistence of a syrup. This syrup being mixed with some water, crystals begin immediately to be deposited. Leave it for twenty-four hours to evaporate spontaneously, then decant the liquid portion from off the crystals, and wash them with a little alcohol. The decanted liquid being left to spontaneous evaporation, will yield more crystals, and finally remains a thick uncrystallizable liquid. If it be evaporated to dryness, macerate the dry mass in cold water, and evaporate afresh: more crystals are obtained, which may be purified, like the other, by washing them in alcohol. These crystals thus obtained constitute *hematin*, or the pure colouring matter of logwood.

Its properties.

They have considerable lustre, and a scarlet colour. Under the microscope they appear to constitute needles arranged in sphericles. When rubbed on a glass it appears *orange* by transmitted light, and white by reflected light. But if we let fall on it a drop of alcohol, it appears *carmine red* by transmitted, and *yellow* by reflected light. When put into the mouth it is at first tasteless; but after some time a sensation of astringency, acridity, and bitterness, is perceived. When heated in a retort to decomposition, it gives out among other products ammonia, from which we may conclude that it contains azote. After every thing volatile is driven off, there remains fifty-four per cent. of charry matter half fused; which, when burned in the open air, leaves a quantity of lime and peroxide of iron, amounting to rather less than one per cent. of the hematin employed.

Simple Colours.

Hematin requires for solution 1000 times its weight of water. By evaporation it does not yield crystals, but when very much concentrated it is converted into a confused crystalline mass. It dissolves in alcohol and ether, and the solutions have a reddish-yellow colour. It combines with the acids, which render it yellow when added in small quantity; but when in a larger proportion they give it a red colour. Sulphurous acid and carbonic acid give the solution of hematin a pale-yellow colour. Boracic acid gives it a pale-red, and phosphoric and phosphorous acid a pale-orange colour. Arsenious acid has no sensible action on it. Sulphuretted hydrogen gas renders it yellow; and if we keep a solution of hematin charged with this gas for some time in a corked phial, it loses its colour altogether; but the colour appears if we remove the gas by means of a little oxide of lead. The salifiable bases give solution of hematin a violet, purple, or blue colour. With the fixed alkalies it forms compounds perfectly saturated and soluble. The alkaline earths fall down in combination, and have a purple colour when they fall from neutral salts, and a blue colour when from subsalts. An excess of alkali destroys the colour altogether. With the hydrated oxides of antimony, zinc, bismuth, nickel, iron, and copper, it forms blue or purple coloured compounds. The compound which hematin forms with alumina and oxide of copper at once may be fixed upon linen or cotton, and gives a blue colour like that of indigo, only it is rendered yellow by the concentrated acids, while indigo remains unchanged, unless the acid be the nitric. The protoxide of tin, when united with hematin, forms a blue-coloured compound, while its combination with the peroxide of tin is red. We see from this that the protoxide of tin possesses the characters of an alkali, while the peroxide is an acid. A solution of gelatine throws down a concentrated solution of hematin purple.

Hematin is easily altered. When a mixture of alkali and hematin is kept *in vacuo*, or in a well-corked phial, quite full, no action takes place; but when air has access, oxygen is absorbed, and the hematin quite destroyed in a few hours. During this action, the blue colour of the liquid changes first into red, and then into brown. The alkali becomes saturated with carbonic acid.

II.—*Method of dyeing Wool Red.*

All the colouring matters employed for dyeing wool red by modern dyers require a mordant to fix them. The shade of colour depends partly upon the kind of colouring matter used, partly on the mordant, and partly on the quantity of colour which the cloth is made to imbibe by the length of time that it remains exposed to the action of the dyeing liquor. The purple of the ancients, the colouring matter of which was obtained from different species of shell-fish, required no mordant; but it has already been observed that this mode of dyeing has been for ages out of use.

Madder red.

Madder Red.—Madder is only employed for dyeing coarse woollen stuffs; and the following is the process. The stuffs are first boiled for two or three hours with alum and tartar; they are then left to drain, slightly wrung out, put into a linen bag, and carried into a cool place, where they are to remain for some days. The quantities and proportions of the alum and tartar are varied according to the views of the dyer, and the shade of colour which is wanted. Some recommend five ounces of alum and one ounce of tartar to each pound of wool. By increasing the proportion of tartar to a certain degree, a deep and permanent cinnamon colour, instead of a red, is produced. This arises from the yellow tinge which is induced by means of the acid on the colouring particles of the madder. Others propose to diminish the proportion of tartar, and to employ only a seventh part. In conducting the process of dyeing with madder, the bath should not be brought to the boiling point; because at that temperature the fawn-coloured particles would be dissolved, and a different shade obtained from that which is desired. When the water is at that degree of temperature which the hand can bear, Hellot recommends the addition of half a pound of grape madder for every pound of wool to be dyed. It is then to be well stirred before the wool is introduced, which must remain for an hour without boiling, excepting for a few minutes towards the end of the process, that the combination of the colouring particles with the stuff may be more certain.

Simple Colours. Process.

Rosing.

Madder reds are sometimes rosed, as it is called, with archil and Brazil wood. In this way they become more beautiful and velvety; but this brightness is not permanent. But madder reds, even when they are most perfect, are far inferior to those obtained from lac and cochineal, and even to that produced by kermes; but as the expense of the materials is comparatively small, they are employed, as we have already observed, for coarse stuffs.

Proportion of madder.

Different authors recommend different proportions of madder. Poerner proposes to employ one third of the weight of the wool, while Scheffer limits the quantity to one fourth. In one process, Poerner added to the alum and tartar a quantity of solution of tin equal in weight to the tartar, and after two hours boiling allowed the cloth to remain in the bath, which had been left to cool for three or four days. He then dyed it in the usual way, and thus obtained a fine red. According to another process, he prepared the cloth by the common boiling, and dyed it in a bath slightly heated, with a larger proportion of madder, tartar, and solution of tin. The cloth remained twenty-four hours in the bath; and when it had become cold he put it into another bath, made with madder only, where it remained for twenty-four hours. By this process he got a fine red, somewhat brighter than the common, but inclining a little to yellow. Scheffer informs us that he obtained an orange-red by boiling wool with a solution of tin and one fourth of alum, and then by dyeing with one fourth of madder. A cherry colour is obtained, according to Bergman, by dyeing with one part of a solution of tin and two of madder, without previously boiling the wool. By exposure to the air this colour becomes deeper. By boiling the wool for two hours with one fourth of sulphate of iron, then washing it, and afterwards immersing it in cold water with one fourth of madder, and then boiling for an hour, the result is a coffee colour. But if the wool has not been soaked, and if it be dyed with one part of sulphate of iron and two of madder, the colour is a brown approaching to red.

Different mordants.

When sulphate of copper is employed as the mordant, the madder dye yields a clear brown, inclining somewhat to yellow; and a similar colour may be produced by dyeing the wool, simply soaked in hot water, with one part of sulphate of copper and two of madder. But when this mordant and dyestuff are used in equal proportions, the yellow is somewhat more obscure, approaching to green; and in both these instances exposure to the air does not produce a darker colour. Berthollet informs us that he employed a solution of tin in various ways, both in the preparation and the application of the madder; and by the use of different solutions of tin, he found, that although the tint was somewhat brighter than what is obtained by the common process, it was always more inclined to yellow or fawn colour.

Scarlet.

Scarlet.—The finest and most splendid of all colours is scarlet. This, like other colours, is of various shades, according to the quality and proportion of the colouring matter employed. The scarlet dye is communicated to wool-

Simple Colours. len stuffs by means of cochineal, the history and properties of which we have already detailed. The Mexicans, as appears from their history, employed alumina as the basis or mordant to fix the colour of cochineal; and previous to the discovery of the solution of tin, the use of the same substance seems to have prevailed in Europe. The fine colour obtained from the latter received, as we have already mentioned, different names in different places; as that of *bow dye* in England, *scarlet of the Gobelins* in France, and in Holland *Dutch scarlet*.

Process. In the process for dyeing scarlet two operations are necessary. The first is denominated the boiling, and the second is distinguished by the name of finishing or reddening.

Boiling. The operation of boiling, which is the first part of the process, is conducted in the following manner:—For one hundred pounds of cloth, six pounds of pure tartar are added to the water, which is made pretty warm. The bath is then to be briskly stirred; and when the heat has increased a little more, half a pound of powdered cochineal is to be added, and the whole is then to be well mixed. The next moment five pounds of a very clear solution of tin are to be poured in and carefully mixed. When the bath begins to boil, the cloth is introduced, and briskly moved for two or three turns: after which it is moved more slowly. The boiling having continued for two hours, the cloth is taken out, exposed to the air, and carried to the river to be well washed.

Reddening. In the preparation of the second bath, which is for the reddening, the boiler is to be emptied, and when the bath has just reached the boiling point, five pounds and three quarters of cochineal, previously powdered and sifted, are to be added. These are to be carefully mixed; and after having ceased stirring, when a crust has formed on the surface, and opened of itself in several places, thirteen or fourteen pounds of solution of tin are poured in. Should the bath during the boiling rise above the edge of the boiler, it may be cooled with a little cold water. This solution being well mixed, the cloth is put in, and two or three times quickly turned. It is then boiled in the bath for an hour, taking care to keep it under the surface. It is afterwards taken out, exposed to the air, and, when it has cooled, washed in the river and dried.

Proportion of ingredients. There are no determinate proportions of cochineal and solution of tin in either of these operations. Hellot informs us that some dyers employ two thirds of solution of tin and one fourth of cochineal in the boiling or first operation, and the other one third of the solution of tin with the remaining three fourths of the cochineal in the second operation, or the reddening. He adds farther, that the use of tartar gives a greater degree of permanency to the colour, provided the proportion do not exceed one half the weight of the cochineal employed. According to Berthollet, several dyers at present adopt this practice. Tartar, he observes, promotes the solution of the colouring matter; and this effect is greater when it is ground with the cochineal, after which it is found that the residuum is more completely exhausted. But this consideration is of inferior consequence when the operations are successively performed, because any colouring matter that may remain in the residuum is employed in the next operation. It ought not, however, to be overlooked, that the tartar communicates to the colour a rosy hue.

Shorter process. It is the practice of some dyers not to remove the cloth out of the boiling. They merely refresh it, and perform the operation of reddening in the same bath. When this is done, the infusion of cochineal, made in a separate vessel, and mixed with the proper proportion of solution of tin, is added. By conducting the process in this way the scarlet is supposed to be equally fine, and there is a considerable saving of time and fuel.

Brighter red. To give scarlet the bright lively red, which, as it approaches to the colour of fire, has been distinguished by the name of *fiery scarlet*, a yellow tinge is communicated by boiling fustic in the first bath, or by adding a little turmeric to the cochineal. A larger proportion of the solution of tin also produces this yellow shade, but it renders the cloth harsh, and limits the action of the colouring matter. The use of fustic or turmeric, therefore, although the colour obtained from them is not permanent, is preferable to an excess of the solution of tin. When these substances are used, the inside of the cloth, when it is cut, appears yellow; but in the ordinary processes, the cochineal, it is found, does not penetrate the cloth, for when no other substance is employed the cloth is internally white.

Tin and copper boilers. The use of tin boilers is recommended in dyeing scarlet. When copper boilers are employed, the acid acts on the metal, and thus forming a solution, injures the beauty of the colour. Tin boilers, however, are attended with several inconveniences. It is difficult to procure them of sufficient size, and they are apt to be melted by the incautious continuance of the fire after they have been emptied. In the use of copper boilers there are several necessary precautions. They must be kept very clean, the acid liquor should not be allowed to remain in them for any length of time, and some contrivance should be adopted to prevent the cloth from touching the metal, either by using a net or a wicker basket.

Different proportions of ingredients. Different proportions of materials, we have observed, are recommended by different authors. For the boiling, Scheffer directs an ounce and a half of solution of tin, with an equal quantity of starch, and as much tartar, to every pound of cloth. The effect of the starch is to give more uniformity to the colour. When the water boils, a dram of cochineal is to be added; it is then to be well stirred, and after the wool is introduced, to be boiled for an hour, taken out, and washed. The proportions for the reddening bath, in which the wool is to be boiled half an hour, are half an ounce of starch, three fourths of an ounce of solution of tin, half an ounce of tartar, and seven drachms of cochineal. In Scheffer's process, it may be observed, the proportion of solution of tin is smaller than in that of Hellot, but the quantity of tin in the solution of the former is greater than in that of the latter.

Poerner's process. Poerner has described three principal processes, according to the variety of the shade of the scarlet. He uses no cochineal in the boiling; the materials of which are one ounce and six drachms of tartar, and an equal weight of solution of tin, the latter being added after the tartar is dissolved, for every pound of cloth. As soon as the boiling has commenced, the cloth is introduced, and it is boiled for two hours. For the reddening of the first process he employs two drachms of tartar and one ounce of cochineal, adding gradually afterwards two ounces of solution of tin. For the reddening of the second process the same quantity of cochineal and solution of tin, without any tartar, is employed. In the reddening of the third process, two drachms of tartar with one ounce of solution of tin, one ounce of cochineal, and two ounces of common salt, are directed to be used. The colour produced in the first process has the deepest shade, that of the second is more lively, while that of the third is paler and brighter.

Different shades. By the use of tartar in the reddening in different proportions, various shades of scarlet may be obtained. When it is employed, the shade is deeper and fuller; but when it is entirely omitted, the scarlet approaches to an orange colour. The shade of colour also is subject to considerable variety, from the different degrees of strength of the solution of tin. To ascertain this effect, Berthollet made a number of experiments. He found that a solution of tin, composed of sixteen parts of nitric acid, two of muriate of

Simple Colours

ammonia, and three of tin, produced a deeper shade than when the proportions of the acid and muriate of ammonia were equal, with only two parts of tin. The last proportions, he observes, succeeded best. Four parts of water were mixed with the solution. When the proportion of muriate of ammonia amounted only to half a part, the colour was brighter, and inclining to orange.

Use of common salt.

Common salt has the effect of increasing the brightness of scarlet, while it is also attended with the advantage of causing the colour to penetrate deeper into the cloth. It seems difficult to explain why common salt, which gives a deeper shade to the colour of the infusion of cochineal, and indeed produces a similar effect on colours in general, should diminish the intensity of the colour of scarlet. The proportion of common salt mentioned above is, according to Poerner, the greatest that can be employed. When less is used, the shade, though lighter, is more agreeable. By adding five ounces of white sugar to the ingredients of the second process, a fine colour, which is always lighter than that of the first process, will be obtained. The colour, it is said, is more permanent, and the shade more agreeable, when the cloth is left twenty-four hours in the boiler after it has cooled.

Method of using the lac dye.

For dyeing fine woollen cloth the lac dye is commonly used. It comes to the dyer in the state of a fine powder, having a brownish-red colour, inclining to violet. It contains much less colouring matter than cochineal, but is incomparably cheaper. To dye forty-three pounds of fine woollen cloth, six pounds of lac, three pounds of cream of tartar, and five pounds of tin mordant are put into a dyeing vessel, either of tin, or at least lined with tin, with a sufficient quantity of water. The whole is brought to the boiling temperature, and after it has boiled briskly a sufficient time to dissolve the colouring matter, the cloth is passed through it for about an hour, or till it has acquired the requisite depth of colour.

Tin mordant, how made.

The tin mordant used is made by dissolving two ounces of tin in thirty pounds of aquafortis mixed with one pound of muriatic acid. The solution is transparent, and it is kept in well-corked bottles for use. The tin is doubtless in the state of protochloride, though it sometimes also gets into the state of perchloride. Either state will answer, but in the second case the dyeing process is much slower, the cloth not seeming to imbibe the perchloride of tin so rapidly as the protochloride. From the above proportions, it is obvious that to dye forty-three pounds of woollen cloth scarlet, one third of an ounce of tin converted into protochloride is sufficient. This is rather less than 146 grains of tin; so that each pound of the woollen cloth combines with not more than 3·4 grains of tin. It is obvious from this that the particles of tin must be exceedingly minute indeed, otherwise 3·4 grains of tin could not be so minutely divided as to cover the surface of a pound weight of woollen cloth.

When the dyer wishes the scarlet to assume a brighter shade, he sometimes adds a little quercitron bark, which, by the yellow colour which it induces, adds materially to the brightness of the colour. This plan was first suggested by Dr Bancroft, and it has been since pretty generally acted on.

Dr Bancroft recommended the tin mordant to be prepared by dissolving tin in muriatic acid mixed with one fourth of its weight of sulphuric acid. This solution, he says, answers very well, and is much cheaper. We cannot find, however, that any of the dyers in this country follow that process. We can hardly think that the present method of using so much nitric and so little muriatic acid is a good one. The object being to obtain a protochloride of tin, one would think that muriatic acid would be a better vehicle. Tin dissolves in this acid very well, and the protochloride of tin formed in this way is easily obtained in crystals. But the tin mordant, as prepared by the dyers, contains a great excess of nitric acid; and we cannot avoid suspecting that this excess is connected with the shade of scarlet produced. The nitric acid doubtless renders a part of the colouring matter of the lac yellow, and thus changes the dark crimson colour natural to this dyestuff into scarlet.

Simple Colours.

Cochineal is still employed to a considerable extent in dyeing the finest kinds of woollen cloth scarlet. The process is precisely the same as when lac is employed, remembering only that cochineal is much richer in colouring matter than lac, and that therefore a smaller quantity will serve. Dr Bancroft introduced the method of putting the cochineal, the tin mordant, and the tartar into the dyeing vessel at once, and dissolving them all together in water before the cloth is passed through the liquid; and this method is pretty generally though not universally followed.

Dr Bancroft's method of using quercitron bark to supply the place of a portion of the cochineal, is likewise pretty generally followed. The price of cochineal, in consequence of the introduction of the lac dye, has sunk from thirty shillings the pound to about nine shillings and sixpence. This makes the saving not so considerable in point of expense as it was when Bancroft wrote, though even at present it is an important saving.

Different shades of scarlet.

To produce different shades of scarlet, and the other colours which are derived from it, all that is necessary is to vary the proportions of cochineal, tartar, and solution of tin; and for the shades which incline most to yellow, the addition of quercitron bark or fustic is requisite. The use of the tartar is to deepen the colour, and the solution of tin produces a shade of orange. When the shade of colour required to be communicated to the stuff is light, the time of continuing the process must be shortened.[1]

Crimson.

Crimson.—The processes which are employed to dye wool a crimson colour are two. The stuff is either dyed crimson at once, or the crimson shade is communicated to it after being previously dyed of a scarlet colour. To dye crimson by a single process, a solution of two ounces and a half of alum and an ounce and a half of tartar for every pound of stuff, is employed for the boiling, and the stuff is afterwards to be dyed with an ounce of cochineal. It is usual also to employ solution of tin, but in smaller proportion than for dyeing scarlet. The processes employed, it is scarcely necessary to observe, must vary according as the shade wanted is deeper or lighter, or more or less distant from scarlet. Common salt is also employed by some in the boiling. To render the crimson deeper, and to give it more bloom, archil and potash are frequently used; but this bloom, it ought to be observed, is extremely fugacious. By adding tartar and alum, the boiling for crimson is sometimes prepared after a scarlet reddening; and it is said that the colour possesses more bloom when both the boiling and reddening are made after scarlet, than when the crimson is dyed in a fresh bath prepared on purpose. In dyeing these colours the wild cochineal may be employed; but as it contains a smaller proportion of colouring matter, the quantity must be greater.

dyed by one process,

or by the conversion of scarlet.

Different substances, as the alkalies, alum, and earthy salts in general, convert the colour of scarlet to crimson, which is the natural colour of cochineal. To effect this, the stuff previously dyed scarlet is boiled for an hour in a

[1] Berthollet, ii. 194.

Simple Colours.

solution of alum, the strength of which is to be regulated by the depth of shade required. In conducting this process, it is necessary to observe, that water impregnated with earthy salts has a considerable effect in varying the shade, so that the quantity of alum employed must be proportioned to the purity of the water. Hellot tried soap, soda, potash, and some other substances, and although they produced the crimson, yet it was of a deeper shade, and had less lustre, than what was produced by means of alum. Ammonia produced a good effect, but, from its great volatility, a considerable proportion must be put into the bath, moderately heated, with a little sal ammoniac, and an equal quantity of potash. By this process the stuff became of a bright rosy colour, and thus rendered a smaller quantity of cochineal necessary. Poerner directs the stuff, previously dyed scarlet, to remain twenty-four hours in a cold solution of sal ammoniac and potash.

Half-grain crimson, &c.

To produce crimsons, as well as scarlets, in half grain, madder is to be substituted for half the quantity of the cochineal; or in other proportions, according to the shade desired. The same boiling is given as for scarlet in grain, and the other parts of the process are to be conducted as for reddening the scarlet or crimson. Even the common madder red assumes a greater degree of lustre when the boiling is made after the reddening for scarlet.

At present we are not aware that kermes is ever employed by the dyers in this country. The use of this dye-stuff seems to have been completely superseded by cochineal and lac dyes. Certainly the colour given by kermes is not so fine as that given by these substances, but it has the advantage of being exceedingly durable.

III.—*Method of dyeing Silk Red.*

Different processes with madder.

Madder Red.—The colour which is obtained from madder does not possess sufficient brightness for dyeing silk. We shall here, however, describe some of the processes which are employed for this purpose. That of De la Folie is the following: Half a pound of alum is to be dissolved in each quart of hot water, and two ounces of potash are afterwards to be added. When the effervescence has ceased, and the liquor has become clear, the silk must be kept in it for two hours, after which it is to be washed and put into the madder-bath. The silk which is dyed in this way becomes more beautiful by means of the soap proof. The process of Scheffer is somewhat different. For each pound of scoured silk he directs a solution of four ounces of alum and six drachms of chalk to be prepared. When the sediment has formed, the solution is to be decanted, and having become quite cold, the silk is immersed in it, and left for eighteen hours. It is then taken out and dried, and afterwards dyed with an equal weight of madder. The colour thus obtained is of a dark shade. Mr Guhliche describes another process. For every pound of silk he proposes a bath of four ounces of alum and one ounce of solution of tin. When the liquor has become clear it is decanted, and the silk carefully soaked in it for twelve hours, after which it is to be immersed in a bath with half a pound of madder softened by boiling with an infusion of galls in white wine. The bath is to be kept moderately hot for an hour, and then made to boil for two minutes. The silk, being taken from the bath, is to be washed in a stream of water, and dried in the sun. The colour thus obtained is very permanent. By leaving out the galls it is clearer. The brightness of the first colour may be considerably increased by passing the stuff through a bath of Brazil wood, to which one ounce of solution of tin is added. In this way the colour becomes extremely beautiful and durable.

Process with Brazil wood.

Silk is sometimes dyed with Brazil wood, and the colour thus obtained has been distinguished by the name of *false crimson*, to distinguish it from the more durable colour which is produced by cochineal. The silk, after being boiled with soap, is to be alumed. It is then to be refreshed at the river, and dipped in a bath more or less charged with Brazil juice, according to the depth of shade required. If pure water be employed, the colour will be too red for crimson; but to remedy this, the stuff may be passed through a weak alkaline solution, or a little alkali may be added to the bath, or the stuff may be washed in hard water till it has acquired the proper shade. To deepen the shade of false crimsons or dark reds, the solution of logwood is added to the Brazil bath, the silk being previously impregnated with the latter; or a little alkali may be added, according to the shade required.

With cochineal.

The crimson produced by cochineal is called *grain crimson*, to distinguish it from false crimson. The silk, being well cleansed from the soap at the river, is to be immersed in alum liquor of the full strength, and to remain for a night. It is then to be washed and twice beetled at the river. The bath is prepared by filling a long boiler two thirds with water, to which are added, when it boils, from half an ounce to two ounces of powdered white galls for every pound of silk. When it has boiled for a few moments, from two to three ounces of cochineal, also powdered and sifted, for every pound of silk, are put in, and afterwards one ounce of tartar to every pound of cochineal. When the tartar is dissolved, one ounce of solution of tin is added for every ounce of tartar. In the preparation of this solution of tin, the following proportions are recommended by Macquer. For every pound of nitric acid two ounces of sal ammoniac, six ounces of fine grain tin, and twelve ounces of water, are employed. When these ingredients are mixed together, the boiler is to be filled up with cold water; and the proportion of the bath for every pound of silk is about eight or ten quarts of water. In this the silk is immediately immersed and turned on the winch till it appear to be of a uniform colour. The fire is then increased, and the bath is kept boiling for two hours, taking care to turn the silk occasionally. The fire is afterwards put out, and the silk put into the bath, where it is allowed to remain for a few hours longer. It is then taken out, washed at the river, twice beetled, wrung, and dried. Two processes are recommended by Scheffer and Macquer. In that of the former, a greater proportion of cochineal is employed in the dye-bath; but in that of the latter, a yellow ground is previously communicated to the silk. The colour which is thus obtained resists the action of soap, and is more durable than that which is produced by means of carthamus.

Poppy red.

To obtain other shades of red, the above processes must be varied. If, after the silk has been wrung out of the solution of tin, it is steeped for a night in a cold solution of alum, in the proportion of one ounce to a quart of water, wrung, and dried, then washed and boiled with cochineal, it will only appear of a pale poppy colour; but a fine poppy red may be produced by steeping it twelve hours in the solution of tin, diluted with eight parts of water, then left all night in the solution of alum, washed, dried, and passed through the two baths of cochineal, taking care to add to the second bath a small quantity of sulphuric acid. The same colour may be produced by dyeing the silk previously with anotta, and then passing it successively through a number of baths prepared with an alkaline solution of carthamus, to which lemon juice has been added, till it acquire a fine cherry-colour. To brighten the colour, the silk, after being dyed, may be immersed in hot water acidulated with lemon juice.

Cherry red, &c.

Other shades of red, as a cherry red, and flesh red, are also produced by carthamus. For a cherry red it is not necessary that the stuff be previously dyed with anotta.

Simple Colours.

and the proportion of colouring matter is smaller. A flesh-red colour is obtained by adding a little soap to the bath, which has the effect of softening the colour, and of retarding the action of the colouring matter on the stuff. To produce dark shades, it is sometimes usual to mix archil, and by this means the expense is diminished.

Scarlet. Those who have produced a colour on silk which comes nearest to scarlet, Berthollet observes, begin with dyeing the silk crimson. It is then dyed with carthamus, and lastly it is dyed yellow without heat. By this process a fine colour is obtained; but the dye of the carthamus is not permanent, as it is destroyed by the action of the air, and the colour becomes deeper. The following is Dr Bancroft's process. In a solution of murio-sulphate of tin, diluted with five times its weight of water, the silk is to be soaked for two hours; and after being taken out, it is to be wrung and partially dried. It is then to be dyed in a bath prepared with four parts of cochineal and three of quercitron bark. In this way a colour approaching to scarlet is obtained. To give the colour more body, the immersion may be repeated both in the solution of tin and in the dyeing bath; and the brightness of the scarlet is increased by means of the addition of carthamus. A lively rose colour is produced by omitting the quercitron bark, and dyeing the silk with cochineal only; and by adding a large proportion of water to the cochineal, a yellow shade is obtained, which changes the cochineal to the compound scarlet colour.[1]

Rose colour.

IV.—*Method of dyeing Cotton and Linen Red.*

The dyestuff usually employed to give a red colour to cotton and linen is madder. It is easier to dye cotton than linen; but as the processes are the same for each, one general description will apply to both. There are two kinds of madder red; the one is called *simple* madder red, and the other, which was originally invented in the Levant, is distinguished in this country by the name of *Turkey red.* This last constitutes by far the brightest and most beautiful and permanent red which is communicated to cotton; we shall therefore proceed to give a somewhat particular account of the process.

The method was first put in practice in Glasgow about forty years ago, by M. Papillon, a French gentleman, who established a Turkey-red dye-work along with Mr Mackintosh. He made an agreement with the commissioners and trustees for manufactures in Scotland, that the process was to be by them published for the benefit of the public at the end of a certain term of years. The period agreed upon having expired in 1803, the trustees laid a minute account of the different processes before the public. Since that period Turkey-red dyeing has been conducted in Glasgow upon a very extensive scale. Different individuals, possessed of both chemical skill and considerable sagacity, have studied the different parts of this very complicated method of dyeing. The effects of each individual operation have been carefully investigated, and the whole has been somewhat shortened and simplified, though it still constitutes the most complicated process in the whole art of dyeing. The Turkey-red dye is practised by a considerable number of persons in Glasgow; but the oldest, and perhaps the most extensive establishment, is that of Henry Monteath and Company at Rutherglen Bridge. The character of that house has been long established, and the beauty of their Turkey-red dye is known and appreciated in every part of the globe where British manufactures are known. From Glasgow the Turkey-red dye has gradually made its way into Lancashire.

Cotton cloth which is to receive the Turkey-red dye is never bleached beforehand; because it has been found that the first parts of the processes succeed better with unbleached than with bleached cloth.

The rot steep. 1. The first step of the dyer is to remove the weaver's dressing. This is done by steeping the cloth in a weak alkaline ley. To this the technical name of the *rot steep* is given. From four to five pounds of caustic potash are generally employed for every 100 lbs. of cotton cloth. The temperature of the solution is from 100° to 120°, and the cloth is kept in the steep for twenty-four hours, and then well washed.[2]

2. From seven to ten pounds of carbonate of soda are dissolved in a sufficient quantity of water to keep the cloth (supposed always to weigh 100 lbs.) wet. In this ley the cloth, previously deprived of the weaver's dressing, is boiled for some time.

The soap steep. 3. The process which we are now going to describe is the one upon which the goodness of the Turkey-red dye depends more than upon any of the others. Without it the dye cannot be produced upon new cloth; but when cloth which has been frequently washed with soap is to be dyed (an old cotton shirt, for example), this process may be omitted altogether. It is evident from this that soap communicates to cotton cloth the same properties as the process which we are now going to describe.

A liquor is composed of the following ingredients:

1 gallon of gallipoli oil,

1½ gallon of soft sheep dung,

4 gallons of solution of carbonate of soda, of the specific gravity 1·06,

1 gallon of solution of pearl ash, of the specific gravity 1·04,

mixed with a sufficient quantity of cold water to make up twenty-two gallons. The specific gravity of this liquor should be from 1·020 to 1·025.

This liquor has a milk-white appearance, and is in fact a kind of incipient soap. It is put into a large wooden open cylindrical vessel, called the *liquor tub* (see Plate CCXIX., figs. 1 and 2), and is kept continually in a state of agitation by a kind of wooden levers, driven round in it by machinery put in motion by the steam-engine. This liquor is conveyed by a tin pipe to the *padding machine*, which is situated in an apartment below. Several sections of this machine are given in the same plate, fig. 3, 4, and 5. A kind of trough in this machine is kept always full of the milky liquor, and the pieces of cloth to be dyed are made to pass through this liquid, and are thoroughly soaked with it.

By this process the cloth is impregnated with the soapy matter, and the longer this matter is left undisturbed on the cloth, the better does it take the dye. Fourteen days is the least period that this impregnation is allowed to remain.

The sheep dung gives the cloth a dark-green colour, and is found materially to assist the bleaching which the cloth afterwards undergoes. This bleaching goes on much more rapidly with than without the sheep dung, especially when the cloth is exposed on the grass between the different operations. In what way the sheep dung contributes to this acceleration has not been determined, but the fact is certain.[3]

4. When the weather is favourable, the cloth, after be-

---

[1] *Philosophy of Permanent Colours*, 312.

[2] In general the alkaline ley of No. 9 is worked up in this process, and when this is done less potash is required.

[3] No advantage has been found to result from using the alkalies caustic in this process; and a mixture of potash and soda answers much better than soda alone.

Simple Colours.

ing impregnated with the oleaginous liquor, is spread upon the grass to dry. But should the weather be rainy, as it would not do to allow the oleaginous liquid to be washed out by the rain, the goods are dried in the stove.

5. After the cloth has been dried in the stove, it is a second time impregnated with the oleaginous liquid described in No. 3, by means of the padding machine. It is then spread on the grass for some hours if the weather be favourable, and ultimately dried in the stove.

The impregnation with the oleaginous liquor, the exposure on the grass, and the stove drying, are repeated a third time. When the weather is rainy, which prevents exposure on the grass, and obliges the workmen to dry the cloth at once in the stove, the impregnation with the oleaginous liquor is sometimes repeated a fourth time.

Upon the sides of the tubs in which the oleaginous liquor is kept, a white solid crust gradually accumulates. This matter being examined, was found to consist almost entirely of phosphate of lime. It was doubtless derived from the sheep dung with which the saponaceous liquid was mixed.

6. The next process is to steep the cloth in a weak solution of pearl ash, of the specific gravity 1·0075 to 1·01, heated to the temperature of 120°. From this liquor it is wrung out and again dried.

7. A mixture is now made of the following substances:

1 gallon gallipoli oil,
3 gallons soda ley of specific gravity 1·06,
1 gallon caustic potash ley of specific gravity 1·04,

diluted with as much water as will make up the whole to twenty-two gallons. In this liquid, which is milky, like the preceding, and which contains an imperfect soap, the cloth used formerly to be tramped with the hand, and then wrung out. It is now soaked with the liquid by means of the padding machine, in the manner described under No. 3.

If the weather be fine, the cloth thus impregnated with the soap is exposed on the grass. It is then dried in the stove.

8. The above process (No. 7) is repeated thrice; and after each soaking in the saponaceous liquor, the cloth is exposed on the grass for some hours, and then dried in the stove.

9. The cloth, thus so many times soaked in the saponaceous liquor, is now steeped in a mixed ley of pearl ash and soda of the specific gravity from 1·01 to 1·0125, heated to the temperature of 120°. After being taken out of the steep, and allowed to drain for a few hours (taking care to preserve the liquor), the cloth is well washed. The object of this process is to remove any superfluous oil with which the cloth may be impregnated, the object being that all the oil adhering to the cloth should be in combination with an alkali. About half the alkali used in this process disappears during the steeping. The remaining liquor, which is about half as strong as at first, is reserved for future use. The cloth thus washed clean is dried in the stove.

The galling.

10. The preceding washing is necessary for the success of the next operation, called the *galling;* for the nutgall liquor will not be imbibed by the cloth unless it be thoroughly freed from all uncombined oil, which would give it a greasy feel. If the first steeping in alkali and washing has not fully accomplished this necessary object, they ought to be repeated.

For the galling, eighteen pounds of Aleppo galls are to be boiled for four or five hours in twenty-five gallons of water till it is reduced to about twenty gallons; and the liquid being now passed through a sieve, is sufficient for impregnating 100 lbs. of cloth with the requisite quantity of nutgalls. Of late years, sumach from Sicily has been substituted for nutgalls, thirty-three lbs. of sumach being considered as equivalent to eighteen lbs. of nutgalls. Sometimes a mixture of nine lbs. nutgalls and sixteen and a half lbs. of sumach is employed.

Through this decoction the cloth is either tramped by the hand, or it is passed and soaked in it by means of the padding machine. The temperature of the decoction should be from 80° to 100°. It is unnecessary to steep the cloth in the gall liquor; a complete soaking is all that is necessary. The cloth, thus soaked in a decoction of fustic, comes out dyed yellow, a colour which serves to improve the madder red by rendering it more lively.

The aluming.

11. The next process is to fix the alumina mordant upon the cloth. This step is essential, because without it the madder dye would not remain fixed in the cloth, but would be easily washed out. Accordingly the depth of the shade of red depends entirely upon the quantity of alumina fixed on the cotton. In a preceding part of this article we have stated the quantity of alumina fixed by this process upon the surface of a square yard of cloth.

In this country common alum is usually employed; but in many parts of the Continent they use acetate of alumina. The high price of that article prevents its employment in Britain. Acetate of alumina, however, is made in this country by the chemical manufacturers, and largely used by the calico-printers. It is made by mixing acetate of lime (obtained by saturating the acetic acid formed when wood is distilled with lime) with a solution of alum, and afterwards drawing off the clear liquor; or by mixing acetate of lead with solution of alum, though that process is more expensive.

Alum (as has been explained under the article ALUM) is a double salt, composed of

3 atoms sulphate of alumina,
1 atom sulphate of potash,
24 atoms water.

To form the alum liquor used by the Turkey-red dyers: To a solution of alum in water of the specific gravity 1·04 as much pearl ash, soda, or chalk is added as is sufficient to precipitate the alumina contained in the alum. Through this muddy liquor, which should have a temperature of from 100° to 120°, the cloth is passed and steeped for twelve hours. The alumina, in the state of extreme division which it has when thus newly precipitated, is readily imbibed by the cloth, and unites with the fibres of the cotton.

12. The cloth thus united to alumina is stove dried, and then washed out of the alum liquor.

13. These essential preliminary steps having been taken, the cloth is ready for being dyed.

The dyeing.

From one to three lbs. of madder reduced to the state of powder for every pound of cloth is employed, the quantity depending upon the shade of colour wanted. The cloth is entered into the boiler when the water is cold. It is brought to boil in one hour, and the boiling is continued for two hours. During the whole of this time the cloth is passed through the dyeing liquor by means of the winch.

For every twenty-five lbs. of cloth dyed, one gallon of bullock's blood is added. This is the quantity of cloth dyed at once in a boiler. This addition of blood is indispensable for obtaining a fine red colour Various attempts have been made to dispense with the use of blood in Turkey-red dyeing, but hitherto they have been unsuccessful. No satisfactory explanation of the way in which the blood acts has been given. For our own parts, we are disposed to consider the colouring matter of the blood as the useful ingredient. It is probably fixed upon the cloth to a certain extent, and by its fine scarlet tint it is obvious that it must improve the colour of madder red.

Simple Colours.

14. After the cloth has been thus dyed, it was formerly customary to steep it in a solution the same as that described in No. 7. This was called the *cuing* process. It is now generally dispensed with, and is unnecessary if the cloth has been well cleaned before the galling process. The object of it is merely to dissolve any greasy matter which may continue attached to the cloth, and to form a soap with it, which assists in the subsequent process.

The clearing.

15. Madder contains two colouring matters, a brown and a red. Both are fixed upon the cloth by the dyeing process. The consequence is, that the cloth has a dirty brownish-red colour, which is any thing but agreeable. Fortunately the brown colouring matter is not nearly so *fixed* upon the cloth as the red colouring matter. The next process, called the *clearing process*, is to get rid of the brown colouring matter. For this purpose the cloth is boiled from twelve to fourteen hours, in a mixture of five pounds of soda, eight pounds of soap, and sixteen to eighteen gallons of the residual liquor of No. 9, with a sufficient quantity of water. These quantities are supposed to be employed to clear a hundred pounds of cloth. By this process the brown colouring matter is almost wholly removed, and the cloth begins to assume the fine tint which distinguishes Turkey-red dyed cloth.

16. The next process serves not merely to remove the brown colouring matter more completely, but also to improve the shade of red. Five or six pounds of soap, and from sixteen to eighteen ounces of protochloride of tin, in crystals, are dissolved in water, in a globular boiler, into which the cloth is put. The boiler is then covered with a lid which fits close, and the boiling is conducted under the pressure of two atmospheres, or at the temperature of $250\frac{1}{2}°$. The boiler is furnished with a safety valve and a small conical pipe, the extremity of which has an aperture about $\frac{5}{16}$ths of an inch in diameter, from which there issues a constant stream of steam during the operation. We have given a section and elevation of this boiler in Plate CCXX. fig. 8 and 9, and in fig. 10 a plan of its top, and in fig. 11 of its lid. The use of the salt of tin is to give a shade of scarlet to the cloth. The oxide of tin seems to combine with the oleaginous acid of the soap, and this insoluble soap unites with the red colouring matter of the madder fixed upon the cloth, and improves the shade of colour.

17. After these processes, the cloth is spread out on the grass and exposed to the sun for a few days, which finishes the clearing. It is seldom that recourse is had to a bleaching liquor, consisting of a solution of chloride of lime in water, especially when a salt of lime is used in the cleaning process. When this method is employed, however, one gallon of the solution of chloride of lime, of the specific gravity 1·015, is mixed with twenty gallons of pure water. The cloth is immersed in this dilute solution from five to ten minutes, which is sufficient for completing the clearing.

Remarks on the processes.

Such are the different steps in fixing this beautiful and permanent colour, as practised in the principal works in Glasgow. Many attempts have been made to shorten these tedious processes, but hitherto these attempts have been unsuccessful. The impregnation with oil, or rather with soap, is essential, as is evident from this, that if one, two, or three of these operations be omitted, the red is inferior in proportion to the number of omissions.

Cloth bleached by chloride of lime does not produce a good red. Probably the fibres of the cotton wool are combined with lime, or rather sulphate of lime, which, by decomposing the oleaginous soap, prevents it from being deposited upon and combining with the cloth. But cloth bleached by the old process, namely, boiling in ley or soap, and exposing to the action of the sun, answers perfectly, and will produce as good a red as when unbleached cloth is used; but there would result no saving from bleaching the cloth in this way before commencing the impregnation with the oleaginous soap, because the bleaching is effected betwixt the oil operations by exposing the cloth on the grass.

The colour would be as good without the galls or sumach as with them. But there would be considerable difficulty in sufficiently impregnating the cloth with the solution of alum without its being previously passed through the gall decoction, and more particularly if the cloth be in the least degree greasy. The use of the galls, then, is to facilitate the fixation of the alumina upon the cloth.

Alumina is essential to the fixation of the colour; for without it the madder dye would be fugitive, and would disappear whenever the cloth was washed. The subsequent *clearing* operations would completely remove both the colouring matters of the madder, unless it were cleared along with a quantity of cloth that had received alumina, and been dyed a deep red. In that case the unalumed cloth will receive a little alumina from the alumed portion. This will serve to fix the colour; but as the quantity of alumina which in such a case is imbibed is very small, the red colour will be very pale. It is in this way that the two shades of red, the deep and the pale, which are often seen upon garments and furniture dyed Turkey red, are given. These two shades, by their contrast, frequently add considerably to the beauty of the pattern. The fustic, as well as the tin, probably serves to render the red colour more lively by the shade of yellow which they superinduce.

The three essential processes in the Turkey-red dyeing are, the impregnation with oleaginous soap, the impregnation with alumina, and the dyeing with madder. The last communicates the colour, the second fixes the colour, and the first gives beauty to the colour.

For the better understanding of the Turkey-red processes, we have got drawings made of the principal machinery used.

Figs. 1 and 2, Plate CCXIX., exhibit a section and plan of the *liquor tub*, in which the mixture of oil and alkali is put, with its agitators to prevent the oil from separating and swimming on the surface. From the liquor tub (which is placed in an upper room) the liquor passes by a tin pipe to the padding machine, represented in various ways in figs. 3, 4, and 5.

It consists essentially of a box for holding the liquor, through which the cloth passes; and afterwards it goes between two rollers, the distance between which regulates the quantity of liquor which the cloth retains.

a, is the lapper for folding the cloth.

b, a compound lever for regulating the pressure.

c, the box for containing the liquor.

d, a frame or *scrae* for laying the cloth on before it passes through the liquor.

e, pulleys for moving the lapper; and

f, the cylinders between which the cloth passes. They regulate, by their distance from each other, the quantity of liquor allowed to remain in the cloth.

Figs. 6 and 7 represent the elevation and plan of a *dyeing box* on the latest and most improved construction.

a, the winch for moving the cloth through the liquor while dyeing.

b, steam pipe for supplying the vessel with steam.

c, *c*, *c*, the dotted part, represents the valves through which the steam enters into the vessel.

d, *d*, *d*, *d*, divisions of the vessel for different pieces of cloth.

e, catch for stopping or setting on the winch at pleasure.

f, valve for regulating the quantity of steam admitted.

Simple Colours.

Figs. 8 and 9 represent a section and elevation of the clearing boiler. Fig. 10 represents exactly the mouth of this boiler, and fig. 11 the lid or cover. On the upper edge of this cover there is fixed all round a layer of hemp (a piece of flat rope). The lid is slipt into the inside of the boiler, and by the piece of rope it attaches itself exactly to the inside. The elasticity of the steam within presses it firmly against the inside rim of the mouth, and renders it quite steam-tight.

Scarlet with cochineal. The scarlet colour communicated to cotton by means of cochineal is far from being permanent; but if this colour is wished to be communicated to cotton, Dr Bancroft recommends to steep the cotton, previously moistened, for half an hour, in a diluted solution of murio-sulphate of tin, and then having wrung the cotton, to plunge it into water in which as much potash has been dissolved as will neutralize the acid adhering to the cotton, so that the oxide of tin may be more copiously fixed on the fibres of the cotton. The stuff being afterwards rinsed in water, may be dyed with cochineal and quercitron bark, in the proportion of four pounds of the former to two and a half or three pounds of the latter. A full bright colour is thus given to the cotton, which will bear slight washings with soap, and exposure to the air. Indeed the yellow part of the colour derived from quercitron bark will bear long boiling with soap, and will resist the action of acids.

Crimson. With the aluminous mordant, as it is usually applied by calico-printers for madder reds, cotton dyed with cochineal receives a beautiful crimson colour, which will bear several washings, and resist the weather for some time. It is not, however, to be considered as a fixed colour. Dr Bancroft is of opinion that the addition of a small portion of cochineal in dyeing madder reds upon the finer cottons, would be highly advantageous to the calico-printers. By this addition the madder reds are rendered more beautiful, and the fawn colour, or brownish-yellow hue, which injures these colours, would be thus overcome.[1]

Sect. II.—*Of Yellow.*

All the yellow dyes, as well as the red, require a mordant to fix them on the cloth; and the usual mordant employed is alumina. As in the last section, we shall in the first place give an account of the dyestuffs usually employed for giving a yellow colour to cloth, and then give a sketch of the methods employed for giving a yellow colour to wool, silk, cotton, and linen.

I.—*Description of the Dyestuffs.*

The principal colouring matters used in dyeing yellow are *weld*, *fustic*, *catechu*, *anotta*, and *quercitron*. We shall give a short account of these dyestuffs in succession.

Substances employed in dyeing yellow. Weld. 1. *Weld*, in French *gaud* or *vaud*, is the dried leaves and stems of the *reseda luteola*, a plant which grows wild in Britain, and in different European countries. Its leaves are long, narrow, and of a bright green, but the whole plant is made use of in the dyeing of yellow. There are two kinds of weld, cultivated and wild, the former of which is deemed more valuable than the latter, as it yields a much greater proportion of colouring matter. When this plant is fully ripe, it is pulled, dried, and bound up in bundles for the use of the dyer. The wild species grows higher and has a stronger stalk than that which is cultivated, by which the one may be readily distinguished from the other.

A decoction of this plant, if strong, has a brownish-yellow colour, and when diluted with water, it acquires a shade of green. The acids render this colour more pale, while alkalies, common salt, and sal ammoniac, render it deeper; and when sufficient quantities of these substances are dissolved in the decoction, a deep-yellow precipitate falls. A solution of alum or of protochloride of tin throws down a fine yellow lake; sulphate of iron occasions a black precipitate, and sulphate of copper a brownish-green precipitate.

Luteolin. Chevreul has discovered in weld a yellow colouring matter, to which he has given the name of *luteolin*. It may be sublimed, and in that case it crystallizes in needles, which are transparent, and have a pale-yellow colour. Luteolin dissolves in water, but the solution has little colour; yet silk or woollen previously impregnated with alumina, if passed through it, acquires a fine yellow colour. It is soluble in alcohol and ether. It combines with acids, but still more readily with bases. The compound which it forms with potash has a golden-yellow colour; but when exposed to the air it assumes first a shade of green, and then passes into brown. The compounds of luteolin with the other bases are easily obtained by double decomposition.

The yellow colour communicated by weld is more permanent than that communicated by quercitron or by old fustic.

Fustic. 2. *Fustic*[2] is the name given by the dyers in Great Britain to the wood of the *morus tinctoria*, a tree which grows in the West Indies, and probably also in South America. In France it is distinguished by the name of *bois jaune*. The wood is yellow, as its name imports, with orange veins. Ever since the discovery of America it has been used in dyeing, as appears from a paper in the Transactions of the Royal Society, of which Sir William Petty was the author. Its price is moderate, the colour it imparts is permanent, and it readily combines with indigo, which properties give it a claim to attention as a valuable ingredient in dyeing. Before it can be employed as a dyestuff, it must be cut into chips and put into a bag, that it may not fix in, and tear the stuff, to which it is to impart its colouring matter.

Properties. When a decoction of yellow wood or fustic is made very strong, the colour is of a reddish yellow, and when diluted it is of an orange yellow, which it readily yields to water. It becomes turbid by means of acids, its colour is of a pale yellow, and the greenish precipitate may be re-dissolved by alkalies. The sulphates of zinc, iron, and copper, as well as alum, throw down precipitates composed of the colouring matter and the different bases of the salts employed.

Morin. Chevreul discovered in fustic a yellow uncrystallizable colouring matter, to which he has given the name of *morin*. It restores the colour of turmeric paper reddened by lime. It is but little soluble in water, even when boiling hot. Alcohol is a better solvent of it than water, and ether still better than alcohol. When the alcoholic or ether solutions are evaporated, they deposite yellow crystals. The aqueous solution is rendered muddy by gelatine. The solutions of the fixed alkalies and alkaline earths give the aqueous solution a fine yellow colour,

[1] *Philosophy of Permanent Colours*, 317.

[2] The origin of the word *fustic* is not very well understood. The French applied the term *Fustet* to the *rhus cotinus* or *Venice sumach*, which yields fugitive and bad yellow. Bancroft supposes that *fustic* is merely a corruption of the word *fustet*. When the morus tinctoria was introduced, about a couple of centuries ago, being the wood of a large tree, it was called *old fustic*, while the rhus cotinus, being only a shrub, was called *young fustic*. Rhus cotinus being now hardly used by dyers, the term fustic has been assigned to the wood of the morus tinctoria.

Simple Colours.

without occasioning any precipitate. Alum causes it to assume a greenish-yellow colour. The sulphated peroxide of iron renders it green, and then throws down a precipitate. Concentrated sulphuric acid increases the intensity of the yellow colour, while nitric acid gives it a reddish shade, and renders it muddy. Boiling nitric acid converts it into oxalic acid. By combining with oxygen it seems to assume a red colour. Morin, when distilled, yields a liquid, which crystallizes as it cools, and furnishes a number of yellowish-brown needles. According to the experiments of George, boiling water extracts from fustic 0·15, and alcohol 0·09 of matter; and the wood is composed of

Lignin	74
Morin	9·1
Tannin	4
Gum	2
Resin	9
	98·1

3. *Catechu*, or *terra japonica*, comes from the East Indies, and is the inspissated decoction of certain plants containing tannin, but principally of the *areka nut*, the wood of *mimosa catechu*, the leaves of the *nauclea catechu*. Areka nuts, cut into small pieces, are sprinkled in an earthen vessel with water holding saltpetre in solution. A portion of the bark of kantai-babela (a species of mimosa) is added. The vessel is closed by a lid luted down with clay, that the temperature may be the higher. After an ebullition of two hours, the fire is gradually diminished during five or six hours. When the vessel is cold the areka nuts are taken out, and the decoction is evaporated down to the consistency of a syrup. It is then kneaded into small balls, and left to dry in the shade.

Constituents.

The principal constituents of catechu are tannin and extractive. The former may be thrown down by gelatine, the latter remains in solution. It has a reddish-brown colour and a sweetish taste. In India catechu is employed in dyeing and calico-printing. The colours which it gives are very various, depending upon the nature of the mordants employed along with it; but they are all very fixed. With verdigris and sal ammoniac the colour is brown; with protochloride of tin yellow; with perchloride of tin a brown, or, if nitrate of copper be added, a deep bronze; with nitrate of alumina a copper red; with nitrate of iron a deep brownish gray.

At the present day catechu is employed in this country both by the dyers and calico-printers, and it is very well entitled to their attention, both on account of its cheapness, and the permanency and variety of the colours which it gives.

4. *Anotta*, in French *rocou*, is a species of paste of a red colour, obtained from the berries of the *bixa orellana*, Lin. which is a native of America. The anotta of commerce is imported from America to Europe in cakes of two or three pounds weight, where it is prepared from the seeds of the tree mentioned above; but the Americans are said to be in possession of a species of anotta superior to that which they export, both for the brilliancy and permanency of the colour it imparts. They bruise the seeds with their hands moistened with oil, separating with a knife the paste as it is formed, and drying it in the sun; but the seeds are pounded with water when designed for sale, and allowed to undergo the process of fermentation.

According to John, the cakes of anotta are composed of twenty-eight parts of resin mixed with colouring matter, twenty parts of coloured extractive, twenty-six of gum, and twenty of lignin, mixed with an acid and an aromatic substance.

The colouring matter of anotta is but little soluble in water, though it communicates a yellow colour to that liquid. It is more soluble in alcohol, and tinges it orange. Ether dissolves it still better, and assumes also an orange colour. We obtain the colouring matter in a sufficiently pure state by evaporating the alcoholic solution to dryness, treating the residue with ether, and finally distilling off the ether. It is a reddish-brown substance, heavier than water, soft and adhesive. Even when exposed to a very low temperature, it does not become brittle. When heated it melts, and when sufficiently heated in an open vessel it takes fire and burns like a resin.

Its colouring matter.

We may likewise obtain the colouring matter of anotta by digesting it in a caustic alkaline solution, and then saturating the alkali by an acid. The colouring matter precipitates in orange flocks. Concentrated sulphuric acid gives anotta an indigo-blue colour; but in contact with air this colour soon passes into green, and then into violet brown. Cold nitric acid does not alter the colour of anotta but if the quantity of acid be small, the mixture assumes the consistence of a syrup, and detonates when slightly heated, leaving charcoal. Anotta gives an orange-red colour to oils, both fixed and volatile.

According to Chevreul, anotta contains two different colouring matters, the one yellow and the other red. The yellow colouring matter is soluble in water and alcohol, and slightly in ether; the red colouring matter is scarcely soluble in water, but it dissolves in alcohol and ether, communicating to these liquids an orange-red colour.

Anotta yields an orange precipitate with a solution of alum, and the sulphates of copper and iron produce effects of nearly a similar nature. With a solution of tin the precipitate is of a lemon colour, and slowly deposited.

It is employed both for dyeing silk and cotton, but the colours which it yields have little permanency.

Quercitron bark.

5. *Quercitron bark.*—Quercitron, as it is denominated by Dr Bancroft, is the *quercus nigra* of Linnæus, and is a large tree which grows spontaneously in North America. The bark of it yields a considerable quantity of colouring matter, which was first discovered by Dr Bancroft in the year 1784, in whom the use and application of it in dyeing were exclusively vested for a certain term of years by virtue of an act of parliament. To prepare it for use, the epidermis is taken off and pounded in a mill, the result of which process is a number of filaments and a fine light powder; but as these do not contain equal quantities of colouring matter, it will be proper to employ them in their natural proportions.

Quercitron bark contains a good deal of tannin, and a yellow colouring matter capable of being extracted by water. The aqueous solution, when evaporated to dryness, leaves a quantity of extract, amounting to eight per cent. of the weight of the bark employed. The tannin is that variety which forms a green precipitate with oxide of iron. Its presence is injurious to the beauty of the yellow colour, because it is precipitated by the same re-agents as the colouring matter itself, and of course communicates to it a shade of brown. To free the colouring matter from tannin, ox bladder steeped in water, and deprived of every thing soluble in cold water, is introduced into the quercitron infusion. With this substance the tannin gradually unites, and thus is removed from the solution. It may be thrown down also by a solution of gelatine.

When the infusion of quercitron is gently concentrated, the colouring matter is deposited in crystals, which have a pearly lustre as long as they continue suspended in the liquid. To this colouring matter Chevreul has given the name of *quercitrin*. It restores the yellow colour of turmeric paper reddened by an alkali. It is but little soluble in ether, more soluble in alcohol, and still more soluble in water. The aqueous solution is tinged orange by al-

Simple Colours.

kalies. The acetates of lead and copper, and the protochloride of tin, throw it down in yellow flocks. The sulphated peroxide of iron gives it an olive-green colour, and then precipitates it. Sulphuric acid dissolves quercitrin, the solution is orange with a shade of green, and is rendered muddy when mixed with water. When quercitrin is subjected to distillation, it yields, among other products, a liquid which speedily deposites yellow crystals possessing the characters of quercitrin.

Other substances.

Besides the substances already mentioned as employed in the dyeing of yellow, we may add saw-wort to the number (*serratula tinctoria*, Lin.), a plant which yields a colouring matter nearly similar to that of weld, and may of consequence be used as a proper substitute. Dyers' broom (*genista tinctoria*) produces a yellow of very indifferent nature, and is therefore only employed in dyeing stuffs of the coarsest kind. Tumeric (*curcuma longa*) is a native production both of the East and West Indies, and yields a more copious quantity of colouring matter than any other yellow dyestuff; but it will probably never be of any essential service in dyeing yellow, as no mordant has yet been discovered capable of giving permanency to its colour.

Chamomile (*anthemis tinctoria*) yields a faint yellow colour, the hue of which is not unpleasant, but is far from being durable, and even mordants are not capable of fixing it. Sulphate of lime, tartar, and alum, bid fairest for success.

Fenugreek (*trigonella fænugræcum*) yields seeds which, when ground, communicate to stuffs a pale yellow of tolerable durability; and the best mordants are found to be alum and muriate of soda, or common salt. American hiccory (*juglans alba*) is a tree, the bark of which yields a colouring matter in every respect resembling that of the *quercus nigra*, but in quantity greatly inferior. French berries (*rhamnus infectorius*) produce a tolerable yellow colour, but it is by no means permanent. When used in the process of dyeing, they are to be employed in the same manner as weld. According to Scheffer, a fine yellow colour may be imparted to silk, thread, and wool, by means of the leaves of the willow; but Bergman informs us that only the leaves of the sweet willow (*salix pentandra*) are proper for producing a permanent colour, as a few weeks' exposure to the sun extracts that which is produced by the colouring matter from the leaves of the common willow.

In Switzerland and in England the seeds of purple trefoil are sometimes employed in the art of dyeing, on which Vogler made a number of experiments, in order to ascertain what colours they would produce; and he found that a fine deep yellow was afforded by a bath made of a solution of these seeds with potash; that sulphuric acid yielded a light yellow, and sulphate of copper or blue vitriol a yellow inclining to green. M. Dizé informs us that the seeds of trefoil impart to wool a beautiful orange, and to silk a greenish yellow; and that while aluming is necessary in the process of dyeing with the seeds of trefoil, a solution of tin cannot be employed.

Many other vegetable substances are occasionally employed in dyeing yellow, but it seems useless to enumerate them. Saffron and turmeric yield exceedingly beautiful but fugitive yellows. The colouring matter of saffron (*crocus sativus*) is extremely rich; it has been subjected to a chemical examination, and distinguished by the name of *polychroite* by Bouillon La Grange and Vogler, to whom we are indebted for the first examination of it.

The finest and most fixed of all the yellows on cotton is chromate of lead. It is employed abundantly by the calico-printers, but scarcely by the dyers in general. On that account we think it better to reserve it till we come to that part of this article in which we propose to describe the processes followed by the calico-printers.

II.—*Of the Processes for dyeing Wool Yellow.*

With weld.

In dyeing woollen stuffs with weld, the mordants employed are alum and tartar, and by their means a pure, permanent yellow is obtained. The boiling is to be conducted in the usual way; and, according to Hellot, four ounces of alum to one ounce of tartar are to be employed. Other dyers, however, employ half as much tartar as alum. The colour is rendered paler, but more lively, by means of the tartar.

Preparation of the bath.

The bath is prepared by boiling the plant inclosed in a thin linen bag, and keeping it from rising by means of a wooden cross. Some boil it till it sinks to the bottom of the vessel; while others, after it is boiled, take it out and throw it away. From three to four pounds of weld, and sometimes less, are allowed for every pound of stuff; but the quantity must be regulated by the intensity of the shade desired. Some dyers add a small quantity of quicklime and ashes which are found to promote the extraction of the colouring matter. These substances at the same time heighten the colour, but render it less susceptible of resisting the action of acids.

For different shades

With other additions, and different management, different shades may be obtained. Thus lighter shades are produced by dyeing after deeper ones, adding water at each dipping, and keeping the bath at the boiling temperature. These shades, however, are less lively than when fresh baths are employed, with a suitable proportion of weld. The addition of common salt or sulphate of lime to the weld bath communicates a richer and deeper colour. With alum it is paler and more lively, with tartar still paler, and with sulphate of iron the shade inclines to brown. According to Scheffer, by boiling the stuff two hours, with one fourth of its weight of a solution of tin, and the same proportion of tartar, and then washing and boiling it with an equal weight of weld, a fine yellow is produced; but if the stuff be in the state of cloth, its internal texture is not penetrated. Poerner recommends a similar preparation as for dyeing scarlet, and by these means the colour is brighter, more permanent, and lighter.

With quercitron bark.

Dr Bancroft recommends the quercitron bark as one of the cheapest and best substances for dyeing wool yellow. The following is the simple process which he has proposed for its application. The bark is to be boiled up with about its weight, or one third more, of alum, in a suitable proportion of water, for about ten minutes. The stuff previously scoured is then to be immersed in the bath, taking care to give the higher colours first, and afterwards the paler straw colours. By this cheap and expeditious process, colours which are not wanted to be of a full or bright yellow may be obtained. The colour may be considerably heightened by passing the unrinsed stuff a few times through hot water, to which a little clean powdered chalk, in the proportion of about a pound and a half for each 100 lbs. of stuff, has been previously added. The bark, when used in dyeing, being first reduced to powder, should be tied up in a thin linen bag, and suspended in the liquor, so that it may be occasionally moved through it, to diffuse the colouring matter more equally.

Process for permanent colours.

But although the above method possesses the advantages of cheapness and expedition, and is fully sufficient for communicating pale yellows; to obtain fuller and more permanent colours, the common mode of preparation, by previously applying the aluminous mordant, ought to be preferred. The stuff, therefore, should be boiled for about one hour or one hour and a quarter, with one sixth or one eighth of its weight of alum dissolved in a proper pro-

Simple Colours.

portion of water. The stuff is then to be immersed, without being rinsed, into the dyeing bath, with clean hot water, and about the same quantity of powdered bark tied up in a bag as that of the alum employed in the preparation. The stuff is then to be turned as usual through the boiling liquor, until the colour appears to have acquired sufficient intensity. One pound of clean powdered chalk for every 100 lbs. of stuff is then to be mixed with the dyeing bath, and the operation continued for eight or ten minutes longer. This addition of the chalk raises and brightens the colour.

For different shades.

Orange Yellow.—To communicate a beautiful orange yellow to woollen stuffs, ten lbs. of quercitron bark, tied up in a bag, for every 100 lbs. of stuff, are to be put into the bath with hot water. At the end of six or eight minutes, an equal weight of murio-sulphate of tin is to be added, and the mixture well stirred for two or three minutes. The cloth, previously scoured, and completely wetted, is then immersed in the dyeing liquor, and briskly turned for a few minutes. By this process the colouring matter fixes on the cloth so quickly and equally, that after the liquor begins to boil, the highest yellow may be produced in less than fifteen minutes.

High shades of yellow, somewhat similar to those obtained from quercitron bark by the above process, are frequently given with young fustic (*rhus cotinus*, Lin.), and dyers' spirit, or nitro-muriate of tin; but this colour is much less beautiful and permanent, while it is more expensive, than what is obtained from the bark.

Bright Golden Yellow.—This colour is produced by employing ten pounds of bark for every 100 pounds of cloth, the bark being first boiled a few minutes, and then adding seven or eight pounds of murio-sulphate of tin, with about five pounds of alum. The cloth is to be dyed in the same manner as in the process for the orange yellow.

Bright yellows of less body are produced by employing a smaller proportion of bark, as well as by diminishing the quantity of murio-sulphate of tin and alum. And indeed every variety of shade of pure bright yellow may be given by varying the proportions of the ingredients.

For greenish yellow.

To produce the lively delicate green shade, which, for certain purposes, is greatly admired, the addition of tartar, with the other ingredients, only is necessary, and the tartar must be added in different proportions, according to the shade which is wanted. For a full bright yellow, delicately inclining to the greenish tinge, it will be proper to employ eight pounds of bark, six of murio-sulphate of tin, with six of alum, and four of tartar. An additional proportion of alum and tartar renders the yellow more delicate, and inclines it more to the green shade; but when this lively green shade is wanted in the greatest perfection, the ingredients must be used in equal proportions. The delicate green lemon yellows are seldom required to have much fulness or body. Ten pounds of bark, therefore, with an equal quantity of the other ingredients, are sufficient to dye three or four hundred pounds of stuffs.[1]

For pale green yellow.

To produce the exquisitely delicate and beautiful pale green shades, the surest method, Dr Bancroft observes, is to boil the bark with a small proportion of water, in a separate tin vessel, for six or eight minutes, and then to add the murio-sulphate of tin, alum, and tartar, and to boil them together for about fifteen minutes. A small quantity of this yellow liquor is then to be put into a dyeing vessel which has been previously supplied with water sufficiently heated. The mixture being properly stirred, the dyeing process is to be conducted in the usual way, and the yellow liquor, as it is wanted, gradually added from the first vessel. In this way the most delicate shades of lively green lemon yellows are dyed with ease and certainty. Weld is the only dyestuff from which similar shades of colour can be obtained; but it is four times more expensive. The yellows dyed from quercitron bark, Dr Bancroft adds, with murio-sulphate of tin and alum as mordants, do not exceed the expense of one penny for each pound of stuff, besides a considerable saving of time, labour, and fuel.[2]

Verdigris used for tartar.

A greenish shade may also be produced without tartar, by substituting verdigris dissolved in vinegar, along with the bark; but it is neither so permanent, nor so bright and delicate, as that produced by means of tartar. Sulphate of indigo also, in very small proportion, communicates a similar shade when it is employed with the bark, murio-sulphate of tin, and alum; but it is apt to take unequally on the stuff, and besides, in the language of the dyers, the colour has a tendency to *cast* or *fly* in the finishing.

Cochineal and madder employed.

Small proportions of cochineal, employed along with the bark and other ingredients, raise the colour to a beautiful orange, and even to an aurora. Madder may be also employed with the same view, for it heightens the yellow obtained from quercitron bark, although the colour thus obtained is inferior in beauty to that from cochineal. The madder may also be employed with weld for the same purpose.[3]

Colours from quercitron bark very durable.

The colours obtained from quercitron bark, by the processes which we have now described, are very durable. They resist the action of the air, of soap, and of acids. It is by the effects of alum, but especially of tartar, that these colours become so fixed as to remain permanent by exposure to the air. It is observed of the highest yellows, even when they approach to the orange, and which are best dyed either with muriate or murio-sulphate of tin and bark, that although they resist the action of soap and acids, they are apt to lose their lustre and become brown by the effect of the sun and air; but this also happens to yellows dyed with nitro-muriate of tin, both with the bark and with weld, but in a still greater degree with other yellow vegetable colouring matters. In some of these this defect is less easily obviated by alum and tartar, than it is in the yellow obtained from weld and quercitron bark.[4]

III.—*Of the Processes for dyeing Silk Yellow.*

With weld.

To dye silk a plain yellow colour, the only ingredient which was formerly employed was weld. The following is the process. The silk being previously scoured in the proportion of twenty pounds of soap to the hundred of stuff, and then alumed, and washed after the aluming, or, as it is called, *refreshed*, the bath is prepared with two pounds of weld for every pound of silk; and having boiled for fifteen minutes, it is to be passed into a vat through a sieve or cloth. When the temperature is such as the hand can bear, the silk is introduced and turned until it has acquired a uniform colour. While this operation is going on, the weld is to be boiled a second time in fresh water; one half of the first bath is taken out, and its place supplied with a fresh decoction. The temperature of the fresh bath may be a little higher than the former; but it is necessary to guard against too great a degree of heat, that the colouring matter already fixed may not be dissolved. The stuff is to be turned as before, and afterwards taken out of the bath. A quantity of soda is to be dissolved in a part of the second decoction, and a larger or smaller proportion of this solution is to be added to the

[1] Bancroft, 330. [2] *Ibid.* 333. [3] *Ibid.* 355. [4] *Ibid.* 334.

Simple Colours.

bath, according to the intensity of the shade required. When the silk has been turned a few times, a skain is wrung out, that it may be examined whether the colour be sufficiently full, and have the proper golden shade. To render the colour deeper, and to give it the gold cast, an addition of the alkaline solution is to be made to the bath, and to be repeated till the shade has acquired sufficient intensity. The alkaline solution may also be added along with the second decoction of the weld, observing the precaution that the temperature of the bath be never too great.

For a deeper colour.

For other shades.

To produce other shades of yellow, having more of a gold or jonquille colour, a quantity of anotta, proportioned to the shade required, is to be added to the bath along with the alkali. Lighter shades of yellow, such as pale lemon or Canary bird colour, are obtained by previously whitening the silk, and regulating the proportion of ingredients in the bath by the shade required. To communicate a yellow having a tinge of green, a little indigo is added to the bath, if the silk has not been previously azured. To prevent the intensity of the shade from being too great, the silk may be more slightly alumed than usual.

A cheaper process.

But, according to Dr Bancroft, the different shades of yellow obtained from weld may be given to silk with equal facility and beauty, and at a cheaper rate, by employing quercitron bark as a substitute. A quantity of bark powdered and enclosed in a bag, in proportion to the shade of colour wanted, as from one to two pounds for every twelve pounds of silk, is put into the dyeing vat while the water is cold. Heat is then applied; and when it has become rather more than blood warm, or of the temperature of 100°, the silk, having previously undergone the aluming process, is to be immersed and dyed in the usual way. If a deep shade is wanted, a small quantity of chalk or pearl-ashes may be added towards the end of the operation. To produce a more lively yellow, a small proportion of murio-sulphate of tin may be employed; but it should be cautiously used, as it is apt to diminish the lustre of the silk. To produce such a shade, the proportions of the ingredients may be four pounds of bark, three of alum, and two of murio-sulphate of tin. These are to be boiled with a proper quantity of water for ten or fifteen minutes; and the temperature of the liquid being so much reduced as the hand can bear it, the silk is immersed and dyed as usual, till it has acquired the proper colour. Care should be taken to keep the liquor constantly agitated, that the colouring matter may be equally diffused.[1]

For an orange colour.

To dye silk of an aurora or orange colour, after being properly scoured, it may be immersed in an alkaline solution of anotta, the strength of which is to be regulated by the shade required; and the temperature of the bath should be between tepid and boiling water. When the desired shade has been obtained, the silks are to be washed and twice beetled, to free them from the superfluous colouring matter, which would injure the beauty of the colour. When raw silk is to be dyed, that which is naturally white should be selected, and the bath should be nearly cold; for otherwise the alkali, by dissolving the gum of the silk, destroys its elasticity. Silk is dyed of an orange shade with anotta; but the stuffs must be reddened with vinegar, alum, or lemon juice. The acid, by saturating the alkali employed to dissolve the anotta, destroys the yellow shade produced by the alkali, and restores its natural colour, which inclines to a red. But although beautiful colours are obtained by this process, they do not possess any great degree of permanency.

Yellow dye from mushrooms.

Several kinds of mushrooms afford lively and durable yellow dyes. A bright shining dye of this description has been extracted from the *boletus hirsutus*, which commonly grows on walnut and apple trees. The colouring matter is contained both in the tubular part, and also in the parenchyma of the body of the mushroom. To extract the colouring matter, it is pounded in a mortar, and the liquor which is thus obtained is boiled for a quarter of an hour in water. An ounce of liquor is sufficient to communicate colouring matter to six pounds of water. After the liquor has been strained, the stuff to be dyed is immersed in it, and boiled for fifteen minutes. When silk is subjected to this process, after being dyed, it is made to pass through a bath of soft soap, by which it acquires a shining golden yellow colour, which has a near resemblance to the yellow of the silk employed to imitate embroidery in gold. This has been hitherto brought from China, and bears a very high price, the method of dyeing it being unknown in Europe. All kinds of stuff receive this colour; but it is less bright on linen and cotton, and seems to have the strongest affinity for silk. The use of mordants, it is supposed, would modify and improve it greatly.[2]

IV.—*Of the Processes for dyeing Cotton and Linen Yellow.*

Processes with weld.

The process which has been usually followed in dyeing cotton and linen yellow, is by scouring it in a bath prepared in a ley with the ashes of green wood. It is afterwards washed, dried, and alumed, with one fourth of its weight of alum. After twenty-four hours it is taken out of the aluming and dried, but without being washed. The cotton is then dyed in a weld bath, in the proportion of one pound and a quarter of weld for each pound of cotton, and turned in the bath till it has acquired the proper colour. After being taken out of the bath, it is soaked for an hour and a half in a solution of blue vitriol (sulphate of copper), in the proportion of one fourth of the weight of the cotton, and then immersed, without washing, for nearly an hour in a boiling solution of white soap, after which it is well washed and dried.

For a deeper yellow,

A deeper yellow is communicated to cotton by omitting the process of aluming, and employing two pounds and a half of weld for each pound of cotton. To this is added a dram of verdigris, mixed with part of the bath. The cotton is then to be dipped and worked till the colour become uniform It is then taken out of the bath, that a little solution of soda may be added, after which it is returned and kept for fifteen minutes. It is then wrung out and dried.

and other shades.

Other shades of yellow may be obtained by varying the proportion of ingredients. Thus a lemon colour is dyed by using only one pound of weld for every pound of cotton, and by diminishing the proportion of verdigris, or using alum as a substitute.[3]

Cheaper and more permanent colours.

But a better method, as it affords more permanent and more beautiful colours, and at a smaller expense, is recommended by Dr Bancroft. This is by the use of quercitron bark, and the calico-printers' aluminous mordant, or the sugar of lead. The following is the process which he proposes to employ for producing bright and durable yellow colours. One pound of sugar of lead and three pounds of alum are to be dissolved in a sufficient quantity of warm water. The cotton or linen, after being properly rinsed, is to be soaked in this mixture, heated to the temperature of 100°, for two hours. It is then taken out, moderately pressed over a vessel, to prevent the waste of the aluminous liquor. It is then dried in a stove heat, and after being again soaked in the aluminous solution, it is wrung

[1] Bancroft, 345.

[2] *Philosophical Magazine*, vol. 100.

[3] Berthollet, ii. 267.

Simple Colours.

out and dried a second time. Without being rinsed, it is to be barely wetted with lime water, and afterwards dried; and if a full, bright, and durable yellow is wanted, it may be necessary to soak the stuff in the diluted aluminous mordant, and, after drying, to wet it a second time with lime water. After it has been soaked for the last time, it should be well rinsed in clean water, to separate the loose particles of the mordant, which might injure the application of the colouring matter. By the use of the lime-water, a greater proportion of alumina combines with the stuff, besides the addition of a certain proportion of lime.

Dyeing bath.

In the preparation of the dyeing bath, from twelve to eighteen pounds of powdered quercitron bark are inclosed in a bag for every hundred pounds of the stuff, varying the proportion according to the intensity of the shade desired. The bark is put into the water while it is cold; and immediately after, the stuff is immersed and agitated or turned for an hour or an hour and a half, during which the water should be gradually heated, and the temperature raised to about 120°. At the end of this time the heat is increased, and the dyeing liquor brought to a boiling temperature; but at this temperature the stuff must remain in it only for a few minutes, because otherwise the yellow assumes a brownish shade. The stuff having thus acquired a sufficient colour, is taken out, rinsed, and dried.

Advantage of a diluted mordant.

Dr Bancroft observes, that when the aluminous mordant is employed without the addition of water, one soaking only, and an immersion in lime water, may be sufficient; but he thinks that greater advantage is derived from the application of a more diluted mordant at two different times, or even by the immersion of the stuff a greater number of times, alternately in the diluted aluminous mordant, and lime water, and drying it after each immersion. By this treatment he found that the colour always acquired more body and durability.

Nankeen yellow.

Chaptal has proposed a process for communicating to cotton a nankeen yellow, which, at the same time that it affords a durable colour, has the advantage of being cheap and simple. When cotton is immersed in a solution of any salt of iron, it has so strong an affinity for the oxide, that it decomposes the salt, combines with the iron, and assumes a yellow colour. The process recommended by Chaptal is the following: The cotton to be dyed is put into a cold solution of copperas (sulphate of iron), of the specific gravity 1·02. It is afterwards wrung out, and immediately immersed in a ley of potash of the specific gravity 1·01. This ley must have been previously saturated with a solution of alum. When the stuff has been kept for four or five hours in this bath, it may be taken out, washed, and dried. By varying the proportion of sulphate of iron, every variety of shade of nankeen yellow may be obtained.

By another process.

We shall lay before our readers another process for dyeing nankeen colour, which is proposed and followed by Mr Brewer, a practical dyer. It is as follows:—

"Mix as much sheep's dung in clear water as will make it appear of the colour of grass; and dissolve in clear water one pound of best white soap for every ten pounds of cotton yarn, or in that proportion for a greater or lesser quantity.

"Observe:—The tubs, boards, and poles, that are used in the following preparations must be made of deal; the boiling pan of either iron or copper.

First operation.—"Pour the soap liquor prepared as above into the boiling pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan as will be sufficient to boil the yarn intended to be dyed, for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat regularly during that period. Continue it boiling for three hours; then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B.—"The cotton yarn, when in the shed, should not be exposed either to the rain or sun. If it is, it will be unequally coloured when dyed.

Second operation.—"In this operation use only one half of the soap that was used in the last, and as much dung liquor (strained as before directed) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it out without washing, and hang it to dry, as in the former operation.

Third operation.—"This operation the same as the second in every respect.

Fourth operation.—"For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry, as in former operations.

N. B.—"This operation is to cleanse the yarn from any oleaginous matter that may remain in it after boiling in the soap and dung liquors.

Fifth operation.—"To every gallon of iron liquor[1] add half a pound of ruddle or red chalk (the last the best) well pulverized.

"Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling-pan, and bring it to such a degree of heat as a person can well bear his hand in; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it, and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley, made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clean board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour. This done, it must be hung to dry, as in former operations.

N. B.—"Any degree of red or yellow hue may be given to the yarn, by increasing or diminishing the quantity of ruddle or red chalk.

Sixth operation.—"For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn when the liquor is a little warm; observe to keep it constantly under the liquor for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry, as in former operations.

[1] Iron liquor is what the linen printers use.

Seventh operation.—" Make a sour liquor of oil of vitriol and water. The degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well, and wring it; give it a second washing and wringing, and lay it upon a board.

N. B.—" This operation is to dissolve the metallic particles, and remove the ferruginous matter that remains on the surface of the thread after the fifth operation.

Eighth operation.—" For every ten pounds of yarn dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling-pan as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water very well, and hang it to dry, as in former operations. When dry, it is ready for the weaver.

N. B.—" It appears to me, from experiments that I have made, that less than four operations in the preparation of the yarn will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent."[1]

Process followed in the East.

A method of giving a very fixed yellow to cotton and linen is practised in the East. It is precisely similar to the plan followed in dyeing Turkey red. The cloth is first impregnated with the oleaginous soap. It is then passed through a decoction of nutgalls, or of some substance containing tannin. The aluminous mordant is then applied. After all these preliminary steps have been accomplished, the cloth is dyed in the usual way with quercitron bark. These complicated processes being precisely similar to those followed by the Turkey-red dyers, we refer the reader for particulars to the fourth division of the first section of the present chapter.

Such processes, however, are unnecessary in this country, because as permanent and beautiful a colour can be given at once to cotton by impregnating it with acetate or nitrate of lead, and then passing the cloth through a solution of bichromate of potash.

Sect. III.—*Of Blue.*

We shall follow the same method in giving an account of the blue dye, as we did when giving an account of the red and yellow dyes; that is to say, we shall first notice the dyestuffs, and then describe the processes followed by the dyers.

I.—*Description of the Dyestuffs.*

The only dyestuff used for giving a blue colour to cloth is *indigo*, a blue pigment obtained from various species of plants. The most common plant yielding indigo is the *Indigofera*, of which there are three species, the *tinctoria*, the *disperma*, and the *argentea*. The *nerium tinctorium*, or rose bay, a tree which is a native of India, also yields it. The method of procuring indigo from these plants, the nature and properties of indigo, and its composition, have been detailed in the article Chemistry in this Encyclopædia, to which therefore we refer the reader.

Constituents of indigo.

Mr Crum has shown that the atomic constituents of indigo are,

16 atoms carbon	12
4 atoms hydrogen	0·5
1 atom azote	1·75
2 atoms oxygen	2
	16·25

Indigo in its perfect state is insoluble in water and alcohol, and has not the property of combining with bases. But when deprived of one atom of oxygen, it assumes a yellow colour, and in that state is capable of combining with lime or potash, and doubtless with other bases, and of forming with them compounds which dissolve in water. When cloth to be dyed is dipt into the indigo vat, rendered soluble by being deprived of an atom of oxygen, and united to a base, it comes out stained yellow. But the basis of the indigo begins immediately to attract oxygen from the atmosphere, and to resume its blue colour. This causes the cloth speedily to become *green* by the mixture of yellow and blue, and finally to assume a deep-blue colour. No mordant is necessary, as there is a strong affinity between indigo and the fibres of the cloth.

Cerulin.

When indigo is digested in concentrated sulphuric acid it undergoes a remarkable change, being converted into a peculiar blue substance, with which the Saxon blue is dyed. To this substance Mr Crum, to whom we are indebted for the first accurate examination of it, has given the name of *cerulin.* Mr Crum has shown that it is a compound of one integrant particle of indigo, and four integrant particles of water.

The mixture of cerulin with sulphuric acid is semifluid, which requires a considerable quantity of water to dissolve it. When potash is added to this solution, a deep-blue precipitate falls, which is a compound of sulphate of potash and cerulin. To this compound Mr Crum has given the name of cerulio-sulphate of potash. All the neutral salts have the property of combining with cerulin, and of precipitating it from its aqueous solution.

Phenicin.

Mr Crum discovered that if the action of sulphuric acid on indigo be stopped at a certain point, a new substance is formed, different from cerulin. To this new substance he gave the name of *phenicin.* It may be obtained by the following process: Digest indigo in sulphuric acid diluted with thrice its weight of water. By this process the indigo is deprived of the greater part of its impurities. Mix one part of this purified indigo with seven or eight parts of concentrated sulphuric acid in a stoppered phial, and agitate the mixture occasionally till it becomes of a bottle-green colour. Then mix it with a large quantity of distilled water, and throw it upon a filter. By continuing to wash the filter, the liquid, which at first passes through colourless, becomes more and more blue, and after some time all the indigo which has been changed passes through. The colourless washings must be thrown away. The blue liquid contains the phenicin in solution, which, on the addition of chloride of potassium precipitates of a most beautiful reddish-purple colour, exactly similar to the colour of the vapour of indigo. Its solution is of a fine blue colour like cerulin, but when a neutral salt is added it is precipitated of a fine purple colour. Hence the origin of the term *phenicin.*[2] Mr Crum has shown that it is a compound of one integrant particle of indigo and two integrant particles of water.

Indigo is not confined to plants growing within the torrid zone. The *isatis tinctoria* and *isatis lusitanica*, plants which are cultivated in England and France, yield, when treated in the same way with the leaves of the indigofera, a little indigo; but the quantity is too small to make it worth while to employ these plants for the preparation of this valuable dyestuff. But those plants under the names of *pastel* or *woad* were formerly employed for dyeing blue in all parts of Europe; and it was to prevent any supposed injury to the cultivators of woad that the em-

[1] *Edinburgh Magazine*, xxii.

[2] From φοῖνιξ, *purple.*

Simple Colours.

ployment of indigo in dyeing was prohibited in Queen Elizabeth's time in England. The limitations of the use of indigo in France and Saxony were owing to the same cause. So little at that time were the first principles of political economy understood by the rulers of the different kingdoms of Europe.

Woad is still used by the dyers in some of their processes, but merely for the purpose of de-oxidyzing indigo, and thus rendering it soluble in water.

II.—*Methods of dyeing Wool Blue.*

Preparation of the vat.

The preparation for dyeing blue is made in a large wooden vessel or vat, which should be so constructed as to retain the heat, which is a matter of considerable importance in the process. The vat is therefore set up in a separate place from the coppers, and is sunk so far in the ground as to be only breast-high above it. Before the introduction of indigo, blue was dyed with woad, which furnished a permanent but not a deep colour; but a very rich blue is obtained by mixing indigo with the woad, and these are almost the only substances which are now employed for dyeing woollen stuffs. The proportions of these substances are varied by different dyers, and according to the shade which is required. The following is the account of the preparation of a vat, as it is given by Quatremere. Into a vat of about seven and a half feet deep, and five and a half in diameter, are thrown two balls of pastel or woad, which are previously broken, and together amount to about 400 pounds weight; thirty pounds of weld are boiled in a copper for three hours in a sufficient quantity of water to fill the vat. To this decoction are added twenty pounds of madder and a basket full of bran. The boiling is then continued half an hour longer. This bath is cooled with twenty buckets of water, and after it is settled, and the weld taken out, it is poured into the vat, which must be stirred with a rake all the time that it is running in, and for fifteen minutes longer. The vat is then covered up very hot, and allowed to stand for six hours, when it is uncovered, and raked again for thirty minutes. The same operation must be repeated every three hours. When the appearance of blue streaks is perceived on the surface of the vat, eight or nine pounds of quicklime are added; the colour then becomes of a deeper blue, and the vat exhales more pungent vapours. Immediately after the lime, or along with it, the indigo, which has been previously ground in a mill, with the smallest possible quantity of water, is put into the vat. The quantity is to be regulated by the intensity of the shade required. From ten to thirty pounds may be put into a vat such as we have now described. If on striking the vat with a rake a fine blue scum arises, no other previous preparation is required than to stir it with the rake twice in the space of six hours, to mix the ingredients completely. Great care should be taken not to expose the vat to the air, except during the time of stirring it. When that operation is finished, it is covered with a wooden lid, on which are spread thick cloths, to retain the heat as much as possible; but after all these precautions, at the end of eight or ten days it is greatly diminished, and is at last entirely dissipated, so that the liquor must be again heated, by pouring the greater part of the liquor of the vat into a copper under which a large fire is made. When the liquor has acquired a sufficient temperature, it is returned into the vat, and carefully covered up.

Accidents to which the vat is liable.

Vats of this description are sometimes liable to accidents. A vat is said to be repelled when, having previously afforded fine shades of blue, it appears black, without any blue streaks; and if it be stirred, the black colour becomes deeper; the vat at the same time exhales, instead of a sweetish smell, a pungent odour; and the stuff dyed in a vat in this state comes out of a dirty gray colour. These effects are ascribed to an excess of lime.

Means of obviating them,

Different means are employed to recover a repelled vat. Some are satisfied with merely reheating it, while others add tartar, bran, urine, or madder. Hellot recommends bran and madder as the best remedy. If the excess of lime be not very great, it is sufficient to leave it at rest five or six hours, putting in a quantity of bran and three or four pounds of madder, which are to be sprinkled on the surface, and then it is to be covered up, and after a certain interval to be tried again. But if the vat has been so far repelled as to afford a blue only when it is cold, it must be left at rest to recover, and sometimes must remain whole days without being stirred with the rake. When it begins to afford a tolerable pattern, the bath must be reheated. In general this revives the fermentation. The addition of bran or madder, or a basket or two of fresh woad, produces the same effect.

and remedying putrefaction.

This vat sometimes runs into the putrefactive process. When this happens, the colour of the vat becomes reddish, the paste rises from the bottom, and a fetid smell is exhaled. This accident is owing to a deficiency of lime, and it must be corrected by adding a fresh quantity. The vat is then to be raked; after two hours more lime is added, and the process of raking again performed. These operations are to be repeated till the vat is recovered.

Precautions in the use of lime.

Nothing requires more attention in treating a vat of this kind than the distribution of the lime, the principal use of which is to moderate the tendency to putrefaction, and to limit the fermentation to that degree which is necessary to deprive the indigo of its oxygen. If too much lime be added, the necessary fermentation is retarded; and if there be too little, the putrefactive process commences.

Dyeing process.

Two hours previous to the dyeing operation, the vat should be raked; and to prevent the stuff coming in contact with the sediment, which would produce inequalities in the colour, a cross of wood is introduced, The stuff is then to be completely wetted with pure water a little heated, and being wrung out, it is dipped into the vat, where it is moved about for a longer or a shorter time, according to the depth of shade required. During this operation, it is taken out occasionally to be exposed to the air, the action of which is necessary to change the green colour of the bath into a blue. Stuffs dyed blue in this manner must be carefully washed, to carry off the loose particles of colouring matter; and when the shade of blue is deep, they ought even to be cleansed by fulling with soap. This operation does not alter the colour.

What happens in vats of this kind is the separation of an atom of oxygen from the indigo by the action of the fermenting wood. The base of the indigo thus evolved unites to the quicklime, and this compound dissolving in the water, forms the dyestuff. The reason why the air must be so cautiously excluded is, that, by reviving the indigo, it precipitates it from the liquid, and thus deprives the vat of its colouring matter.

Instead of woad, and the other ingredients just mentioned, indigo is deprived of an atom of oxygen, and the base of it dissolved in water by a mixture of bran and potash. Orpiment is also occasionally employed, which has the property of absorbing an atom of oxygen from indigo, and rendering it capable of combining with a base, and of dissolving in water.

The indigo vat employed by the calico-printers is formed by mixing the indigo with the requisite quantity of sulphate of iron to reduce it to its base, and of quicklime to combine with the base evolved, and to cause it to dissolve in water. Such vats are made very deep. The surface, in consequence of exposure to the air, has a blue colour, the indigo being revived. But the liquor, at a little dis-

Simple Colours.

tance from the surface, has a yellow colour. This indeed is the case with all indigo vats. The green colour which they exhibit near the surface is merely the consequence of the mixture of revived indigo with the yellow coloured liquid.

Discovery of Saxon blue.

The colour which is obtained by dyeing with a solution of indigo in sulphuric acid is known under the name of *Saxon blue*, because the process was first carried on at Grossenhayn, in Saxony, by Counsellor Barth, who made the discovery about the year 1740. This discovery was for some time kept secret, and the method seems to have been originally very complicated. Alumina, antimony, and some other substances, were previously added to the sulphuric acid. These, however, are now omitted, and the indigo alone is dissolved in the acid.

For woollen stuffs.

To produce a Saxon blue colour on woollen stuffs, they are prepared with alum and tartar; and in proportion to the shade required, the quantity of solution of indigo put into the bath must be regulated. When a deep shade of Saxon blue is wanted, the stuff must be passed different times through vessels containing such a quantity of colouring matter as is sufficient to give light colours. In this way, by repeated applications, the colours become more uniform.

We are not aware that Prussian blue is employed as a dyeing material for wool; but it is used to a considerable extent in calico-printing, and has an exceedingly good effect when skilfully used. We shall notice its employment in a subsequent part of this article.

III.—*Processes for dyeing Silk Blue.*

With indigo.

Silk is dyed blue with indigo alone, without any proportion of woad. The proportion of indigo mentioned in the preparation of the indigo vat, and sometimes a larger proportion, is employed, with six pounds of bran and about twelve ounces of madder. According to Macquer, half a pound of madder for each pound of potash renders the vat greener, and produces a more fixed colour in the silk. When the vat is come to, it should be refreshed with two pounds of potash and three or four ounces of madder, and, after being raked, in the course of four hours it is fit for dyeing. The temperature should be so moderated that the hand may be held in it without uneasiness.

Preparation of the silk.

The silk, after being boiled with soap, in the proportion of thirty pounds of soap to a hundred of silk, and well cleaned by repeated beetlings in a stream of water, must be dyed in small portions, because it is apt to take on an uneven colour. When it has been turned once or oftener in the bath, it is wrung out and exposed to the air, that the green colour may change to a blue. When the change is complete, it is thrown into clear water, and afterwards wrung out. Silk dyed blue should be speedily dried. In damp weather and in winter it is necessary to conduct the drying in a chamber heated by a stove. The silk should be hung on a frame kept constantly in motion. To dye light shades, some dyers employ vats that are somewhat exhausted; but it ought to be observed that the colour thus obtained is less beautiful and less permanent than when fresh vats, containing a smaller quantity of indigo, are employed.

For Turkey blue.

Some addition is required to be made to the indigo, to give silk a deep blue. A previous preparation is necessary, by giving it another colour or ground. For the Turkey blue, which is the deepest, a strong bath of archil is first prepared. Cochineal is also sometimes used instead of archil, for the ground, to render the colour more permanent. A blue is given to silk by means of verdigris and logwood, but it possesses little durability. It might be rendered more permanent by giving it a lighter shade in this bath, then dipping it in a bath of archil, and finally in the indigo vat.

Dyeing raw silk.

When raw silk is to be dyed blue, such as is naturally white should be selected. Being previously soaked in water, it is put into the bath in separate hanks, as already directed for scoured silks; and as raw silk is found to combine more readily with the colouring matter, the scoured silk, when it can be conveniently done, should be first put into the bath. If archil, or any of the other ingredients which have been already mentioned, are required to give more intensity to the colour, the mode of application is the same as that directed for scoured silk.

IV.—*Processes for dyeing Cotton and Linen Blue.*

Preparation of the vat.

For dyeing cotton and linen blue, Pileur d'Apligny recommends a vat containing about 120 gallons. From six to eight pounds of indigo, reduced to powder, are boiled in a ley drawn off from a quantity of lime equal in weight to the indigo, and a quantity of potash double its weight. During the boiling, which is to be continued till the indigo is completely penetrated with the ley, the solution must be constantly stirred, to prevent the indigo from being injured by adhering to the bottom of the vessel.

During this process another quantity of quicklime, equal in weight to the indigo, is to be slaked. Twenty quarts of warm water are added, in which is to be dissolved a quantity of sulphate of iron equal to twice the weight of the lime. The solution being completed, it is poured into the vat, which is previously half filled with water. To this the solution of indigo is added, with that part of the ley which was not employed in the boiling. The vat must now be filled up to within two or three inches of the top. It must be raked twice or thrice a day till it is completely prepared, which is generally the case in forty-eight hours, and sometimes sooner, as it depends on the temperature of the atmosphere. A small proportion of bran, madder, and woad, is recommended by some to be added to such a vat as we have now described.

A simpler process.

The process which is followed at Rouen, and described by Quatremere, is simpler. The vats, which are constructed of a kind of flint, are coated within and without with fine cement, and are arranged in one or more parallel lines. Each vat contains four hogsheads of water. The indigo, to the amount of eighteen or twenty pounds, being macerated for a week in a caustic ley strong enough to bear an egg, is ground in a mill; three hogsheads and a half of water are put into the vat, and afterwards twenty pounds of lime. The lime being thoroughly slaked, the vat is raked, and thirty-six pounds of copperas are added; and when the solution is complete, the ground indigo is poured in through a sieve. It is raked seven or eight times the same day, and after being left at rest for thirty-six hours, it is in a state fit for dyeing.

Process on a larger scale.

In extensive manufactories it is necessary to have vats set at different times. In conducting the process of dyeing, the stuffs are first dipped in the most exhausted vat, and then regularly proceeding from the weakest to the strongest, if they have not previously attained the desired shade. The stuffs should remain in the bath only about five or six minutes, for in that time they combine with all the colouring matter they can take up. After the stuffs have been dipped in a vat, it should not be used again till it has been raked, and has stood at least twenty-four hours, unless it has been lately set, when a shorter period is sufficient.

After the stuffs have been dipped three or four times in a vat, it begins to change. It becomes black, and no blue or copper-coloured streaks are seen on the surface after raking it. It must then be renewed by adding four pounds of copperas with two of quicklime, after which it

Simple Colours.

must be raked twice. In this way a vat may be renewed three or four times; but the additional quantity of ingredients must be diminished as the strength of the vat is exhausted.[1]

Process of Bergman.

A vat which is still more simple and more easily prepared has been recommended by Bergman. The proportion of the ingredients which he has directed to be employed is the following. To three drachms of indigo reduced to powder, three drachms of copperas, and three of lime, add two pints of water. Let it be well raked, and in the course of a few hours it will be in a proper state for dyeing.

Haussmann's.

Haussmann employs a still smaller proportion of indigo. For 3000 lbs. of water he takes thirty-six lbs. of quicklime slaked in 200 lbs. of water, with which the indigo in the proportion of from ten to twenty lbs. well ground is to be mixed. He then dissolves thirty lbs. of copperas in 120 lbs. of hot water. The whole being left at rest for fifteen minutes, the vat is filled, and gently and constantly stirred. When a deeper shade is wanted, and particularly when linen is to be dyed, the proportion of indigo should be greater; but the shade depends very much on the time the stuffs remain in the vat, and the times it has been used. When the vat becomes turbid, the process of dyeing must be interrupted till it has been again raked, and the supernatant liquor become transparent. If the effects of the lime fail, a new quantity, fresh slaked, must be added; and if the iron cease to produce the effect on the indigo, a new portion must be also added, observing the precaution to have a greater quantity of lime than what is necessary to saturate the sulphuric acid. When the indigo seems to be exhausted, fresh portions ground in water are also to be added; the vat is to be raked several times, and allowed to settle, after which it is again fit for use. In this way Mr Haussmann informs us he preserved a vat for the space of two years; and had it not been for the accumulation of sediment, which prevented the stuffs from being immersed to a sufficient depth, it might have been continued in use for a much longer time. It is worth while to add, that Mr Haussmann found that a pattern of cloth dipped in water acidulated with sulphuric acid, immediately after it was taken out of the bath, became of a much deeper blue than a similar pattern exposed to the air, or another dipped in river water.

Another convenient and expeditious vat is mentioned by Bergman and described by Scheffer. Indigo reduced to fine powder, in the proportion of three drachms to a quart, is added to the strong ley of the soap boiler. After a few minutes, when the colouring matter is well penetrated by the ley, six drachms of coloured orpiment are to be added. In a few minutes after the bath has been well raked it becomes green, and the blue streaks appear on the surface. Heat is to be applied, when the operation of dyeing may commence.

The preparation employed for printing cottons is similar to the above bath, excepting in the proportions of orpiment and indigo, which are greater in the former; but these proportions are very different in different manufactories.

English blue.

The colour denominated *English blue* is produced by the solution of indigo in sulphuric acid, to which Bancroft gave the improper name of *sulphate of indigo*. To give silk this colour, it is first to be dyed a light blue; and, when taken out of this bath, it is dipped in hot water, washed in a stream, and left in a bath composed of the sulphate of indigo, to which a little of the solution of tin has been added, until the proper shade is obtained, or the bath is exhausted. Previous to its being put into this bath, it may be dipped in a solution of alum, in which it should remain only a very short time. Silk which has been dyed according to thir process is free from the reddish shade which it derives from the blue vat, as well as from the greenish cast of the Saxon blue.[2]

The sulphate of indigo has been hitherto only applied for the purpose of dyeing wool and silk. The affinity of indigo for vegetable substances is not sufficiently strong to effect the decomposition of the sulphate. It cannot, therefore, be employed with advantage in dyeing cotton and linen.

Sect. IV.—*Of Black.*

Juices of plants.

Though black, considered optically, is not a colour, but the absence of the power of reflecting light, it constitutes a very important colour in the estimation of the dyer.

I.—*Description of the Dyestuffs.*

There are few substances which have the property of producing a permanent black colour without any addition. The juice of some plants produces this effect on cotton and linen. A black colour is obtained from the juice of the *cashew nut*, which will not wash out, and even resists the process of boiling with soap or alkalies. The cashew nut of India is employed for marking linen. That of the West Indies (*anacardium occidentale*, Lin.) also yields a permanent dye, but the colour has a brownish shade. The juice of some other plants, as that of the toxicodendron, or sloes, affords a durable bluish black colour; but these substances cannot be obtained in sufficient quantity, even if they afforded colours equal to those produced by the common processes.

Tan, &c.

The principal substances which are employed to give a black colour are gallnuts, which contain the astringent principle or tan, and the red oxide of iron.[3] These have been described either in a preceding part of this article, or under the article Chemistry, to which therefore we refer the reader. The black colour is produced by the combination of the astringent principle with the oxide of iron, held in solution by an acid, and fixed on the stuff. When the particles are precipitated from the mixture of tan and a solution of iron, they have only a blue colour; but after they are exposed for some time to the air, and moistened with water, the colour becomes deeper, although the blue shade is still perceptible. After the particles are fixed on the stuff, the shade becomes much deeper.

Mordants necessary for black.

Logwood is not to be considered as affording a black dye, but is much employed to give a lustre to black colours. We have already described its nature and properties among the substances from which red colouring matters are obtained.

Black colours are rarely produced by a simple combination between the colouring matter and the stuff, but are usually fixed by means of mordants, as in the case of the black particles which are the result of a combination of

---

[1] Berthollet, ii. 90.

[2] *Ibid.* ii. 319.

[3] Oak bark has been recommended as a substitute for gallnuts in dyeing black, and particularly in dyeing hats; and it is said that the colour thus obtained is fuller, more beautiful and durable, while the operation is easier, and less liable to accident. It was first proposed in the year 1782, by Stephanopoli, a Corsican, and a surgeon in the French army. The examination of the process was referred by the French government to Macquer, who gave a favourable report of it; and afterwards to Berthollet, who gave a different opinion. The process has since been examined, and promises to be more economical and advantageous, especially for dyeing hats. (*Phil. Mag.* vi. 176.)

Simple Colours.

the astringent principle and the oxide of iron, held in solution by an acid. But when the particles are precipitated from the mixture of an astringent and a solution of iron, they have only a blue colour. By being exposed to the air, and moistened with water, the colour becomes deeper, although the blue shade is still perceptible. No fine black colour is ever obtained, unless the stuffs are freely exposed to the air. In dyeing black, therefore, the operations must be conducted at different intervals. Berthollet has observed that black stuffs, when brought in contact with oxygen gas, diminish its volume, so that some portion of it is absorbed.

II.—*Of the Processes for dyeing Woollen Black.*

Must be first dyed blue.

In dyeing woollen stuffs black, if a full and fine deep colour is wanted, it is necessary that they be previously dyed of a deep blue colour. To remove all the particles of colouring matter which happen to be loosely attached to the stuff, it should be washed in a river as soon as it is taken out of the vat, and afterwards cleansed at the fulling mill. After these preliminary processes, the stuffs are ready to receive the black colouring matter. The process of Hellot is the following.

Hellot's process.

For every hundred pounds of stuff, ten pounds of logwood, and ten pounds of galls reduced to powder, are put into a bag, and boiled in a middle-sized copper, with a sufficient quantity of water, for twelve hours. A third of this bath is put into another copper, along with two pounds of verdigris. The stuff is immersed in this bath, and continually stirred for two hours. The bath should be kept hot, but it ought not to boil. At the end of two hours the stuff is taken out, and a similar portion of the bath is put into the copper, with eight pounds of copperas (sulphate of iron). During the solution of the copperas the fire is diminished, and the bath is allowed to cool for half an hour stirring it well the whole time. The remainder of the bath is then to be added, and after making this addition, the bag containing the astringent matters should be strongly pressed, to separate the whole. A quantity of sumach, from fifteen to twenty pounds, is now to be added, and the bath is just raised to the boiling temperature; and when it has given one boil it is to be immediately stopped with a little cold water. A fresh quantity of sulphate of iron, to the amount of two pounds, is then added, and the stuff is kept in it for another hour, after which it is taken out, washed, and aired; it is again put into the copper, and constantly stirred for an hour. It is then carried to the river, well washed, and fulled. To soften the black colour, and make it more firm, another bath is prepared with weld. This is made to boil for a moment, and when it has cooled, the stuff is passed through it. By this process, which is indeed somewhat complicated, a beautiful black colour is produced.

Common process.

But the processes usually followed for dyeing black are more simple. Cloth which has been previously dyed blue is merely boiled in a vat of galls for two hours. It is then kept two hours, but without boiling, in the bath of logwood and sulphate of iron, and afterwards washed and fulled. According to Hellot's process, a bath is to be prepared of a pound and a half of yellow wood, five pounds of logwood, and ten pounds of sumach, which is the proportion of the ingredients for every fifteen yards of deep blue cloth; and the cloth having boiled in this bath for three hours, ten pounds of sulphate of iron are added; the cloth is allowed to remain for two hours longer, when it is taken out to be aired, after which it is again returned to the bath for an hour, and then washed and fulled.

A cheaper process.

When stuffs are to be dyed at a less expense, instead of the blue ground, a brown or root-coloured ground may be substituted. This brown or fawn colour is communicated by means of the root of the walnut tree, or green walnut peels. The stuffs are then to be dyed black, according to some of the processes already described.

Process of the English dyers.

The proportions of the ingredients employed by the English dyers are, for every hundred pounds of cloth previously dyed a deep blue, about five pounds of sulphate of iron, five pounds of galls, and thirty of logwood. The first step in the process is to gall the cloth, after which it is passed through the decoction of logwood, to which the sulphate of iron has been added.

Arbutus used for galls.

The leaves of the *arbutus uva ursi* have been recommended and employed as a substitute for galls. The leaves must be carefully dried, so that the green colour may be preserved. A hundred pounds of wool are boiled with sixteen pounds of sulphate of iron and eight of tartar for two hours. The day following the cloth is to be rinsed, as after aluming. A hundred and fifty pounds of the leaves of *uva ursi* are then to be boiled for two hours in water, and after being taken out, a small quantity of madder is to be added to the liquor, putting in the cloth at the same time, which is to remain about an hour and a half. It is then taken out and rinsed in water.[1] By this process, it is said, blue cloth receives a pretty good black, but white cloth becomes only of a deep brown. It is said, too, that the madder and tartar are useless ingredients.

Last operation.

After the different operations for dyeing the cloth have been finished, it is washed in a river, and fulled, till the water comes off clear and colourless. Soap suds are recommended by some in fulling fine cloths, but it is found difficult to free the cloth entirely from the soap. After the cloth has come from the fulling-mill, some propose to give it a dip in a bath of weld, by which it is said to be softened, and the colour better fixed; but, according to Lewis, this operation, which in other cases is of some advantage, is useless after the cloth has been treated with the soap suds.

III.—*Of the Processes for dyeing Silk Black.*

In communicating a black colour to silk, different operations are necessary, such as boiling, galling, repairing the bath, dyeing, and softening.

To give a deeper shade to silk, it is necessary to deprive it of the gummy substance to which its stiffness and elasticity are owing. This is done by boiling the silk four or five hours with one fifth its weight of white soap, and afterwards beetling and carefully washing it.

Galling.

In conducting the process of galling silk, three fourths of its weight of galls are to be boiled for three or four hours; but the proportion of galls must depend on their quality. After the boiling, the liquor is allowed to remain at rest for two hours; the silk is then put into the bath, and left there from twelve to thirty-six hours, when it is to be taken out, and washed in the river. But as silk is capable of combining with a great proportion of the astringent principle, or tan, from which it receives a considerable increase of weight, it is allowed to remain for a longer or shorter time, as the silk is required to have more or less additional weight. To communicate, therefore, to silk, what is called a *heavy* black, it is allowed to remain longer in the gall liquor: the process is repeated oftener, and the silk is also dipped in the dye a greater number of times.

Dyeing.

While silk is preparing for the process of dyeing, the bath is to be heated, and should be occasionally stirred, that the grounds which fall to the bottom may not acquire too much heat. It should always be kept under the boiling temperature. Gum and solution of iron are added in different proportions, according to the different processes.

[1] *Stockholm Trans.* 1753.

Simple Colours.

When the gum is dissolved, and the bath near the boiling temperature, it is left to settle for about an hour. The silk, which in general is previously divided into three parts, that each may be successively put into the bath, is immersed in it. Each part is then to be three times wrung, and after each wringing hung up to air. The silk being thus exposed to the action of the air, acquires a deeper shade. This operation being finished, the bath is again heated, with the addition of gum and sulphate of iron; and this is repeated two or three times, according as the black required is light or heavy. When the process of dyeing is finished, the silk is rinsed in a vessel with some cold water, by turning or shaking it over.

Softening.

Silk, after it has been taken out of the dye, is extremely harsh, to remove which it is subjected to the operation of softening. A solution of four or five pounds of soap for every hundred pounds of silk is poured through a cloth into a vessel of water. The solution being completed, the silk is immersed, and allowed to remain in it for about fifteen minutes; it is then to be wrung out and dried.

Dyeing raw silk.

When raw silk is to be dyed, that which has a natural yellow colour is preferred. The galling operation must be performed in the cold, if it be proposed to preserve the whole of the gum, and the elasticity which it gives to the silk; but if part only of the gum is wished to be preserved, the galling is to be performed in the warm bath.

The dyeing operation is also performed in the cold. All that is necessary is to add the sulphate of iron to the water in which the stuff is rinsed. By this simple process the black dye is communicated. It is then washed, once or twice beetled, and dried without wringing, that its elasticity may not be destroyed. Raw silk may be dyed by a more speedy process. After galling, it may be turned or shaken over in the cold bath; and thus, by alternately dipping and airing the stuff, the operation may be completed. It is then to be washed and dried, as in the former process.

A speedier process.

Improved process for velvet.

The method of dyeing velvet at Genoa, which has been simplified and improved in France, is thus described by Macquer. For every hundred pounds of silk, twenty pounds of Aleppo galls, reduced to powder, are boiled in a sufficient quantity of water for an hour. The bath is allowed to settle till the galls have fallen to the bottom; they are then taken out, and two pounds and a half of sulphuric acid, twelve pounds of iron filings, and twenty pounds of gum, are put into a copper vessel, or cullender, furnished with two handles. This vessel is immersed in the bath, and supported that it may not touch the bottom. The gum, which is allowed to dissolve for an hour, is to be occasionally stirred; and if it appear that the whole of the gum is dissolved, three or four pounds more are to be added. Excepting during the operation of dyeing, the cullender is to remain in the copper, which must be kept hot the whole time, but at a temperature below the boiling point. In galling the silk, one third of Aleppo galls is employed, and the stuff should remain six hours in the liquor the first time, and twelve hours the second. By frequent additions of sulphate of iron, and repeated immersions of the stuff, a fine black, according to Lewis, has been obtained. In the above process, the proportion of sulphate of iron is too small; and the gum, according to some, being carried off in the washing, may be considered as useless. Berthollet thinks, that although the quantity be excessive, it has some effect in keeping up the bath; and he adds, if it is to be diminished, it would be useful to add the sulphate of iron in separate portions during each interval.

Simple Colours.

Substitute for galls.

To diminish the quantity of galls, which are an expensive ingredient in dyeing silk black, other substances have been proposed as substitutes. With this view the following process is recommended.

The silk being boiled and washed, is immersed in a strong decoction of green walnut peels, and allowed to remain till the colouring matter of both is exhausted. It is then to be slightly wrung out, dried, and washed.[1] To give the silk a blue ground, logwood and verdigris are employed, in the proportion of one ounce of the latter for every pound of silk. The verdigris is dissolved in cold water, and the silk is allowed to remain two hours in this solution. It is then immersed in a strong decoction of logwood, slightly wrung out, dried, and afterwards washed at the river. The bath is prepared by macerating two pounds of galls and three of sumach in twenty-five gallons of water, over a slow fire, for twelve hours. The liquid being strained, three pounds of sulphate of iron and the same quantity of gum-arabic are to be dissolved in it. The silk is dipped in this solution at two different times; it is to remain in the bath two hours each time, and it must be aired and dried between each dip. After being twice beetled at the river, it is dipped a third time, and left in the bath four or five hours, after which it is to be dried, washed, and beetled, as before. The temperature of the bath should not exceed 120°. After the first dipping, it may be necessary to add half a pound of sulphate of iron, and an equal quantity of gum-arabic.

Silk which has been previously dyed blue with indigo, it is said, takes only a mealy black; but when it has been prepared with logwood and verdigris, it acquires a velvety lustre. A fine black may be obtained from green walnut peel; but the addition of logwood and verdigris renders a smaller quantity of sulphate of iron necessary, and this is of importance, because it is apt to weaken the silk. The only use of galls, according to some, is to increase the weight of the silk; for the purposes of dyeing, sumach is considered sufficient.[2]

IV.—*Of the Processes for dyeing Cotton and Linen Black.*

Must be previously dyed blue.

It is more difficult to communicate a fine black to linen or cotton than to silk or woollen stuffs. To succeed in producing a black colour of that degree of intensity which will resist soap, it is necessary to adopt particular processes. In dyeing animal matters black, as silk and wool, the best colours are obtained on those which have been previously dyed blue. This also is an essential preliminary process in dyeing linen and cotton black; for it is found that the process which succeeds best is first to give a deep blue grain to the cotton or linen.

Galling.

The first part of the process is the operation of galling. The stuffs, which have been previously dyed blue, wrung out, and dried, are kept twenty-four hours in the gall liquor, composed of four ounces of galls to every pound of thread. A bath is then prepared of a solution of iron in acetic acid. This solution is obtained by saturating the acid with oxide of iron. In France, vinegar, small beer, or small wine, is employed for this purpose. To promote the acid fermentation, rye meal, or some other substance, is added, and pieces of old iron are thrown into the liquid, which are allowed to remain for six weeks or two months, that the acid may be saturated with the iron. This solution, called *iron liquor* in this country, is prepared from fermented worts, to which old iron is added, as is described above. Five quarts of the iron liquor for every pound of stuffs are put into a vessel. In this the stuffs are wrought with the hand, pound by pound, for fifteen mi-

Dyeing.

[1] The decoction of walnut peels is prepared by boiling for fifteen minutes, after which it is taken from the fire. After it has subsided, the silk, which has been previously immersed in warm water, is dipped in it.

[2] Berthollet, ii. 20.

Simple Colours.

nutes; they are then wrung out and aired. This operation is to be again repeated, taking care to add a fresh quantity of the iron liquor, which should be carefully scummed, after which the stuffs are to be wrung out, aired, and washed at the river. In the next operation, a pound of alder bark for every pound of stuff is boiled in a sufficient quantity of water for an hour. One half of the bath which was employed in the galling, and about one half the quantity of sumach as of alder bark, are then added. The whole is boiled together for two hours, and strained through a sieve. When this liquid is cold, the stuffs are immersed, wrought pound by pound, and occasionally aired. They are afterwards put into the bath, and, after remaining for twenty-four hours, are wrung out and dried. The above is the process which, according to D'Apligny, is followed at Rouen for dyeing cotton and linen.

Another process.

The process followed at Manchester, which is described by Mr Wilson, is the following. For the operation of galling, galls or sumach are employed. The stuff is afterwards dyed in a bath consisting of a solution of iron in acetic acid. This bath is also frequently composed of alder bark and iron. After having passed through this bath, the stuff is dipped in a decoction of logwood, to which a small quantity of verdigris has been added. This process is to be repeated till a black of sufficient intensity is obtained, observing to wash and dry after each operation.

Preparation of solution of iron.

According to Guhliche, a solution of iron may be prepared by the following process. A pound of rice is to be boiled in twelve or fifteen quarts of water, till the whole is dissolved. A sufficient quantity of old iron made red hot, to reach half way to the surface of the liquor, is thrown into the solution. The vessel in which the solution is kept must be under cover, but exposed to the air and light, at least for a week. In another vessel, containing a quantity of warm vinegar equal to the solution of rice, an equal quantity of red-hot iron is to be put. This vessel must also be exposed in the same way to the air and light. After several days, the contents of both vessels are mixed together, and the mixture is to be exposed for a week to the open air, after which it is to be decanted and kept for use in a close vessel. To give a sufficient

Its application.

black to linen and cotton, it is only necessary, it is said, to steep them twenty-nine hours in this solution; and if it should appear that the liquor is exhausted of colouring matter, a fresh portion is to be employed. In this way a fine permanent black is obtained. According to the same author, this solution may be advantageously employed as a substitute for sulphate of iron, in dyeing silk and wool. But to give them a fine black, silk and woollen stuffs must be dipped in a decoction of logwood after they are taken from the bath.

Sect. V.—*Of Brown.*

The last of the simple colours is brown. This is also known under the name of *fawn* colour (*fauve*, Fr.). It is that brown colour which has a shade of yellow, and might perhaps be considered as a compound colour, although it is communicated to stuffs by one process.

I.—*Of the Substances employed in Dyeing Brown.*

Walnut peels.

The vegetable substances which are capable of inducing a fawn or brown colour on different stuffs are very numerous, but those chiefly employed for this purpose are walnut peels and sumach. The peels constitute the green covering of the nut; they are internally of a white colour, which is converted into brown or black by exposure to the air. The skin, when impregnated with the juice of walnut peels, becomes of a brown or almost black colour. When the inner part of the peel, taken fresh, is put into weak oxymuriatic acid, it assumes a brown colour. If the decoction of walnut peels be filtered and exposed to the air, its colour becomes of a deep brown; the pellicles on evaporation are almost black; the liquor detached from these yields a brown extract, completely soluble in water. The colouring particles are precipitated from a decoction of walnut peels by means of alcohol, and they are soluble in water. No apparent change is at first produced by a solution of potash; but it gradually becomes turbid, and the colour is deepened. A copious precipitate, of a fawn colour, approaching to an ash colour, is produced in a decoction of walnut peels, by means of a solution of tin, and the remaining liquor has a slightly yellow tinge.

Properties.

A decoction of walnut peels yields a small quantity of fawn-coloured precipitate by means of a solution of alum, and the liquor remains of the same colour. Sulphate of copper renders it slowly turbid, and throws down a small quantity of precipitate of a brownish-green colour, leaving the supernatant liquor of the same colour. Sulphate of iron deepens the colour; when diluted, the colour becomes brownish green, without the deposition of any sediment. Sulphate of zinc also deepens the colour, and produces no precipitate. The same properties are exhibited by a decoction of the walnut-tree wood, but the colouring matter is not obtained from it in such abundance as from the peels; and the bark may also be used with advantage in dyeing.

Advantages.

The affinity of the colouring matter of walnut peels for wool is very strong; and it readily imparts to it a durable colour, which even mordants do not seem capable of increasing, but they are generally understood to give it additional brightness. A lively and very rich colour is obtained with the assistance of alum. Walnut peels afford a great variety of pleasing shades; and as they require not the intervention of mordants, the softness of the wool is preserved, and the process of dyeing becomes both cheap and simple.

Preparation.

Walnut peels are not gathered till the nuts are completely ripe, when they are put into large casks, along with as much water as is sufficient to cover them. When used in dyeing at the Gobelins in Paris, Berthollet informs us, they are kept for upwards of a year, and very extensively used; but if not made use of till the end of two years, they yield a greater quantity of colouring matter, at which time their odour has become peculiarly disagreeable and fetid. The peels separated from the nuts before they arrive at maturity, may likewise be used in dyeing, but in this state they do not keep so long.

Sumach.

Sumach (*rhus coriaria*, Lin.) is a shrub produced naturally in Palestine, Syria, Portugal, and Spain, being carefully cultivated in the last two of these countries. Its shoots are annually cut down, dried, and reduced to powder in a mill, by which process they are prepared for the purposes of dyeing.

Properties.

The infusion of sumach, which is of a fawn colour with a greenish tinge, is changed into a brown by exposure to the air. A solution of potash has little action on the recent infusion of sumach; its colour is changed to yellow by the action of acids; the liquor becomes turbid by means of alum, a small quantity of precipitate being at the same time formed, and the supernatant liquor remaining yellow. A copious precipitate of a yellowish-green colour is thrown down by sulphate of copper, and the liquor remains clear. No change is speedily produced by muriate of soda (common salt), but it becomes rather turbid at the end of some hours, and its colour is rather clearer. Sulphate of copper produces a copious precipitate of a yellowish green, which after standing some hours changes to a brownish green; the supernatant liquor, which is slightly

Simple Colours.

yellow, remains clear. Sulphate of zinc renders the liquor turbid, darkens its colour, and produces a deep blue precipitate; but when the sulphate of zinc is pure, the precipitate, which is of a brownish fawn colour, is in very small quantity. Acetate of lead gives a copious precipitate of a yellowish colour; the supernatant liquor is of a clear yellow colour. No astringent has so strong a resemblance to galls as sumach; but the precipitate thrown down from an infusion of it by a solution of iron, is not so copious as that which is yielded by an equal quantity of galls, on which account sumach may be generally employed as a substitute for galls, only its quantity will require to be increased.

Bark of birch.

The bark of the birch tree (*betula alba*, Lin.) yields a decoction of a clear fawn colour, but it soon becomes turbid and brown. The addition of a solution of alum, in the open air, produces a copious yellow precipitate; a solution of tin gives also a copious precipitate of a clear yellow colour. With solutions of iron the decoction of the birch tree strikes a black colour, and it dissolves in considerable quantity the oxide of iron, but in smaller proportion than the decoction of walnut peels. On account of this property, it is employed in the preparation of black vats for dyeing thread.

Sandal wood.

Sanders or sandal wood (*Petrocarpus sachtalinus*) is also employed for the purpose of giving a fawn colour. There are three kinds of sandal wood, the white, the yellow, and the red. The last only, which is a compact heavy wood, brought from the Coromandel coast, is used in dyeing. By exposure to the air it becomes of a brown colour; when employed in dyeing, it is reduced to fine powder, and it yields a fawn colour with a brownish shade, inclining to red. But the colouring matter which it yields of itself is in small quantity, and it is said that it gives harshness to woollen stuffs. When it is mixed with other substances, as sumach, walnut peels, or galls, the quantity of colouring matter is increased; it gives a more durable colour, and produces considerable modifications in the colouring matter with which it is mixed. Sandal wood yields its colouring matter to brandy, or diluted alcohol, more readily than to water.

Soot.

Soot communicates to woollen stuffs a fawn or brown colour, of a lighter or deeper shade, in proportion to the quantity employed; but the colour is fading, and its affinity for wool is not great; and besides leaving a disagreeable smell, it renders the fibres harsh. In some manufactories it is employed for browning certain colours, and it produces shades which could not otherwise be easily obtained.

II.—*Of the Processes for dyeing Woollen, &c. a Fawn or Brown Colour.*

With walnut peels.

In dyeing with walnut peels, a quantity proportioned to the quantity of stuff, and the intensity of shade wanted, is boiled for fifteen minutes in a copper. All that is necessary in dyeing with this substance is, to moisten the cloth or yarn with warm water previous to its immersion in the copper, in which it is to be carefully stirred till it has acquired the proper shade. This is the process if the aluminous mordant is not employed. In dyeing cloth, it is usual to give the deepest shades first, and the lighter ones afterwards; but in dyeing woollen yarn, the light shades are given first, and the deeper ones afterwards. An additional quantity of peels is joined to each parcel.

Berthollet's experiments.

Berthollet made a number of experiments to ascertain the difference of colour obtained from the simple decoction of walnut peels, and the addition of metallic oxides as mordants. The oxide of tin, he found, yielded a clearer and brighter fawn colour than that of the simple decoction. The oxide of zinc produced a still clearer colour, inclining to ash or gray. The colour from oxide of lead had an orange cast, while that from oxide of iron was of a greenish brown.[1]

Compound Colours.

Dyeing with sumach.

A fawn colour, which has a shade of green, is obtained from sumach alone; but to cotton stuffs which have been impregnated with printers' mordant, or acetate of alumina, sumach communicates a good and durable yellow. Here, however, some precaution is necessary in the use of this substance for this purpose; for as the colouring matter is of so fixed a nature, the ground of the stuff cannot be bleached by exposure on the grass. This inconvenience is avoided by impregnating the whole of the stuff with different mordants, producing in this way a variety of colours, and leaving no part white.

With sandal wood.

Vogler employed the tincture of sanders wood for dyeing patterns of wool, silk, cotton, and linen, having previously impregnated them with a solution of tin, and afterwards washing and drying them. Sometimes he used the solution unmixed, and at other times added six or ten parts of water, and in whatever way he employed it he obtained a poppy colour. When the mordant employed was the solution of alum, the colour was a rich scarlet; with sulphate of copper it was a clear crimson, and with sulphate of iron a beautiful deep violet.[2]

CHAPTER V.

OF COMPOUND COLOURS.

Nature of compound colours.

A mixture of two colouring substances, it is well known, produces a very different shade from that of either of the uncombined colouring matters; hence compound colours are obtained, which are merely mixtures of simple colours. It would undoubtedly be a desirable thing to ascertain with accuracy the peculiar shade produced by the combination of two colouring matters; but these results can only be certainly known by experiment, because by the action of different substances in the bath they are subject to great variations in their effects, according to the affinities which are brought into action, and the new combinations which are formed. What is natural to colouring particles is not to be considered as a constituent part of compound colours, but only the difference of shade which they ought to assume with a particular mordant, or in a particular bath. The effects, therefore, of the chemical agents employed in these processes, and the result of different combinations, ought to be particularly attended to. It is in dyeing compound colours that skill and ingenuity are most conspicuous, and their application of greatest utility, to enable the dyer to vary his processes according to the shade desired, and at the same time to accomplish his operations by the shortest and cheapest means.

Great variety of shade.

As compound colours are obtained by the mixture of simple colours, very different shades will be obtained from different proportions of the simple colours; hence compound colours exhibit an indefinite variety of shade, and the processes by which they are produced are very numerous. It would extend this treatise to an unusual length were we to attempt to describe every variety of shade which is obtained from the mixture of simple colours. We shall therefore limit our observations to some of the principal

[1] *Elements of Dyeing*, ii. 296.

[2] *Crell. Ann.* 1790

Compound Colours.

compound colours, and an account of the processes by which they are obtained, leaving it to our readers, who have made themselves familiar with the principles already detailed, to vary these colours by employing different proportions and different combinations of simple colouring matters.

Compound colours have been usually divided into four classes, namely, green, purple, orange, and gray or drab colour. These are obtained from mixtures of the following simple colours:

1. Blue and yellow produce a green.
2. Red and blue produce a purple, &c.
3. Red and yellow produce orange.
4. Black and other colours produce gray, &c.

The following sections will be occupied in a short detail of the methods which are usually employed in producing these different compound colours.

Sect. I.—*Of the Mixture of Blue and Yellow, or Green.*

Various shades of green.

Green colours, from the great variety of shades which they exhibit, have been long known by different names, by which the intensity of shade is characterized, such as sea-green, apple-green, meadow or grass-green, pea-green, parrot-green, &c. Many plants afford a green colour, such as brome grass (*bromus secalinus*, Lin.) green berries of *rhamnus frangula*, wild chervil (*chærophyllum sylvestre*, Lin.), purple clover (*trifolium pratense*), common reed (*arundo phragmites*). These colours, however, do not possess sufficient permanency. According to D'Ambourney, indeed, a permanent green may be obtained from the fermented juice of the berries of the berry-bearing alder (*rhamnus frangula*). Having previously prepared the cloth with tartar, solution of nitrate of bismuth, and common salt, he added to the fermented juice of the berries, after it was warmed, a small proportion of acetate of lead; and in this bath he communicated to the cloth an intermediate shade between parrot and grass green. But it is usually from the mixture of blue and yellow that green is obtained; and it may be observed, that it requires much skill and experience, especially in giving light shades, to produce a colour which is uniform and entirely without spots.

I.—*Of the Processes for dyeing Woollen Stuffs Green.*

Common process.

To dye woollen green, either the yellow or the blue dye may be given to it first. But when the stuff is first dyed yellow, and in this state is introduced into the blue vat, part of the yellow colouring matter being dissolved in the vat, communicates to it a green colour, which renders it unfit for dyeing any other colour than green. To avoid this inconvenience, therefore, the blue colour is first given, and afterwards the yellow. It would be quite unnecessary to resume the account of any part of the processes for dyeing blue, which have been already detailed. It is proper, however, to add, that the intensity of the blue shade must be proportioned to the green, or to the depth of the green colour which is wished to be obtained. Thus, for instance, to produce a parrot green, a ground of sky blue is given, and for the green like that of a drake's neck, a deep blue is required. When the blue dye has been communicated, the yellow is afterwards given, according to some of the processes which have been already described for dyeing yellow. The proper ground being communicated to the cloths, they are washed in the fulling mill, and boiled as for the common process of welding; but when the shade is light, the proportion of salts should be less. Cloths which are to receive light shades are first boiled, and when these are taken out, tartar and alum are added in fresh portions till the cloths which are intended for the darkest shades are boiled. The process of welding is conducted in the same way as for dyeing yellow, with this difference, that a larger proportion of weld is employed, excepting for lighter shades, when the proportion must be smaller. In dyeing green, it is usual to have a succession of shades at the same time; the process is begun with the deepest and ends with the lightest. Between each dip there should be an interval of one half or three quarters of an hour, and at each interval water is added to the bath. It is the practice of some dyers to give each parcel two dips, beginning the first time with the deep shades, and the second with the lighter ones; but when this practice is followed, the time of immersion should be shortened. In dyeing very light shades, the bath should never be permitted to reach the boiling temperature. For deep greens, a browning is given with logwood and a small proportion of sulphate of iron.

Saxon green.

For some kinds of green, sulphate of indigo is employed; and in this case either the blue and yellow are dyed separately, or the whole of the ingredients are mixed together in the bath, and the whole process is finished at a single operation. The colour thus obtained has been distinguished by the name of *Saxon green*. The following is the process recommended by Dr Bancroft.

"The most beautiful Saxon green," says he, "may be produced very cheaply and expeditiously, by combining the lively yellow which results from quercitron bark, murio-sulphate of tin, and alum, with the blue afforded by indigo when dissolved in sulphuric acid, as for dyeing the Saxon blue.

"To produce this combination most advantageously, the dyer, for a full-bodied green, should put into the dyeing vessel after the rate of six or eight pounds of powdered bark in a bag for every 100 pounds weight of cloth, with only a small proportion of water as soon as it begins to grow warm; and when it begins to boil, he should add about six pounds of murio-sulphate of tin (with the usual precautions), and a few minutes after, about four pounds of alum. These having boiled together five or six minutes, cold water should be added, and the fire diminished so as to bring the heat of the liquor nearly down to what the hand is able to bear; and immediately after this, as much sulphate of indigo is to be added as will suffice to produce the shade of green intended to be dyed, taking care to mix it thoroughly with the first solution by stirring, &c.; and this being done, the cloth, previously scoured and moistened, should be expeditiously put into the liquor, and turned very briskly through it for a quarter of an hour, in order that the colour may apply itself equally to every part, which it will certainly do in this way with proper care. By these means, very full, even, and beautiful greens may generally be dyed in half an hour; and during this space it is best to keep the liquor at rather less than a boiling heat. Murio-sulphate of tin is infinitely preferable for this use to the dyer's spirit, because the latter consists chiefly of nitric acid, which, by its highly injurious action upon indigo, would render that part of the green colour very fugitive, as I have found by repeated trials. But no such effect can result from the murio-sulphate of tin, since the muriatic acid has no action upon indigo; and the sulphuric is that very acid which alone is proper to dissolve it for this use.

"Respecting the beauty of the colour thus produced, those who are acquainted with the unequalled lustre and brightness of the quercitron yellows, dyed with the tin basis, must necessarily conclude that the greens composed therewith will prove infinitely superior to any which can result from the dull muddy yellow of old fustic; and in point of expense it is certain that the bark, murio-sulphate of tin, and alum, necessary to dye a given quantity of cloth in this way will cost less than the much greater quantity

Compound Colours.

(six or eight times more) of fustic, with the alum necessary for dyeing it in the common way, the sulphate of indigo being the same in both cases. But in dyeing with the bark, the vessel is only to be filled and heated once, and the cloth, without any previous preparation, may be completely dyed in half an hour: whilst in the common way of producing Saxon greens, the copper is to be twice filled; and to this must be joined the fuel and labour of an hour and a half's boiling and turning the cloth in the course of preparation, besides nearly as much boiling in another vessel to extract the fustic; and after all, the dyeing process remains to be performed, which will be equal in time and trouble to the whole of the process for producing a Saxon green with the bark; so that this colour obtained from bark will not only prove superior in beauty, but in cheapness, to that dyed as usual with old fustic."[1]

II.—*Of the Processes for dyeing Silk Green.*

Preparation.

In giving silk a green colour, greater precaution is necessary, to preserve uniformity of colour, and to prevent spots and stripes. Silk which is intended to receive a green colour is scoured in the same way as for other colours; but for light shades the scouring must be as complete as for blue. Silk which is to be dyed green is first dyed yellow, and being well alumed, it is slightly washed at the river, and divided into small parcels, that it may receive the colouring matter uniformly, and then carefully turned in the weld bath. When the ground is supposed to have acquired a sufficient degree of intensity, a pattern is put into the blue vat to ascertain the proper shade. When this is the case, the silk is taken out of the bath, washed, and immersed in the blue vat. To produce a deeper colour, and at the same time to give variety of shade, a decoction of logwood, fustic, or anotta is added to the yellow bath, after the weld has been taken out. For very light shades, such as apple and sea green, it is scarcely necessary to add, that a weaker ground is to be given. For all light shades, except sea-green, the process is found to succeed better when the yellow is communicated by baths which have been already used; but these baths should not contain any logwood or fustic.

Saxon green.

Saxon green is produced by means of sulphate of indigo. This is a brighter but less durable colour than the former. This process is conducted by boiling as for welding, after which the cloth is washed. Fustic in chips is enclosed in a bag, put into the same bath, and boiled for an hour and a half, when it is taken out, and the bath allowed to cool till the hand can bear it. A pound and a quarter of sulphate of indigo for each piece of cloth of eighteen yards is added. The cloth is at first to be turned quickly, and afterwards more slowly, and it should be taken out before the bath boils. Some dyers put in only two thirds of the solution at first, and after two or three turns take out the cloth and add the other one third. By this means the colour is more uniform.

By one operation.

To produce Saxon green at one operation, the following process is recommended by Dr Bancroft. A bath is prepared of four pounds of quercitron bark, three pounds of alum, and two pounds of murio-sulphate of tin, with a sufficient quantity of water. The bath is boiled ten or fifteen minutes, and when the liquor is so far reduced in temperature as the hand can bear it, it is fit for dyeing. By adding different proportions of sulphate of indigo, various and beautiful shades of green may be obtained, and the colour thus produced is both cheap and uniform. Care should be taken to keep the bath constantly stirred, to prevent the colouring matter from subsiding. Those shades which are intended to incline most to the yellow should be dyed first; and by adding sulphate of indigo, the green having a shade of blue may be obtained. This process, Dr Bancroft observes, is the most commodious and certain for dyeing most beautiful Saxon greens upon silk.[2]

English green.

To produce English green, which is more beautiful than common green, and is said to be more durable than the Saxon green, Guhliche gives the following process. He first dyes the silk of a light blue in the cold vat already described, then soaks it in warm water, washes it in a stream, and dips it in a weak solution of alum. He then prepares a bath of sulphate of indigo, one ounce of solution of tin, with the tincture of French berries made with aceto-citric acid. The silk is kept in this bath till it has obtained the desired colour. It is then washed and dried in a shady place. Lighter shades may be dyed afterwards.[3]

III.—*Of the Processes for dyeing Cotton and Linen Green.*

Blue first given.

Cotton and linen, after being scoured in the usual way, are first dyed blue, and after being cleansed, they are dipped in the weld bath, to produce a green colour. The strength of the blue and yellow is proportioned to the shade of green which is wanted. But as it is difficult to give to cotton velvet a uniform colour in the blue vat, it is first dyed yellow with turmeric, and the process is completed by giving it a green with sulphate of indigo. The same result, however, will be obtained by commencing the process either with the yellow or the blue.

Process for cotton velvet.

The process which D'Apligny describes for dyeing cotton velvet, or cotton thread, a sea or apple green, in one bath, is the following. A quantity of verdigris is dissolved in vinegar, and the mixture is kept excluded from the air in the heat of a stove for fifteen days. A quantity of potash equal in weight to the verdigris employed is dissolved in water, and, four hours before dyeing, it is added to the solution of verdigris. The mixture is to be kept hot. One ounce of alum in five quarts of water for each pound of stuff being prepared, the cotton thread or velvet is soaked in this solution. It is then taken out, and the verdigris being added to the solution of alum, it is again introduced to be dyed.

Olive green

The different shades of olive green, and drake's neck green, are given to thread after it has received a blue ground, by galling it, and dipping it in a weaker or stronger bath of iron liquor, then in the weld bath, to which verdigris has been added, and afterwards in the bath with sulphate of copper. The colour is lastly to be brightened with soap.

Green from Prussian blue.

Cotton dyed with Prussian blue may be dyed green by previously aluming while it is still wet with the blue, and then dipping in a weld bath, the strength of which is proportioned to the shade required. The colour from weld is more lively than that obtained from fustic. But fustic, which gives a deeper shade than weld, and diminishes the brightness of the blue, is to be preferred when a green with an olive shade is wanted.

General remarks.

The shade of green given to any stuff, it is obvious, must vary according to the intensity of the blue shade, the strength of the yellow bath, and the nature of the yellow colouring matter employed. Yellow colours are rendered more intense by means of alkalies, sulphate of lime, and ammoniacal salts; but become fainter by means of acids, alum, and solutions of tin. In dyeing Saxon green the result will be different according to the process which is followed. The effects will be different by adding a yellow to a Saxon blue, from the process in which the sulphate of indigo is mixed with the yellow ingre-

[1] *Phil. of Perm. Col.* 336. [2] *Ibid.* 346. [3] Berthollet, ii. 319.

Compound Colours.

dients; because in the latter case the sulphuric acid has a considerable action on the colouring matter, and thus diminishes the intensity of the yellow. As the particles of indigo have a stronger affinity for the stuff than the yellow colouring matter, in dyeing a succession of shades in a bath in which both are mixed, the bath being first exhausted of the indigo, the last shades incline more to the yellow, on account of the predominance of the yellow colouring matter.

Sect. II.—*Of the Mixture of Red and Blue, or Purple, &c.*

By the mixture of red and blue, violet, purple, dove-colour, lilac, and a great variety of other shades, according to the proportion of the substances employed, or the predominance of the blue or the red, are produced. In stuffs which are to be dyed violet, a deeper blue must be given; for purple colours, the ground requires to be of a lighter blue; but in lilac and other light colours, it is necessary that both the blue and the red have a light shade.

I.—*Of dyeing Wool Violet, Purple, &c.*

In the attempts which have been made to communicate a violet or purple colour to a scarlet ground, according to the observations of Hellot, the colour is very unequal. It becomes therefore necessary to give the blue colour first; and for violets or purples, the shade of blue ought not to be deeper than that of sky blue. The stuff being dyed blue, is boiled with alum, and two fifths of tartar, and is afterwards dipped in a bath composed of nearly two thirds the quantity of cochineal required for scarlet, with the addition of tartar. The same process, indeed, as for dyeing scarlet, is followed. It is a common practice to dye these colours after the reddening for scarlet, making such additions of cochineal and tartar as the intensity of the shade may require.

Lilac, &c. For lighter shades, as lilacs, dove-colours, &c. the stuff may be dipped in the bath which has served for violet and purple, and is now somewhat exhausted, taking care to add a quantity of alum and tartar. For reddish shades, such as a peach-blossom, a small proportion of solution of tin is added. It may be observed in general, that although the proportion of cochineal is less in dyeing lighter shades, the quantity of tartar must not be diminished.

Cheaper and shorter process. To obtain the same colours, a shorter and less expensive process is recommended by Poerner. In this process he employs sulphate of indigo. He boils the stuff in a solution of alum, in the proportion of three ounces of the latter to one pound of the former, for an hour and a half, and afterwards allows it to remain in the liquid for a night after it has cooled. The dyeing bath is prepared with an ounce and a half of cochineal, and two ounces of tartar, which are boiled for three quarters of an hour: two ounces and a half of sulphate of indigo are then added, the whole is stirred, and boiled gently for fifteen minutes. The dyeing operation is conducted in the usual way, and a beautiful violet is thus obtained. To have all the variety of shades which are produced by the mixture of red and blue, the proportion of the sulphate of indigo is increased or diminished. It is sometimes increased to five ounces, and diminished to five drachms, for each pound of stuff. The quantity of cochineal is also varied, but when it is less than an ounce the colour is dull. Different proportions of tartar are also employed. To produce variety of shades, the stuff is also prepared with different proportions of solution of tin.

Purple from logwood. To communicate a purple colour to wool, as well as some other shades, logwood, with the addition of galls, has been employed. The stuff is previously dyed blue, and, to give a brown shade, sulphate of iron is used; but the colours thus obtained are not permanent. By the following process, described by Decroizille, a durable dye is produced by means of this wood. He dissolved tin in sulphuric acid, to which were added common salt, red acidulous tartrite of potash, and sulphate of copper; or it may be more conveniently done by making a solution of tin in a mixture of sulphuric acid, common salt, and water, to which are to be added the tartrite and sulphate in the state of powder. Of this mordant not less than 1500 quarts were made in twenty-four hours, in a leaden vessel to which a moderate heat was applied. A very lucrative trade was carried on for three years by Decroizille, who sold it at the rate of 1s. 3d. sterling per pound.

Process. If wool in the fleece is to be dyed, it will require a third of its weight of this mordant, while a fifth is a proportion sufficient for stuffs. A bath is prepared of such a degree of temperature as the hand can bear, with which the mordant is properly mixed, and the wool or stuff dipped in it and stirred; the same degree of temperature being kept up for two hours, and increased a little towards the end; after which it is taken out, aired, and well washed. A fresh bath of pure water is prepared at the same temperature, to which is added a sufficient quantity of the decoction of logwood; the stuff is then immersed, stirred, and the heat increased to the boiling temperature, which is to be continued for fifteen minutes, after which, the stuff being taken out, aired, and carefully rinsed, the process of dyeing is completed. If for every three pounds of wool one pound of decoction of logwood has been used, and a proportionate quantity for stuffs which require less, a fine violet colour is produced, to which a sufficient quantity of Brazil wood imparts the shade known in France by the name of *prune de Monsieur.*

Different shades from other substances. Logwood and Brazil, fustic and yellow wood, are colouring substances which may be fixed with advantage upon wool by means of this mordant. The colour communicated by the two first of these is liable to be changed in the fulling by the action of the soap or urine employed for that purpose; but this change, which is always produced by alkaline substances, is remedied by a slightly acid bath a little hot, called *brightening*, for which the sulphuric acid has the preference. The colour becomes as deep, and frequently much brighter than before the change. Wools which have been dyed by means of this mordant are said to admit of being spun into a finer and more beautiful thread than by the use of alum. If the use of sulphate of copper is omitted, more beautiful colours are produced by fustic and yellow wood, as well as by weld. An orange-red colour is communicated by madder, but not so deep as with a similar quantity of alum. When sulphate of copper is omitted, the wool is said to become much harsher, and the mordant thus prepared yields but indifferent colours with logwood, and in particular with Brazil wood. The use and carriage of this mordant are inconvenient, on account of the heavy sediment by which the vessel is half filled under a corrosive liquor, capable only of being kept in stone ware. These inconveniences may be remedied by the omission of the water in the receipt, which leaves only a paste more conveniently used, and the carriage of it two fifths cheaper.

Nature of the process. The above process is thus explained by Berthollet. The decomposition of the muriate of soda is effected by the action of the sulphuric acid; and the muriatic acid being thus disengaged, dissolves the tin, part of which is precipitated by means of the tartaric acid, producing the sediment already mentioned. The oxide of copper produces the blue with the colouring particles of the logwood; the violet is formed by the oxide of tin with the same wood,

Compound Colours.

and the red with the colouring matter of the Brazil wood. The same ingenious chemist farther observes, that as an excess of acid is retained in the liquor, it might probably be of advantage to employ acetate as a substitute for sulphate of copper, in which case the action of the free acid would be moderated. He thinks it would still be more advisable to make use of verdigris; because the uncombined part of the oxide of copper would in that case unite with the excess of acid, on which account a smaller quantity of acid would remain in the liquor; and probably the quantity of tartar might be diminished, as a smaller quantity of tin would thus be precipitated.[1]

II.—*Of dyeing Silk Violet or Purple.*

Two kinds of violet.

Silk is capable of receiving two kinds of violet colours, denominated the fine and the false, the latter of which is produced by means of archil or Brazil wood. When the fine violet colour is required, the silk must first be passed through cochineal, and dipped afterwards in the vat. The preparation and dyeing of the silk with cochineal are the same as for crimson, with the omission of tartar and solution of tin, by means of which the colour is heightened. The quantity of cochineal made use of is always proportioned to the required shade, whether it is more or less intense; but the usual proportion for a fine violet colour is two ounces of cochineal for each pound of silk. When the silk is dyed it is washed at the river, twice beetled, dipped in a vat more or less strong in proportion to the depth of the violet shade, and then washed and dried with precautions similar to those which all colours require that are dyed in the vat. If the violet is to have greater strength and beauty, it is usual to pass it through the archil bath; a practice which, though frequently abused, is not to be dispensed with for light shades, which would otherwise be too dull.

Purple.

When silk has been dyed with cochineal according to the above directions, only a very light shade is requisite for purple; the shades which are deepest are dipped in a weak vat, while dipping them in cold water is sufficient for such as are lighter, the water having been incorporated with a small quantity of the liquor of the vat, because in the vat itself, however weak it might be, they would acquire too deep a tinge of blue. In this manner are the light shades of this colour, such as gilly-flower, peach-blossom, &c. produced by diminishing the quantity of cochineal.

False violets.

There are various ways of imparting to silk what are denominated the false violets; but those which are most frequently used, and possessed of greatest beauty, are prepared with archil, the bath of which is, in point of strength, to be suited to the colour required. Having been beetled at the river after scouring, the silk is turned in the bath on the skein sticks; and when the colour is deemed sufficiently deep, a pattern is tried in the vat, to ascertain whether it takes the violet colour intended to be produced. If the shade is found to have acquired the proper depth, the silk is beetled at the river and dipped in the vat, in the same way as for the fine violet colours; and less either of the blue or of the archil colour is given, according as it is meant that the red or blue shade of the violet colour should predominate.

Process of Guhliche.

The process recommended by Guhliche for communicating a violet colour to silk is the following. A pound of silk is to be soaked in a bath of two ounces of alum and a like quantity of solution of tin, after having carefully poured off the sediment formed in the mixture. The dye-bath is prepared with two ounces of cochineal reduced to powder, with a drachm of tartar, and the remaining part of the bath, which has answered the purpose of a mordant, with the addition of a sufficient quantity of water. When slightly boiled, such a quantity of solution of indigo is added as may communicate to the bath a proper shade of violet; after which the silk is immersed, and boiled till it has acquired the intended shade. It is then wrung, washed in a stream, and, like every other delicate colour, must be dried in the shade. The light shades exhaust the bath. But it ought to be observed that this colour, which is said to be a beautiful violet, possesses but little durability, and is apt to assume a reddish tinge, owing to the colour of the indigo fading first.

Another.

A violet colour may be imparted to silks by immersing them in water impregnated with verdigris, as a substitute for aluming, and next giving them a bath of logwood, in which they assume a blue colour, which is converted to a violet, either by the addition of alum to the bath, or by dipping them in a weaker or stronger solution of that substance, which communicates a red colour to the particles of logwood. This violet possesses but a small degree of beauty, and little durability; but if alumed silk be immersed in a bath of Brazil wood, and next in a bath of archil, after washing it at the river, a colour is obtained possessing a much higher degree of beauty and intensity. The process described above for dyeing wool succeeds equally well, according to M. Decroizille, in communicating to silk a violet colour.

III.—*Of dyeing Cotton and Linen Violet.*

Common process

The most ordinary mode by which a violet colour is communicated to cotton and linen stuffs, is first to give them a blue ground in the vat, proportioned to the required shade, and to dry them. They are afterwards galled, in the proportion of three ounces of galls to a pound of stuff, and being left in this bath for twelve or fifteen hours, are wrung out and dried again. They are next passed through a decoction of logwood, and when thoroughly soaked and taken out, the bath receives an addition of two drachms of alum and one of dissolved verdigris for each pound of cotton or thread. The skeins are then dipped again on the skein sticks, and turned for about fifteen minutes, when they are taken out and aired. They are next immersed in the bath for fifteen minutes, taken out, and wrung. To complete the process, the vat employed is emptied; half of the decoction of logwood not formerly made use of is now poured in, with the addition of two drachms of alum, and the thread is again dipped in it till it has acquired the shade proposed, which must always regulate the strength or weakness of the decoction of logwood. This colour resists in a considerable degree the action of the air, but in point of permanency is much inferior to that which is obtained from the use of madder.

Sect. III.—*Of the Mixtures of Yellow and Red, or Orange.*

Orange is the usual result of a composition of yellow and red colours; but an almost endless variety of shades may be produced, according as we vary the proportion of the ingredients, and the particular nature of the yellow made use of. It is sometimes the practice of dyers to combine blue with yellow and red, the result of which is the colour denominated *olive*. Many varieties may be obtained from the use of weld, saw-wort, dyers-weed, and other yellows, and by employing tartar, alum, sulphate of zinc, or sulphate of copper, in the bath, or in the preparation of the cloth.

[1] Berthollet, ii. 340.

I.—*Of dyeing Wool Orange.*

Orange by the scarlet process.

By a process exactly the same as that which is followed in communicating to stuffs a scarlet colour, an orange may be given to wool; but the quantity of red must be diminished, and that of the yellow increased. If wool is dyed a red colour by means of madder, and afterwards yellow with weld, the resulting compound is a cinnamon colour, and the most proper mordant in this case is a mixture of alum and tartar. The shades may be varied at pleasure by substituting other yellow dyestuffs instead of weld, and by varying the proportions as circumstances may require. Wool may receive a reddish yellow colour by passing it through a madder bath, after it has undergone the usual process for yellow, which has already been described. The strength of the madder bath is always to be proportioned to the shade required. Brazil wood is sometimes employed with yellow substances, or mixed with cochineal and madder. Snuff, chestnut, musk, and other shades are produced by substituting walnut-tree root, walnut peels, or sumach, for weld.

II.—*Of Dyeing Silk Orange, &c.*

Marone, &c.

Logwood, Brazil wood, and fustic, communicate to silk a marone and cinnamon colour, together with all the intermediate shades. The silk is scoured in the usual manner, alumed, and a bath is prepared by mixing together decoctions of the three different woods mentioned above, made separately, varying the quantity of each according to the shade intended to be given; but the proportion of fustic should be greatest. The silk is turned in the bath on the skein sticks, and when it is taken out, if the colour be uniform, it is wrung and again dipped in a second bath of these three ingredients, according to the effect produced by the first, in order to obtain the shade required.

Olive.

The blue vat is not made use of when an olive colour is to be communicated to silk. After being alumed, it is dipped in a bath of weld, which is made very strong. To this is afterwards added the juice of logwood, with a small quantity of solution of alkali when the silk is dipped. This converts it into green, and gives the olive colour. It is dipped again in this bath till it has acquired the shade wanted.

To communicate to it the colour known by the name of *rotten olive*, fustic and logwood are added to the bath after welding, without any alkali. If the colour wanted is to incline more to a red, the addition of logwood alone is sufficient. A sort of reddish olive may likewise be obtained by dyeing the silk in a fustic bath, to which a greater or less quantity has been added of sulphate of iron and logwood.

III.—*Of dyeing Cotton and Linen Orange, &c.*

Cinnamon colour.

A cinnamon colour is communicated to thread and cotton by commencing the process for dyeing them with verdigris and weld; they are afterwards to be dipped in a solution of sulphate of iron, denominated by the French *bain d'assurage*, and then wrung out and dried. As soon as they are dried, they are galled in the proportion of three ounces to the pound of stuff; then dried again, alumed as for red colours, and maddered. After being washed and dried, they are put into hot soap suds, and turned till they have acquired a sufficient degree of brightness. It is the practice of some dyers to add to the aluming a decoction of fustic.

Olive

By boiling four parts of weld and one of potash in a sufficient quantity of water, M. d'Apligny informs us, a fine olive colour is communicated to cotton and thread. Brazil wood which has been steeped for a night is boiled separately with a small quantity of verdigris, and these solutions are mixed together in various proportions, according to the particular shade required. The thread or cotton is dipped in the compound solution in the usual way.

Compound Colours.

Sect. IV.—*Of the mixture of Black with other Colours.*

Brown.

The compound colours which are obtained from the mixture of black and other colours, are brown, gray, drab, &c. according to the nature and proportions of the simple colours employed.

I.—*Of dyeing Woollen Stuffs Brown, Gray, &c.*

To give a browning to cloth, as soon as it has been dyed, it is dipped in a solution of sulphate of iron, with the addition of an astringent, which makes a *black bath.* It is more common to mix a small quantity of solution of iron with a bath of water, adding more till the dyed stuff dipped in it has received the intended shade. Sulphate of iron is sometimes added to the dye bath; but by dipping the dyed stuff in a solution of this salt, the end is more easily attained. It is the usual practice of M. Poerner to soak the stuff in a solution of sulphate of iron, to which other ingredients are sometimes added; and after having taken it out of the mordant, it is dipped in the dye bath.

Coffee colour.

In order to obtain coffee and damascene colours, with other shades of browns of the common dye, the first method is adopted; a colour more or less deep is communicated to them, according to the shade intended to be obtained by the browning; and a bath is made of galls, sumach, and alder bark, with the addition of sulphate of iron. Those stuffs are first dipped to which the lightest shades are to be communicated, and when these are finished, the browner ones are dipped, a quantity of sulphate of iron being added for each operation, proportioned to the effect intended to be produced.

Gray.

Bluish grays are communicated to stuffs, according to Poerner, by the solution of indigo in sulphuric acid, combined with a mixture of decoction of galls and sulphate of iron, varying the shades according to the different quantities of these ingredients made use of. If to a bath composed of cochineal, fustic, and galls, sulphate of iron be added, other shades are obtained.

For marone, and such other colours as bear a strong resemblance to it, sanders and galls are employed, and sometimes a browning with the addition of logwood. If dyed in the remains of a cochineal bath, these colours may be made to incline to a crimson or purple; and the same effect is produced by adding a small quantity of madder or cochineal to the bath. A little tartar gives a greater degree of brightness to the colour. With a mixture of galls, fustic, and logwood, and a greater or smaller quantity of madder, with the addition of a little alum, those colours may be communicated to stuffs which are known by the name of *hazel.* Hazel

Puce colour.

M. Guhliche produces what is called a *puce* colour, by boiling for fifteen minutes a pound of woollen stuff with two ounces of alum, a certain proportion of vinegar and solution of iron, after which he leaves it in the mordant for twelve hours. He then makes a bath with the decoction of two ounces of white galls carefully poured off from the sediment, and mixed with four ounces of madder, in which, when it grows hot, the stuff is immersed, after being taken out of the mordant, allowing it to remain there, while the temperature is gradually increased, till the colour intended has been imparted to it; after which it is boiled for two minutes, washed, and dried in the sun. The colour thus obtained possesses a great degree of durability. It is of a deeper brown by the omission of the alum and vinegar in the mordant; and after these colours the lighter shades are dyed. Sumach may be employed as a substitute for

Compound Colours. half of the madder. Different brown colours, possessing considerable permanency, may likewise be produced by the use of Brazil and logwood, if more or less of a solution of iron be mixed with a decoction of these substances. The wool being previously alumed and galled, is dyed in it.

II.—*Of dyeing Silk with Mixtures of Black, &c.*

Purple violet. M. Guhliche imparts to silk a purple violet without a blue ground, with a mixture of one part of galls dissolved in white wine, with three parts of water, in which a pound of silk is macerated for twelve hours, soaked in a mordant made up of two ounces of alum, one ounce of solution of tin, and half an ounce of muriatic acid. After wringing the stuff, it is dyed in a bath composed of two ounces of cochineal and a small quantity of solution of iron, till the intended shade has been communicated; and for shades which are lighter, the residua of these baths are sufficient, either separately or mixed together. Madder may be used in the same way, macerating a pound of silk in a solution of alum mixed with an ounce of muriatic acid and a quantity of solution of iron. When the stuff is wrung out, it is dyed in a bath made of eight ounces of madder. When deeper colours are wanted, some of the solution of galls in white wine is mixed with the madder and cochineal baths.

Silk may be dyed in a bath made of equal parts of Brazil and logwood juice, adding a certain quantity of solution of iron after the stuff has been soaked in a solution of two ounces of alum and an ounce of muriatic acid. If solution of galls be added, the colour becomes deeper.

Brick colour. Colours resembling that of brick may be produced by immersing silk in an anotta bath, after preparing it with a solution of galls mixed with a certain quantity of solution of iron. By the mixture of Brazil, logwood, archil, and galls, and by a browning with sulphate of iron, a number of different shades are produced; but the whole of them have more or less a tendency to fade, although their brightness is very pleasing to the eye.

III.—*Of dyeing Cotton and Linen with Mixtures of Black, &c.*

With black cask. A permanent violet colour may be given to thread and cotton, when scoured in the ordinary way, by preparing a mordant with two quarts of the bath of what is called the *black cask*, and four quarts of water, for each pound of stuff, which is made to boil, and the scum is removed which forms on the surface, till it wholly disappears. The liquor is poured into a vat, and, when warm, four ounces of sulphate of copper and one ounce of nitre are dissolved in it. The skeins are left to soak in it for ten or twelve hours, wrung out, and dried. If it is required to produce a deep violet colour, two ounces of verdigris must be added to the bath; and if the nitre be omitted, the colour becomes still deeper by galling the thread more or less prior to its being put into the mordant. If the nitre be increased, and the sulphate of copper be diminished, the violet colour becomes more inclined to lilac. A number of various shades may be produced by different modifications of the mordants employed.

Marone colour. Cotton is galled, dipped, and wrought in the common way, when different shades of marone colour are wanted. To the bath employed must be added more or less of the liquor of the black cask. The cotton is then washed in a bath mixed with verdigris, next welded, and dyed to a fustic bath, to which a solution of soda and alum is sometimes added. When the cotton prepared in this manner has been thoroughly washed, it is next well maddered, dipped in a weak solution of sulphate of copper, and last of all in soap suds.

Hazel. For some hazel and snuff colours, a browning is communicated to stuffs by means of soot, after the welding and madder bath, to which galls and fustic have been added; sometimes soot is mixed with this bath, and a browning is likewise imparted by means of a solution of sulphate of iron; and for browning colours, walnut peels are sometimes employed as a substitute for solutions of iron. For such wools as are designed for the manufacture of tapestry they are very advantageous, because the colour is not changed into yellow by exposure to the air, as is the case in browning, which is imparted by means of iron, but remains a considerable time without any sensible change. The hue is indeed rather dull, but its goodness and very moderate price are sufficient to recommend a more extensive use of it for grave colours, which in common stuffs are sometimes fashionable.

CHAPTER VI.

OF CALICO-PRINTING.

Calico-Printing. Calico-printing is the art of communicating different colours to particular parts of the surface of cotton or linen cloth, while the rest of the cloth retains its white colour; or the whole of the cloth may be dyed one colour, as *red* or *blue*, except particular parts, to which some other colours, as yellow, orange, green, &c. are given. The process is not confined to linen and cotton cloth; it may be applied also to silk and woollen cloth; but as the nature of the processes is in all cases the same, it will answer our purpose sufficiently if we give a sketch of the methods followed by the *calico-printers*.

There is a curious passage in Pliny's Natural History, from which it is evident that calico-printing in his time (the first century) was understood and practised in Egypt. The following is a translation of this passage.

Practised by the ancients. "There exists in Egypt a wonderful method of dyeing. The white cloth is stained in various places, not with dye-stuffs, but with substances which have the property of absorbing *(fixing)* colours. These applications are not visible upon the cloth; but when the pieces are dipt into a hot caldron containing the dye, they are drawn out an instant after dyed. The remarkable circumstance is, that though there be only one dye in the vat, yet different colours appear on the cloth; nor can the colours be afterwards removed."[1] It is evident enough that the substances employed to stain the cloth, as Pliny expresses it, were different mordants, which served to fix the dye upon the cloth. Thus if we suppose certain parts of a piece of cotton cloth to be impregnated with alumina, and the cloth afterwards dyed with madder, after the clearing, those parts only impregnated with the mordant would retain their red colour, while the remaining parts will continue white.

The general opinion is, that this ingenious art originated in India, and from that country made its way into Egypt. Whether this notion be well or ill founded, it is certain that calico-printing was known and executed by the Indians at a very early period. Their colours were beautiful and fast, and the varieties of pattern and the number of colours which they understood to fix on different parts of the cloth gave to their printed calicoes a beauty and a value of no ordinary kind; but their processes are so tedious and so clumsy that they could be put in practice only where labour was exceedingly cheap.

[1] Plinii *Hist. Nat.* xxxv. 11.

Calico-Printing.

Introduced into Europe.

It is not more than a century and a half since calico-printing was transferred from India to Europe, and little more than a century since it became common in Great Britain. The nations with whom it has made the greatest progress are Switzerland, France (especially in Alsace), some parts of Germany, and Great Britain. In Europe the art has been in a great measure created anew. By the application of machinery, and by the light thrown on the processes by the progress of chemistry, the tedious methods of the Indians have been wonderfully simplified; and the processes are remarkable for the rapidity with which they are now executed, and for the beauty, fastness, and variety of the colours which are applied on the surface of cotton. So great have been these improvements, that at the present time in Manchester, a piece of calico can be printed in the short period of one minute; and the quantity of calicoes printed in Manchester in one year amounts to the extraordinary number of from 12,500,000 to 13,000,000.

The different processes to which the cotton cloth destined to be printed is subjected, are the following: singeing, bleaching, calendering, printing, washing, and finishing; or, in some instances, after having been printed, they are stoved, dunged, dyed, brightened, and finished.

The singeing is intended to remove the fibres of cotton which protrude on the surface of the cloth, and which is called "nap." This is done by passing the cloth rapidly over the surface of a red-hot iron plate, which burns off all the "nap" or protruding fibres of cotton without injuring the cloth. Of late years singeing has been effected by a very ingenious coal-gas apparatus, or by a mixture of hydrogen and oxide of carbon. But we need not dwell upon this preliminary process, because the *singeing* has been described already in this Encyclopædia under the article BLEACHING, to which we refer the reader.

We shall endeavour in this chapter to give a sketch of the different processes of calico-printing, such as they are at present practised by the most scientific printers in Lancashire, and in the neighbourhood of Glasgow.

Mousseline-de-laines.

Many of the calico-printers of the present day carry on a large trade in printing mousseline-de-laines, viz., fabrics which are composed of cotton and wool; but we shall not enter here into any special description of this branch of manufacture.

Methods of printing.

There are two modes of printing; namely, *block-printing* and *machine-printing*. The former has been practised from time immemorial; the latter is a modern invention, and originated after the introduction of the art of printing into Great Britain. The figure intended to be communicated to the cloth is cut out upon a block of sycamore, the parts which are to make the impression being left prominent, and the rest of the block cut away, just as practised for wood engravings. When the figure is too complicated, and the lines too fine, to admit of being cut in wood, it is made by means of small pieces of copper, which are very ingeniously driven into the block, and the interstices are filled up with felt.

Of late years several colours have been applied at once on the cloth by means of one block; and the machine used for this purpose is called a "toby," which consists of a box divided into several compartments filled with various colours, and which are in communication through tubes with bottles filled with the same colours; and by means of a gentle pressure the colouring fluid in each of the compartments of the machine is propelled through the felted cloth which covers each compartment. The block being pressed against the cloth, it takes the colour which is to be conveyed to the white calico by the block-printer.

Machine-printing.

Machine-printing is effected by one or several copper cylinders, of 3 feet 6 inches long, and about 6 inches in diameter, upon which the different figures to be given to the cloth are engraved. Each cylinder or roller is made to dip into a small box or trough containing the colour, discharge, mordant, or resist to be applied; and as the cylinder revolves and leaves the colour-trough, it is scraped by a steel blade called a "doctor," which takes off the excess of colour, and then it comes into contact with the white calico, passing between this roller and a larger one made of wood or cast-iron, and covered with felt, acting with pressure. By this means the exact figures on the engraved roller are printed on the cloth. To prevent the colours or mordants from dirtying or "running" into the whites, the printed pieces are immediately dried by passing them over tin cylinders, or flat cast-iron boxes, in which steam circulates. There are now machines in use having as many as 8 or 16 pairs of rollers, and which are technically called "8 or 16 colour machines," which implies that they are made to print 8 or 16 distinct colours successively on one piece of fabric. Another result of modern improvements is, that it only requires $1\frac{1}{2}$ minutes to print one piece, where it formerly required five minutes.

Perrotine machine.

On the Continent the intended figures are sometimes engraved upon a flat copper plate of about a square yard or more in size. Upon this plate the colour to be applied is spread. The plate is then pulled backwards, the excess of colour being removed by a "doctor," and the colour remaining on the engraving is then printed on the white cloth.

Whether the printing is applied by the block, the printing machine, or the perrotine, the treatment of the goods is nearly the same.

Most commonly the printing process consists merely in fixing mordants on the cloth, which is afterwards dyed in the common way, those parts only retaining the colour which have imbibed the mordant, while the other parts of the cloth remain white. Sometimes the substance called "a discharge" is applied to cloth already dyed, in order to remove the colour from certain portions of it which are either intended to remain white, or to receive some other colour afterwards.

Sometimes it is applied to cloth before it is dyed, in order to prevent the indigo, or any other colour, from being fixed on those parts to which it is applied, that they may remain white, or be afterwards made to receive other colours. Substances possessed of this property are called "resists."

Sometimes the cloth is mordanted with stannic acid, and the colours are then applied, and the whole submitted to the action of steam, and called "steamed goods." Finally, the printing process is frequently employed to communicate mordants and colouring matter at once to the cloth. Let us take a view of these different processes.

I.—*Mordants.*

The principal mordants employed by calico-printers are the following:—

How made.

1. *Alumina.*—The usual alumina mordant of the calico-printer is prepared by partly decomposing alum, held in solution by impure acetate of lime, commonly called pyrolignite of lime;[1] sulphate of lime precipitates, and aceto-sulphate of alumina is thus obtained. Red liquors thus prepared have a specific gravity of 1·08, and are composed as follows:—

Composition of four red Mordants per Gallon.

SUBSTANCES.	FORMULA. $Al^2O^3, So^3 + 2(C^4H^3O^3) + NH^3So^3\ HO$				FORMULA. $Al^2O^3, + 2So^3 + C^4H^3O^3 + NH^3, So^3, HO$		FORMULA. $Al^2O^3 + So^3, + 2(C^4H^3O^3)$	
	MORDANT A.		MORDANT B.		MORDANT C.		MORDANT D.	
	Grains.	oz. grs.	Grains.	oz. grs.	Grains.	oz. grs.	Grains.	oz. grs.
Alumina	1680 0	3 18	1830 0	4 19	1239 0	2 369	2164 4	4 416
Sulphuric Acid	2642 5	6 20	2800 0	6 178	3017 0	6 395	1664 6	3 323
Acetic Acid.....	3369 8	7 307	3970 0	8 70	1281 7	2 406	3679 2	8 179
Ammonia and Water........	674 1	1 236	910 0	2 35	693 1	1 215	...	...

[1] Pyrolignite of lime is obtained by neutralizing with lime impure vinegar obtained by the dry distillation of wood.

Calico-Printing.

In the manufacture of pyrolignite of alumina, or "red liquor," sulphate of alumina is frequently substituted for alum, and acetate of lead for pyrolignite of lime.

When cloth to be dyed *red or pink* is impregnated with this mordant, it is not thickened. When applied only to particular parts of the cloth by the block or the machine, it is thickened with flour or calcined farina, according to the nature of the style of work.

"Topical" colours.

2. *Perchloride of Tin.*—Perchloride of tin is very much used as a mordant. The colouring matter is previously mixed with it, and both are applied at once. Such applications are called "*topical" colours.* The mixture is allowed to dry on the cloth, which is then merely washed with water. Colours so applied are easily altered by light, soap, &c.

Hence a topical colour is one which is easily injured by exterior agents, and is commonly called, among printers, a "loose" colour. The colours produced in this way are pinks or reds, from peach or sapanwood; purples from logwood; yellows from quercitron bark or fustic; and greens from the last-mentioned dyes with the addition of Prussian blue.

Steam colours.

Perchloride of tin is much used in another process of calico-printing for producing what are technically known as "steam colours;" it is decomposed by an excess of caustic soda, and the peroxide of tin or stannic acid at first precipitated is re-dissolved, giving rise to stannate of soda.

The cloth is immersed in this liquid and dried, and the stannic acid is then precipitated upon the cloth by immersing it in a solution of sal-ammoniac or sulphate of magnesia, but most commonly in a solution of free sulphuric acid, and the pieces of calico are then washed and dried.

Some calico-printers use crystallized stannate of soda, dissolving it in water, and employing it as above described. The different colouring matters intended to be applied on such prepared cloth are generally mixed with a small proportion of sal-ammoniac, and sometimes with either salts of ammonia, salts of tin, or chlorate of potash, which are intended to give fixity and brilliancy to such colours. The colours are then thickened with starch and printed on the above-mentioned calico, and the whole is submitted to the action of steam. To effect this the calicoes are introduced into a square iron box called a "steam chest," and submitted to the influence of steam, a powerful oxidizing and fixing agent; or the printed cloths are rolled round a perforated roller and submitted to the same action. The pieces then only require to be well washed, dried, and finished, to be ready for the market.

The result of the combined action of moisture and heat is, that a combination takes place between the colouring principle and the peroxide of tin, or stannic acid, which renders the colouring matter insoluble. In this manner pinks, reds, purples, crimsons, yellows, oranges, blues, greens, browns, and drabs, are produced.

Oxides of iron;

3. *Oxides of Iron.*—These metallic oxides are much used as mordants, either in the state of protoxide or peroxide. The salt most employed is the impure pyrolignite of protoxide of iron, which is prepared either by decomposing green copperas with pyrolignite of lime, or by placing in large vats pyrolignous acid and old iron, when, after a few months, the iron, which is gradually oxidized, dissolves in the acid, and gives rise to pyrolignite of protoxide of iron.

how produced.

This valuable mordant is thickened with calcined farina,[1] and applied on the calico. After being exposed for a few days in a moist atmosphere, it loses a part of the acid, and becomes partially peroxidized. Pyrolignite of iron of the specific gravity of 1·05 gives a black with madder and several "tannin" substances. Various shades of purple are obtained by adding different proportions of water to the mordant previously to applying it to the cloth; and various shades of chocolates are produced by mixing this mordant with the alumina one previously described, and then dyeing also with madder. These are the principal mordants employed by the calico-printer. Several dyeing substances have so strong an affinity for calico that they require no mordant; this is the case with indigo, Prussian blue, safflower, peroxide of iron, sesquioxide of manganese, &c.

Purple.

Chocolate.

II.—*Substances used for Discharging Colours.*

Discharges

A discharge is a substance which has the property of removing a mordant, or destroying a colour so completely, that when the printed piece is properly washed no trace of either the mordant or the colour will be visible. In fact, the whites so produced will be as pure, or nearly so, as if no colour or mordant had been previously applied. And, as most colours are fixed on cloth either by means of mordants, or by oxidizing the colouring principle, hence the printers employ something that will dissolve the mordant in its normal state, or by deoxidizing it; but if no mordant be present, it will be by destroying the colouring matter through suroxidation or combustion, as is the case with chlorine, or with oxygen liberated from chromic acid. Therefore discharges employed are either acids, or substances having a strong oxidizing power.

their action.

1. *Citric Acid* is much used by printers to dissolve alumina and peroxide of iron, and thus to prevent the colours which these mordants would fix from remaining on the cloth. This discharge is obtained by using pure citric acid, or by evaporating lemon juice, and thickening it with gum-arabic, calcined starch, or farina for machine-printing; or with the same and pipe-clay for block-printing. It is occasionally assisted by bisulphate of potash or weak sulphuric acid.

Sometimes citric acid is printed on white cloth, and alumina or iron mordant, slightly thickened and dried immediately to prevent the swelling of the acid figures; at other times the mordants are first applied, and the acid printed over them.

In both cases the goods are afterwards passed through hot water containing cow's dung, and well washed before being dried. By these means all the mordant is removed from those parts on which the citric acid was applied, which, of course, remain white when the cloth is dried.

2. *Tartaric Acid,* thickened with gum, is applied by the block or printing machine to cloth previously dyed Turkey-red. It is then passed through an aqueous solution of bleaching powder, and the acid disengaging the chlorine, the red colour is discharged from those places to which it had been applied, while all the other parts of the cloth retain their red colour. Sometimes the Turkey-red calico is folded between metallic plates which are perforated with designs, and so arranged that each figure of the design corresponds through the pile of prints so folded. The whole is then submitted to pressure, and a chlorine liquor is forced by pressure to percolate through the mass, which destroys the red colour in all those parts where the perforated plates allowed the bleaching powder to circulate.

3. *Oxalic Acid*—To obtain white on indigo-blue "dips," the blue-dipped pieces of calico are printed with chromate of lead, and the pieces so prepared are passed through an

[1] Of late years gum arabic and tragacanth have been nearly entirely replaced by calcined farina, which is potato starch heated to a temperature of about 360° Fahrenheit, or until it has assumed a light buff colour and become soluble in cold water. "Purple gums" are the same, or wheat starch which has been mixed with a small percentage of weak nitric acid, and then a lower temperature is necessary to produce the conversion of the insoluble starch into a soluble gummy substance. "British gum" is a term applied to calcined wheat starch. "Flummery" is obtained in the manufacture of wheat starch, being found swimming as a scum on the surface. It is removed, drained by centrifugal force, and calcined.

Calico-Printing.

acid liquor composed of a solution of hydrochloric acid of a specific gravity of 1·050, and 1 ounce of oxalic acid per gallon. Chlorine is thus generated, and the blue indigo colouring matter, called indigotine, is destroyed in all those parts to which the chromate of lead was applied.

Protochloride of iron is sometimes used to discharge the manganese brown. This it does by depriving the oxide of manganese of a part of its oxygen, and thus renders it soluble; whilst the protoxide of iron, converted into a perchloride, deposits peroxide of iron on the cloth, which combines and produces the characteristic buff or orange colour of that oxide.

4. *Protochloride of tin*, when applied to cloth dyed brown by sesquioxide of manganese, immediately reduces it to the state of protoxide, and thus discharges the colour and leaves the parts white. If it be mixed with Brazil wood or cochineal, it discharges the manganese as before, but leaves a pink. When mixed with logwood, it leaves a purple, and with Prussian blue a blue. The protochloride of tin is used in a variety of ways in calico-printing to remove iron mordants, so as to prevent the colours fixing themselves in those parts which are intended to remain white.

The above organic acids, namely, citric, tartaric, and oxalic acids, are preferable to metallic discharges, as they not only remove the mordants which generally fix colours upon calico, but also because they leave no trace of their presence after they have fulfilled the objects for which they were employed; whilst, on the contrary, metallic discharges are apt to leave some sub-salt, which is easily produced when the water used by calico-printers is calcareous, and these traces of metallic salts are apt to dirty the whites.

III.—*Resist Pastes.*

Resists were first employed in China and India. They should possess the following general properties:—First, preventing effectually any colour or mordant from fixing on those parts of the cloth to which they have been previously applied, and at the same time of not injuring the colours which are to be subsequently employed. Secondly, resists should be of such a nature as to be easily removable by washing, after they have fulfilled their object.

Resists.

There are two distinct classes of reserves or resists, those which act by mechanically preventing the colour from reaching the cloth, and those which act chemically, by oxidizing the colour previously to its coming into contact with the fabric, and thus rendering it insoluble or incapable of fixing itself on the fibres of the fabric. A mixture of both these resists is often used.

Mechanical resists.

The resists which act in a purely mechanical manner, such as those composed of wax, resin, or tallow, are seldom resorted to, owing to the difficulty of ultimately removing them; but the use of pipe-clay, conjointly with a chemical resist, is very common. In "steam goods," mechanical resists are those chiefly used; they consist of arsenite or phosphate of lime, of phosphate of zinc and magnesia, or of acetate of lime and zinc.

1. *Blue resist* or *vitriol resist* consists of a mixture of sulphate, acetate, and sometimes nitrate of copper, and the solution is thickened with British gum, or calcined flummery, together with pipe-clay for the block, and flour for machine-printing. When the cloth on which this paste has been printed is dipped into an indigo vat, the indigo is oxidized before it reaches the surface of the cloth. (See BLUE.) After dyeing, the pieces are passed through weak sulphuric acid, not only to remove the oxide of copper, which has been precipitated, but also to fix the indigo on the calico, by liberating it entirely from its lime combination.

2. *Mild resist* consists of sulphate of zinc, flummery, and pipe-clay. It is used along with other colours which copper would injure, or which would be destroyed by immersion in sulphuric acid. It resists a pale-blue, and the removal of oxide of zinc afterwards by an acid is not necessary, as is the case when copper is employed.

3. *Red paste* consists of the alumina mordant above described, mixed with acetate of copper, and calcined British gum, or flummery and pipe-clay. It resists pale blues, and the alumina remains upon the portions of the cloth which are white, and which are to be afterwards dyed with madder to produce red, or with quercitron bark for yellow.

4. *Neutral resist* is a name given by calico-printers to a compound of lime juice,[1] sulphate of copper, British gum, and pipe-clay. It resists during a short dip in the indigo vat, and the lime juice gives it the property of remaining white when the piece is dyed in madder, even where the preceding alumina resist goes over it. This acid also prevents the lime of the blue indigo vats from precipitating copper upon the cloth, which would give it a deep-brown tinge in the madder beck.

5. *Chrome yellow resist* consists of a mixture of a salt of copper to resist the blue indigo vat, with a salt of lead to produce a chromate of lead, after having been dyed blue in the blue vat. (See *Blues.*)

These are the five principal resist pastes. There are a few others, but they will easily suggest themselves to those who understand the principles of chemistry.

"Conversion."

Besides the above methods, the process called "conversion," which has been discovered within the last few years, has proved a great acquisition to the calico-printer, as it enables him to increase the various effects which he may be desirous of producing on his prints. It consists in increasing or decreasing the tints of certain colours without affecting the whites; and this is effected by having a roller so disposed, that while one or two or more rollers are producing certain colours longitudinally, another roller will be printing transversely another colour, which in acting chemically on those printed longitudinally will alter their shades.

Instead of describing the method of printing mordants and colouring matters at once, or of applying "topical" colours, or of producing "steam colours," we think it will be better to make a few observations on each particular colour in succession, without distinguishing whether it is applied by dyeing or printing.

Reds and Pinks.

The most important dye stuff for producing red amongst calico-printers is madder. Goods which have received the alumina mordant as applied in figures, either by the machine or the block, are first hung, or "aged," as technically termed, for several days in large rooms. The purport of this operation is to allow the acetic acid to evaporate, and leave on the print a basic aceto-sulphate of alumina. The pieces are then passed through nearly boiling water, containing cow-dung, or a chemical substance, such as silicate or arseniate of soda, or a mixture called "Mercer's dung substitute." The pieces, after having been sufficiently "aged," are well washed and put into a dye-beck, containing water and madder; and the whole is gradually heated to 180° for two hours, and lastly, to boiling point for half an hour. The prints, having been kept constantly in motion during the above operation, and having assumed the required shades of pink and red, are washed and ready for a second series of operations, called "soaping" or clearing," which is effected by passing them for 25 minutes into a weak solution of soap, heated to about 185°, which substance has the property of removing the loose colours on the white parts, and of giving

[1] "Lime juice" is a commercial term applied to lemon juice, which is imported principally from Sicily, and from which also citric acid can be obtained.

brilliancy and fixity to the red and pink figures on the cloth. For certain styles of pinks, protochloride of tin is added to the soap. All madder colours require two soapings to give great brilliancy and vividness to the colours, and purity to the whites.

Of late years, madder has been nearly replaced in calico-printing by garancine[1] and garanceux, which have the property of yielding colours more brilliant than madder, although not so fast. But the chief reason why garancine has been substituted for madder is, because with it the prints, after they are dyed, require only a simple washing and no soaping to clear the whites.

Turkey red is one of the most beautiful and valuable styles of calico-printing, in consequence of the brilliancy of the colour and its durability. It is also obtained with madder, but the pieces previously to being dyed have to undergo a long series of operations, which consist in passing the pieces successively in Gallipoli oil and carbonate of soda, and hanging them in the air between each process. They are then passed into a weak solution of red mordant, and afterwards of gall-nuts, well washed, and dyed in madder. When this has been effected, the colours are brightened by being boiled, under pressure, in a solution of soap and chloride of tin.

When sapanwood or peachwood is used instead of madder or garancine, the mordant and method of dyeing are the same; the cloth, however, does not receive the same treatment after dyeing, and does not require it, because these colours are much more easily removed from the parts of the cloth which are destitute of mordant.

The chief employment of these dye-stuffs is in producing steam reds or pinks. To effect this, a decoction of these woods is mixed with chlorate of potash, nitrate of alumina, and thickened with wheat starch. This prepared colour is printed on calico which has been mordanted with stannic acid; and when dried it is ready to be introduced into a square iron box called a "steam-chest," and submitted to the action of an atmosphere of steam for 25 minutes, which has the property of fixing the colours on the cloth; or the printed calicoes are rolled round a perforated roller and submitted to the same influence. The pieces then only require to be well washed, dried, and finished, to be marketable.

Beautiful reds and pinks are produced by means of cochineal. The mordant is either alumina or oxides of tin, and the method of proceeding is similar to that already described for madder and garancine colours. Cochineal is also extensively employed to obtain these colours on steamed mousseline-de-laines.

Safflower cannot be applied to calico in figures, but it is frequently employed for giving numerous crimson or pink dyes to pieces of cloth. The safflower is first dipped into water containing carbonate of soda, which dissolves its colouring matter. The solution, freed from the fibrous part of the dye-stuff, is then saturated by impure citric acid, or lemon juice, otherwise lime juice. A piece of cloth immersed in this solution extracts the colouring matter from it, which is afterwards heightened by immersion in weak solution of cream of tartar. By this means a very beautiful but fugitive colour is communicated to calico.

Yellows and Oranges.

A fine yellow is produced by a very simple process, which was first introduced in calico-printing by Professor Thomson, which consisted in fixing on calico, especially blue indigo dips, a yellow or orange chromate of lead. To produce this well-known style, a reserve consisting of nitrate and sulphate of lead is printed, dried, and the pieces dyed in an indigo vat. They are then passed through weak sulphuric acid, and then into an alkaline chromate of potash, when orange chromate of lead designs are produced, or into a bichromate of potash, when yellow chromate of lead designs are raised.

Quercitron bark is also employed frequently to communicate a yellow colour to calicoes. The alumina mordant is first applied, and the cloth is passed in the dung-beck in the way described when giving an account of madder-dyeing. Quercitron bark yields its colouring matter at a lower temperature than madder; and the parts of the cloth to which no mordant has been applied remain tolerably white after the cloth has been washed in cold water.

Fustic is sometimes substituted for quercitron bark, but the yellow or orange colours which it produces are not so fast as those given by quercitron bark.

Persian berries.—A decoction of these berries constitutes likewise a yellow dye for calico-printers, and it may be employed in the same manner as the above substances, but generally it is used to produce steam yellows and oranges. For this purpose the decoction is mixed with oxalic acid, or a little acetate of alumina, and printed on calico prepared with stannic acid. For oranges the solution of Persian berries is mixed with chloride of tin in excess, and thickened with starch. The goods, after having been printed, are dried and steamed, and they only require washing in water.

Quercitron bark and fustic are sometimes used in cheap styles of prints as substitutes for Persian berries; but the yellows and oranges are rapidly injured by the atmosphere, which communicates to them a dirty brownish tint.

Buff.—To produce this colour the cloth is printed with a mixture of sulphate and pyrolignite of iron, or with nitro-sulphate of iron. After having had time to be partly oxidized and partly decomposed, it is washed in water; or if a stronger bath is wanted, it is raised in milk of lime till the protoxide of iron is converted into a sesquioxide. No mordant is required, as peroxide of iron has a strong affinity for cotton cloth. It is very easy to produce whites on such colour, all that is necessary being to print a discharge composed of oxalic and citric acids, which dissolve the hydrate of sesquioxide of iron, and leave those parts of the calico thus treated free of colour. Buff colours are also produced by printing an alkaline solution of annotto on calico prepared with stannic acid, and submitting it to the influence of steam.

Blue.

Not only the most ancient but also the most general means of obtaining blues on calicoes is by indigo, which is applied in various ways.

Indigo-blue dips.—This fine blue colour is produced by adding, in a vat capable of holding from 900 to 1000 gals. of water, 60 lbs. of finely ground indigo, to which is gradually added 140 lbs. of green copperas, or sulphate of protoxide of iron, together with 212 lbs. of slack lime. Owing to the lime removing the sulphuric acid from the salt of iron, the protoxide of that metal is liberated, and by its affinity for oxygen removes a part of the oxygen of the blue indigo, and thus transforms it into white indigo, which is soluble in the excess of lime employed in the operation. After the lapse of a few hours, the dye vat being ready, a piece of calico is hooked on a wooden frame and well stretched out; it is then dipped into the vat for 15 minutes, taken out and left exposed to the air for 5 minutes.

[1] Garancine is obtained by treating madder with weak sulphuric acid, and raising the whole to the boiling point for 2½ hours, then washing and submitting the charred mass to pressure. By this operation a chemical action ensues, and "alizarine," the colouring principle of madder, is produced, so that one part of garancine is equal to two parts of madder. Garanceux is prepared by a similar process, only commercial madder is replaced by madder which has been partly exhausted by having been previously employed for dyeing.

The piece of calico which is white when it comes out of the vat gradually becomes green, and then blue; owing to the oxygen of the air oxidizing the white indigo, transforming it into blue, which is insoluble in water, and fixed on the calico. The number of successive dips that the piece undergoes varies according to the various shades of blue which the printer requires. The pieces, after having been passed into a weak solution of sulphuric acid or "sours," which fixes the indigo thoroughly, only require to be well washed and dried.

To produce the well-known style of print which consists in a blue ground and white design, it is simply necessary to print the blue resist described above, passing the pieces in a vat containing lime, and then dyeing them in the above indigo vat. The pieces only require to be passed through vitriol, well washed and dried. We have also described the mode of obtaining oranges or yellows on such prints.

China blue.—This style of print is obtained by printing on the calico a mixture composed of pulverised indigo and sulphate of protoxide of iron, to which is sometimes added orpiment, and thickened with British gum. The pieces so printed are passed alternately, by means of rollers, first into a milk of lime, and then into a solution of sulphate of protoxide of iron; when there ensues one of the most interesting phenomena of calico-printing, for as fast as the blue indigo is reduced into white indigo, instead of being dissolved by the lime of the bath, it is retained with force through the molecular attraction of the fibre of the calico, and prevented leaving the cloth, until it is fixed by the exposure of the piece to the oxygen of the atmosphere. The pieces then only require to be passed into weak sulphuric acid, washed, and dried, in order to be completed.

Pencil blue is obtained by reducing blue into white indigo, by boiling it for several hours with protochloride of tin and alkali. When the indigo is well reduced, citrate of soda and starch are added; and after having carried the whole to the boiling-point, the calico is printed with it, passed into a milk of lime, washed, and dried.

Prussian blue may be applied to cloth in various ways. We shall mention some of the principal of these.

1. An iron mordant is first applied to the cloth, and allowed to remain untouched till the iron has had time to be partly peroxidized and become fixed. The pieces are then dipped into a solution of prussiate of potash, mixed with a little sulphuric acid, which acid liberates the prussic acid, which, in yielding its cyanogen to the iron of the oxides, produces cyanides of iron or Prussian blue. Sometimes the calico to be dyed is boiled for five hours in a solution of yellow prussiate, common salt, and chloride of tin, and afterwards into a second bath, containing sulphuric acid and alum; when Prussian blue is produced on the cloth, which only requires washing.

To produce white designs on such prints, it is usual to thicken with British gum a solution of caustic alkali, and to print it on all those parts of the cloth from which it is intended to discharge the colour. The pieces are then passed into a solution of oxalic or muriatic acid, well washed and dried.

2. *Prussian blue* is dissolved in muriatic acid, oxalic acid, perchloride of tin, or nitrate of iron, and the solution is applied to the cloth immediately in the usual way.

3. *Ferrocyanic acid* is printed upon cloth prepared with stannic acid, and decomposed under the influence of steam, in the ordinary steaming process; prussic acid escapes, and cyanides of iron, or Prussian blue, remains on the cloth. The blue is developed by exposure to the air, or by being passed through a weak solution of bleaching powder, or bichromate of potash.

4. Prussian blue is often obtained by printing prussiate of tin on prepared calico, and then submitting the print to the influence of steam.

Greens.

1. The fast green discovered by Mr James Thompson of Primrose Hill, near Clitheroe, Lancashire, and commonly known by the name of "Warwick's Green," is a mixture of the pencil blue already described and aluminate of potash. The mixture is thickened and applied in a similar way to the Prussian blue. The alumina is then precipitated from its alkaline solution, by being passed through a weak solution of sal-ammoniac or sulphate of magnesia. The cloth is then dyed yellow in quercitron bark. It is well known that blue and yellow form green. In this operation the alumina mordant can be replaced with advantage by oxide of tin.

2. The most common process followed to obtain green on prints, consists in printing, on prepared calico, prussiate of tin, together with Persian berries, and an alumina mordant, and subjecting such prints to the influence of steam. For producing a cheap style of prints, quercitron bark is often substituted for Persian berries; but the greens thus produced, though cheaper, are not fast.

3. *Arsenites of copper*, or "Scheele's greens." There are several modes of producing these greens on calicoes. The one most commonly employed consists in passing the cloth in a mixture of salts of copper, then into a weak solution of caustic lye, and lastly into a solution of arsenious acid. To obtain green patterns, the pieces are passed into an arsenite of soda, and then the salts of copper are printed on all those parts where green patterns are required.

Blacks.

1. Various methods are employed by the calico-printers to produce a black upon cotton. An iron mordant of the specific gravity of 1·05 gives a black with madder. The same mordant, mixed with "red liquor," gives a black when the cloth is passed through a hot solution of logwood. Great fixity has been imparted of late years to this black, as well as that produced with shumac, by passing the dyed pieces through a weak solution of bichromate of potash, which, in suroxidizing the colouring matter, completely fixes it on the fibres of the calico. No process in calico-printing is easier than to produce white designs on black; it is sufficient to print a mixture of oxalic and tartaric acids, thickened with calcined farina or starch, and passing through water. By this means the colour is discharged, owing to the iron mordant being dissolved, and the loosened colour washed away. By passing such pieces into an alumina mordant, and then into a beck containing sapanwood or peachwood, a red is produced; with logwood a purple, or with quercitron bark or fustic a yellow. Of late years, madder extract has been printed on such discharged blacks.

2. A topical black is made from a decoction of gallnuts, mixed with nitrate of peroxide of iron. Another topical black is produced by mixing a decoction of logwood with a solution of protoxide of iron, or of pyrolignite of iron.

Lilacs and Purples.

These colours are communicated to cloth by printing a diluted solution of pyrolignite of iron, thickened with calcined farina. The cloth is then dyed in madder exactly as described for producing reds. Steam lilacs and purples are obtained by thickening logwood with alumina mordant, or red liquor, and printing this mixture on calico prepared with stannic acid, and then submitting such prints to the influence of steam. Cochineal is sometimes substituted for logwood on mousseline-de-laines. Topical lilacs and purples are procured by printing a logwood solution previously mixed with perchloride of tin containing a little salts of iron.

Chocolates.

Various shades of chocolate are produced, as above stated, by printing on calicoes as mordant a mixture of pyrolignites of alumina and iron, and dyeing, as also described, in a madder beck.

Browns.

1. Of late years, browns and wood colours have been obtained extensively, by employing either a solution of catechu made with vinegar or weak alkali, and mixing it with salts of copper, iron, or tin, according to the shades required; and with sal-ammoniac for steam colours. To give fixity to such colours, the pieces, after having been printed and steamed or dyed, are passed into a weak solution of bichromate of potash or milk of lime.

2. By far the most fixed brown is communicated to cotton by means of the sesquioxide of manganese; but this process of producing browns has almost fallen into desuetude.

Drab.

This colour is procured by printing the cloth with an iron mordant, and then dyeing it in quercitron bark or shumac.

Olive.

This colour is formed by printing a mixture of iron and alumina mordants, and dyeing in quercitron bark or shumac.

Dove.

A weak iron mordant dyed in cochineal, sapanwood, or peachwood.

Finishing Processes.

After the prints have undergone the various operations which we have described, there is still another which they have to undergo to give them a finish—prints in their rough and uneven state being unmarketable. Consequently, they are submitted to a series of processes, whose object is to give to the fabrics such an appearance as will please the eye of the buyer, and obtain a better price in the market. All the finishing processes have one common end, namely, to fill up the interstices which exist between the fabrics, and thus give to the calico a more substantial and glossy appearance; and this is effected by filling the cloth with boiled starch, farina, or sour flour, which is obtained from wheat flour which has been allowed to ferment. To these are often added large quantities of sulphates of lime or baryta. To give a compact and glossy appearance to the surface of the cloth, it is passed between heated rollers under pressure; and according to the heat and pressure applied, so is the degree of lustre imparted to the fabric.

At other times the calico-printer gives little or no lustre to his fabrics; and in such cases the buyer, if he intends the goods for a foreign market, submits them himself to a process called "calendering," which consists in passing the pieces, either dried or slightly moistened, between heated rollers, and under high pressure. See Calender. (F.C.C.)

DYER, Sir James (1511–1582), an eminent English lawyer, who was at one time speaker of the House of Commons, and was afterwards chief judge of the court of common pleas in the reign of Elizabeth. He published a large collection of Reports, and several law tracts, which have been eulogized both by Coke and Camden.

Dyer, *John*, an English poet, the son of Robert Dyer, a Welsh solicitor of great ability, was born in 1700. He received his education at Westminster school under the care of Dr Freind, and was then called home to be instructed in his father's profession. His genius, however, soon led him to abandon the study of law; for besides his early taste for poetry, he had a passion no less strong for the arts of design, and determined to make painting his profession. With this view, having studied some time under a master, he became, as he himself narrates, an itinerant painter, and wandered about South Wales. About 1727 he printed *Grongar Hill*. Being probably dissatisfied with his own proficiency, he made the tour of Italy, where, besides the usual study of the remains of antiquity, and the works of the great masters, he frequently spent whole days sketching the picturesque scenery in the neighbourhood of Rome and Florence. Images drawn from thence naturally transferred themselves into his poetical compositions. The principal beauties of *The Ruins of Rome* are perhaps of this kind; and the description of various landscapes in *The Fleece* have been particularly admired. On his return to England he published *The Ruins of Rome,* 1740; but soon found that he could not relish a town life, nor submit to the assiduity required in his profession. Having been advised by his friends to enter into holy orders, he was ordained by the Bishop of Lincoln, and had a degree conferred on him.

About the same time he married a lady of Coleshill, named Ensor, "whose grandmother," says he, "was a Shakspeare, descended from a brother of every body's Shakspeare." His ecclesiastical provision was for a long time but slender. His first patron, Mr Harper, gave him, in 1741, Calthorpe, in Leicestershire, of L.80 a-year, on which he lived ten years; and in April 1751 he exchanged it for Belchford, in Lincolnshire, of L.75, which was given him by Lord Chancellor Hardwicke. His circumstances afterwards began to be more favourable. In 1752 Sir John Heathcoate gave him Coningsby, of L.140 a-year; and, in 1756, when he received the honorary degree of LL.B., he obtained from the chancellor, Kirby-on-Bane, of L.110. In 1757 he published *The Fleece*, his chief poetical work, of which Dr Johnson relates this ludicrous story. Dodsley the bookseller was one day mentioning it to a critical visitor, with more expectation of success than the other could easily admit. In the conversation the author's age was asked; and being represented as advanced in life, "He will," said the critic, "be buried in woollen." He did not indeed long outlive that publication, nor enjoy the increase of his preferments; for a consumptive disorder, with which he had long struggled, carried him off in 1758.

DYLE, a river of Belgium. See Belgium.

DYNAMETER, an instrument for ascertaining the magnifying power of telescopes, consists of a small tube with a transparent plate accurately divided. It is fixed to the tube of the telescope, in order to measure the diameter of the image of the eye-glass.

DYNAMICS.

Dynamics. Definition.

1. This name marks that department of physico-mathematical science which contains the abstract doctrine of *moving forces;* that is, whatever necessarily results from the relations of our ideas of motion, and of the immediate causes of its production and changes.

Object of dynamics is change of that condition of a thing which we call its *motion.*

2. All *changes* of motion are considered by us as the indications, the characteristics, and the measures of changing causes. This is a physical law of human thought, and therefore a principle to which we may refer, and from which we must derive all our knowledge of those causes. When we appeal to our own thoughts or feelings, we do not find in ourselves any disposition to refer mere existence to any cause, although the beginning of existence certainly produces this reference in an instant. Had we always observed the universe in motion, it does not appear that we should have ascribed it to a cause, till the observation of relative rest, or something leading to it, had enabled us to separate, by abstraction, the notion of matter from that of motion. We might then perceive that rest is not incompatible with matter; and we might even observe, by means of relative motions, that absolute rest might be produced by the concourse of equal and opposite motions. But all this requires reflection and reasoning, whereas we are now speaking of the first suggestions of our minds.

3. We cannot have any notion of motion *in abstracto,* without considering it as a state or condition of existence which would remain if not changed by some cause. It is from changes alone, therefore, that we infer any agency in nature; and it is in these that we are to find all that we know of their causes.

Mechanical relation, what.

4. When we look around us, we cannot but observe that the motions of bodies have in most cases, if not always, some relation to the situation, the distance, and the discriminating qualities of other bodies. The motions of the moon have a palpable relation to the earth; the motions of the tides have as evident a relation to the moon; the motions of a piece of iron have a palpable dependence on a magnet. The vicinity of the one seems to be the occasion at least of the motions of the other. The causes of these motions have an evident connection with or dependence on the other body. We are even disposed to imagine that they are inherent in that body, and that it possesses certain qualities which are the causes of those modifications of motion in other bodies. These serve to distinguish some bodies from others, and may therefore be called *properties;* and since the condition of other bodies so evidently depends on them, these properties express very interesting relations of bodies, and are chiefly attended to in the enumeration of the circumstances which ascertain what we call the *nature* of any thing. We do not mean to say that these inferences are always just; nay, we know that many of them are ill founded; but they are real, and they serve abundantly for informing us what we may expect from any proposed situation of things. It is enough for us to know, that when a piece of iron is so and so situated in relation to a magnet, it will move in a certain manner.

This mutual relation of bodies is differently considered, according to the interest that we chance to take in the phenomenon. The cause of the approach of the iron to a magnet is generally ascribed to the magnet, which is said to attract the iron, because we commonly employ the magnet in order that these motions may take place. The similar approach of a stone to the earth is ascribed to the stone, and we say that it tends to the earth. In all probability the procedure of nature is the same in both; for they are observed in every instance to be mutual between the related bodies. As iron approaches a magnet, so the magnet approaches the iron. The same thing is observed in the motions of electrified bodies; also in the case of the stone and the earth. Therefore the cause of the motions may be conceived as inherent in either, or in both.

Force and Action are figurative terms when used in mechanism.

The qualities thus inherent in bodies constituting their mechanical relations, have been called the *mechanical affections of matter.* But they are more commonly named *powers* or *forces;* and the event which indicates their presence is considered as the effect and mark of their agency. The magnet is said to *act* on the iron, the earth is said to *act* on the stone; and the iron and the stone are said to *act* on the magnet and on the earth.

All this is figurative or metaphorical language. All languages have begun with social union, and have improved along with it. The first collections of words expressed the most familiar and the most interesting notions. In the process of social improvement, the number of words did not increase in the same proportion with the notions that became interesting and familiar in their turn: for it often happened that relations of certain ideas so much resembled the relations of certain other ideas, that the word expressing one of them served very well for expressing the other; because the dissimilar circumstances of the two cases prevented all chance of mistake. Thus we are said to *surmount* a difficulty, without attaching to the word the notion of *getting over* a steep hill. Languages are thus filled with figurative expressions.

But the analogy is not in the force, but in the effect.

5. *Power, Force,* and *Action,* are words which must have appeared in the language of the most simple people; because the notions of personal ability, strength, and exertion, are at once the most familiar and the most interesting that can have a place in the human mind. These terms, when used in their pure, primitive sense, express the notions of the power, force, and action of a sentient, active being. Such a being only is an agent. The exertion of his power or force is (exclusively) action; but the relation of cause and effect so much resembles in its results the relation between this force and the work performed, that the same term may be very intelligibly employed for both. Perhaps the only case of pure unfigurative action is that of the mind on the body. But as this is always with the design of producing some change on external bodies, we think only of them; the instrument or tool is overlooked, and we say that we act on the external body. Our *real* action therefore is but the first movement in a long train of successive events, and is but the remote cause of the interesting event. The resemblance to such actions is very strong indeed in many cases of mechanical phenomena. A man throws a ball by the motion of his arm. A spring impels a ball in the same manner by unbending. These two events resemble each other in every circumstance but the action of the mind on the corporeal organ; the rest of it is a train of pure mechanism. In general, because the ultimate results of the mutual influence of bodies on each other greatly resemble the ultimate results of our actions on bodies, we have not invented appropriated terms, but have contented ourselves with those already employed for expressing our own actions, the exertions of our own powers or forces. The relation of physical cause and effect is expressed metaphorically in the words which belong properly to the relation of agent and action. This has been attended by the usual consequences of poverty

of language, namely, ambiguity, and sometimes mistake, both in our reflections (which are generally carried on by mental discourse), our reasonings, and our conclusions. It is necessary to be on our guard against such mistakes; for they frequently amount to the confounding of things totally different. Many philosophers of great reputation, on no better foundation than this metaphorical language, have confounded the relations of activity and of causation, and even denied that there is any difference; and they have affirmed that there is the same invariable relation between the determinations of the will and the inducements that prompt them, as there is between any physical power and its effect. Others have maintained that the first mover in the mechanical operations, and indeed through the whole train of any complicated event, is a percipient and intending principle, in the same manner as in our actions. According to these philosophers, a particle of gravitating matter perceives its relation to every other particle in the universe, and determines its own motion according to fixed laws, in exact conformity to its situation. But the language, and even the actions of all men, show that they have a notion of the relation of an agent to the action, easily distinguishable (because all distinguish it) from the relation between the physical cause and its effect. This metaphorical language has affected the doctrines of mechanical philosophy, and has produced a dispute about some of its first principles; the only way to decide this dispute is to avoid most scrupulously all metaphorical language, though at the expense of much circumlocution.

Directions for the safe employment of this analogy.

6. When we speak of powers or forces as residing in a body, and the effect as produced by their exertion, the body, considered as possessing the power, is said to *act* on the other. A magnet is said to act on a piece of iron; a billiard ball in motion is said to act on one that is hit by it; but if we attempt to fix our attention on this action, as distinct both from the agent and the thing acted on, we find no object of contemplation; the exertion or procedure of nature in producing the effect does not come under our view. When we *speak* of the action as distinct from the agent, we find that it is not the action, properly speaking, but the act, that we speak of. In like manner the action of a mechanical power can be conceived only in the effect produced.

Action implies change; and mere motion is not action.

7. A man is not said to act unless he produces some effect. Thought is the act of the thinking principle; motion of the limb is the act of the mind on it. In mechanics also, there is action only in so far as there is mechanical effect produced. I must act violently in order to begin motion on a slide. I must exert force, and this force exerted produces motion. I conceive the production of motion in all cases as the exertion of force; but it requires no exertion to continue the motion along the slide; I am conscious of none; therefore I ought to infer that no force is necessary for the continuation of any motion. The continuation of motion is not the production of any new effect, but the permanency of an effect already produced. We indeed consider motion as the effect of an action; but there would be no effect if the body were not moving. Motion is not the action, but the effect of the action.

Pression, impulsion.

8. Mechanical actions have been usually classed under two heads. They are either *pressures* or *impulsions*. They are generally considered as of different kinds—the exertions of different powers. *Pressure* is supposed to differ essentially from *impulse*.

Instead of attempting to define, or describe, these two kinds of forces and actions, we shall just mention some instances. This will give us all the knowledge of their distinctions that we can acquire.

Examples of pression.

When a ball lies on a table, and I press it gently on one side, it moves toward the other side of the table. If I follow it with my finger, continuing my pressure, it accelerates continually in its motion. In like manner, when I press on the handle of a common kitchen jack, the fly *begins* to move. If I continue to urge or press round the handle, the fly accelerates continually, and may be brought into a state of very rapid motion. These motions are the effects of genuine pressure. The ball would be urged along the table in the same manner, and with a motion continually accelerated, by the unbending of a spring. Also, a spring coiled up round the axis of the handle of the jack would, by uncoiling itself, urge round the fly with a motion accelerating in the same way. The more I reflect on the pressure of my finger on the ball, and compare it with the effect of the spring on it, the more clearly do I see the perfect similarity; and I call these influences, exertions, or actions, by one name, *pressure*, taken from the most familiar instance of them.

Again, the very same motion may be produced in the ball or fly, by pulling the ball or the machine by means of a thread, to which a weight is suspended. As both are motions accelerated in the same manner, I call the influence or action of the thread on the ball or machine by the same name, *pressure*, and *weight* is considered as a pressing power. Indeed I feel the same compression from the real pressure of a man on my shoulders that I would feel from a load laid on them. But the weight in our example is acting by the intervention of the thread. By its pressure it is pulling at that part of the thread to which it is fastened; this part is pulling at the next by means of the force of cohesion; and this pulls at a third, and so on, till the most remote pulls at the ball or the machine. Thus may elasticity, weight, cohesion, and other forces, perform the office of a genuine power; and since their result is always a motion beginning from nothing, and accelerating by perceptible degrees to any velocity, this resemblance makes us call them by one familiar name.

But further, I see that if the thread be cut, the weight will fall with an accelerated motion, which will increase to any degree, if the fall be great enough. I ascribe this also to a pressing power acting on the weight. Nay, after a very little refinement, I consider this power as the cause of the body's weight; which word is but a distinguishing name for this particular instance of pressing power. Gravitation is therefore added to the list of pressures; and for similar reasons the attractions and repulsions of magnets or electric bodies may be added to the list; for they produce actual compressions of bodies placed between them, and they produce motions gradually accelerated, precisely as gravitation does. Therefore all these powers may be distinguished by this descriptive name, *pressures*, which, in strict language, belongs to one of them only.

Gravity, attractions, and repulsions, are considered as pressions.

Several writers, however, subdivide this great class into pressions and solicitations. Gravity is a solicitation *ab extra*, by which a body is urged downward. In like manner the forces of magnetism and electricity, and a vast variety of other attractions and repulsions, are called *solicitations*. We see little use for this distinction, and the term is too like an affection of mind.

Examples of impulsion.

9. *Impulsion* is exhibited when a ball in motion puts another ball into motion by hitting, or (to speak metaphorically) by striking it. The appearances here are very different. The body that is struck acquires, in the instant of impulse, a sensible quantity of motion, and sometimes a very rapid motion. This motion is neither accelerated nor retarded after the stroke, unless it be affected by some other force. It is also remarked that the rapidity of the motion depends, *inter alia*, on the previous velocity of the striking body. For instance, if a clay ball,

moving with any velocity, strike another equal ball which is at rest, the struck ball moves with half the velocity of the other. And it is farther remarkable that the striking body always loses as much motion as the struck body gains. This universal and remarkable fact seems to have given rise to a confused or indistinct notion of a sort of transference of motion from one body to another. The phraseology in general use on this subject expresses this in the most precise terms. The one ball is not said to cause or produce motion in the other, but to *communicate* motion to it; and the whole phenomenon is called the *communication of motion*. We call this an *indistinct* notion; for surely no one will say that he has any clear conception of it. We can form the most distinct notion of the communication of heat, or of the cause of heat: of the communication of saltness, sweetness, and a thousand other *things;* but we cannot conceive how part of that identical motion which was formerly in A, is now infused into B, being given up by A. It is in our attempt to form this notion that we find that motion is not a *thing*, not a substance which can exist independently, and is susceptible of actual transference. It appears in this case to be a state, or condition, or mode of existence, of which bodies are susceptible, which is producible, or (to speak without metaphor) causable, in bodies, and which is the effect and *characteristic* of *certain* natural qualities, properties, or powers. We are anxious to have our readers impressed with clear and precise notions on this subject, being confident that such, and only such, will carry them through some intricate paths of mechanical and philosophical research.

Communication of motion not a good expression.

Inherent force is the distinctive character of impulsion,

10. The remarkable circumstance in this phenomenon is, that a rapid motion, which requires for the effecting it the action of a pressing power, continued for a sensible, and frequently a long time, seems to be affected in an instant by impulsion. This has tended much to support the notion of the actual transference of something formerly possessed exclusively by the striking body, inhering in it, but separable, and now transfused into the body stricken. And now room is found for the employment of metaphor, both in thought and language. The *striking* body affects the body which it thus impels: it therefore possesses the *power* of impulsion, that is, of *communicating* motion. It possesses it only while it is in motion. This *power*, therefore, is the efficient distinguishing cause of its motion, and its only office must be the continuation of this motion. It is therefore called the *inherent force*, the force inherent in a moving body, VIS INSITA *corpori moto.* This force is transfused into the body impelled; and *therefore* the transference is instantaneous, and the impelled body continues its motion till it is changed by some other action. All this is at first sight very plausible; but a scrupulous attention to those feelings which have given rise to this metaphorical conception should have produced very different notions. I am conscious of exertion in order to begin motion on a slide; but if the ice be very smooth, I am conscious of no exertion in order to slide along. My power is felt only while I am conscious of exerting it; therefore I have no primitive feeling or notion of power while I am sliding along. I am certain that no exertion of power is necessary here. Nay, I find that I cannot think of my moving forward without effort otherwise than as a certain mode of my existence. Yet we imagine that the partizans of this opinion did really deduce it in some shape from their feelings. We must continue the *exertion* of walking in order to walk on; our power of walking must be continually exerted, otherwise we shall stop. But this is a very imperfect, incomplete, and careless observation. Walking is much more than mere continuance in progressive motion. It is a continually repeated lifting our body up a small height, and allowing it to come down again. This renewed ascent requires repeated exertion.

and said to be infinitely greater than pression.

11. We have other observations of importance yet to make on this force of moving bodies, but this is not the most proper occasion. Meanwhile we must remark, that the instantaneous production of rapid motion by impulse has induced the first mechanicians of Europe to maintain that the power or force of impulse is unsusceptible of any comparison with a pressing power. They have asserted that impulse is infinitely great when compared with pressure; not recollecting that they held them to be things totally disparate, that have no proportion more than weight and sweetness. But these gentlemen are perpetually enticed away from their creed by the similarity of the ultimate results of pressure and impulse. No person can find any difference between the motion of two balls moving equally swift, in the same direction, one of which is descending by gravity, and the other has derived its motion from a blow. This struggle of the mind to maintain its faith, and yet accommodate its doctrines to what we see, has occasioned some other curious forms of expression. Pressure is considered as an *effort* to produce motion. When a ball lies on a table, its weight, which they call a *power*, continually and repeatedly *endeavours* (mark the metaphorical word and thought) to move the ball downward. But these efforts are ineffectual. They say that this ineffectual power is *dead*, and call it a *vis mortua:* but the force of impulsion is called a *vis viva*, a living force. But this is very whimsical and very inaccurate. If the impelling ball falls perpendicularly on the other lying on the table, it will produce no motion, any more than gravity will; and if the table be annihilated, gravity becomes a *vis viva*.

Arguments indistinct and inconclusive.

We must now add, that in order to prove that impulse is infinitely greater than pressure, these mechanicians turn our attention to many familiar facts which plead strongly in their favour. A carpenter will drive a nail into a board with a very moderate blow of his hammer. This will require a pressure which seems many hundred times greater than the impelling effort of the carpenter. A very moderate blow will shiver into pieces a diamond which would carry the weight of a mountain. Seeing this prodigious superiority in the impulse, how shall they account for the production of motion by means of pressure; for this motion of the hammer might have been acquired by its falling from a height; nay, it is actually acquired by means of the continued pressure of the carpenter's arm. They consider it as the aggregate of an infinity of succeeding pressures in *every* instant of its continuance; so that the insignificant smallness of each effort is compensated by their inconceivable number.

No difference between pression and impulsion.

On the whole, we do not think that there is clear evidence that there are two kinds of mechanical force essentially different in their nature. It is virtually given up by those who say that impulse is infinitely greater than pressure. Nor is there any considerable advantage to be obtained by arranging the phenomenon under those two heads. We may perhaps find some method of explaining satisfactorily the remarkable difference that is really observed in the two modes of producing motion; namely, the gradual production of motion by acknowledged pressure, and the instantaneous production of it by impulse. Indeed we should not have taken up so much of our readers' attention with this subject, had it not been for some inferences that have been made from these premises, which meet us in our very entry on the consideration of first principles, and that are of extensive influence on the whole science of mechanical philosophy, and, indeed, on the whole study of nature.

Is impulsion the sole cause of motion?

12. Mechanicians are greatly divided in their opinion about the nature of the sole moving force in nature. Those whom we are now speaking of seem to think that all motion is produced by pressure; for when they consider impulse as equivalent to the aggregate of an infinity of repeated pressures, they undoubtedly suppose any pressure, however insignificant, as a moving force. But there is a party, both numerous and respectable, who maintain that impulsion is the sole cause of motion. We see bodies in motion, say they, and we see them impel others; and we see that this production of motion is regulated by such laws, that there is but one absolute quantity of motion in the universe which remains unalterably the same. It must therefore be transfused in the acts of collision. We also see, with clear evidence, in some cases, that motion can produce pressure. Euler adduces some very whimsical and complicated cases, in which an action precisely similar to pressure may be produced by motion. Thus, two balls connected by a thread may be so struck that they shall move forward, and at the same time wheel round. In this case the connecting thread will be stretched between them. Now, say the philosophers, since we see motion, and see that pressure may be produced by motion, it is preposterous to imagine that it is any thing else than a result of certain motions; and it is the business of a philosopher to inquire and discover what motions produce the pressures that we observe.

They then proceed to account for those pressing powers, or solicitations to motion, which we observe in the acceleration of falling bodies, the attractions of magnetism and electricity, and many other phenomena of this kind, where bodies are put in motion by the vicinity of other bodies, or, in the popular language, by the action of other bodies at a distance. To say that a magnet can act on a piece of remote iron, is to say that it can act *where* it is not, which is as absurd as to say that it can act *when* it is not. *Nihil movetur*, says Euler, *nisi a contiguo et moto.*

How does it produce pressure?

The bulk of these philosophers are not very anxious about the way in which these motions are produced, nor do they fall upon such ingenious methods of producing pressure as the one already mentioned, which was adduced by Euler. The piece of iron, say they, is put in motion when brought into the neighbourhood of a magnet, because there is a stream of fluid issuing from one pole of the magnet, which circles round the magnet, and enters at the other pole. This stream impels the iron, and arranges it in certain determined positions, just as a stream of water would arrange the flote grass. In the same manner, there is a stream of fluid continually moving towards the centre of the earth, which impels all bodies in lines perpendicular to the surface; and so on with regard to other like phenomena. These motions are thus reduced to very simple cases by impulsion.

Incompatible with the rules of philosophising.

It is unnecessary to refute this doctrine at present: it is enough that it is contrary to all the dictates of common sense. To *suppose* an agent that we do not see, and for whose existence we have not the smallest argument; with equal propriety we might suppose ministering spirits, or any thing that we please.

Others maintain that pressure is the sole moving force.

13. Other philosophers are so dissatisfied with this notion of the production of pressure, that they, on the other hand, affirm that pressure is the only moving force in nature; not according to the popular notion of pressure, by the mutual contact of solid bodies, but that kind of pressure which has been called *solicitation*, such as the power of gravity. They affirm that there is no such thing as contact on instantaneous communication of motion by real collision. They say, and they prove it by very convincing facts, that the particles of solid bodies exert very strong repulsions to a small distance; and therefore, when they are brought by motion sufficiently near to another body, they repel it, and are equally repelled by it. Thus is motion produced in the other body, and their own motion is diminished. And they then show, by a scrupulous consideration of the state of the bodies while the one is advancing and the other retiring, in what manner the two bodies attain a common velocity, so that the quantity of motion before collision remains unchanged, the one body gaining as much as the other loses. They also show cases of such mutual action between bodies, where it is evident that they have never come into contact; and yet the result has been precisely similar to those cases where the motion appeared to be changed in an instant. Therefore they conclude that there is no such thing as instantaneous *communication*, or transfusion of motion, by contact in collision or impulse. The reason why previous motion of the impelling body is necessary, is not that it may have a *vis insita corpori moto*, a force inherent in it *by its being in motion*, but that it may continue to follow the impelled and retiring body, and exert on it a force inherent in itself, whether in motion or at rest. According to these philosophers, therefore, all moving forces are of that kind which has been named *solicitation*, such as gravity. We shall know it afterwards by the more familiar and descriptive name of *accelerating* or *retarding* force.

Action, resistance, re-action.

14. The exertions of mechanical forces are differently termed, according to the reference that we make to the result. If in boxing or wrestling I strike, or endeavour to throw my antagonist, I am said to *act;* but if I only parry his blows, or prevent him from throwing me, I am said to *resist.* This distinction is applied to the exertions of mechanical powers. When one body, A, changes the motion of another, B, we may consider the change in the motion of B either as the indication and measure of A's power of producing motion, or as the indication and measure of A's resistance to the being brought to rest, or having its motion any how changed. The distinction is not in the thing itself, but only in the reference that we are disposed, by other considerations, to make of its effect. They may be distinguished in the following manner: If a change of motion follow when one of the powers ceases to be exerted, that power is conceived as having resisted. The whole language on this subject is metaphorical. Resistance, effort, endeavour, &c. are words which cannot be employed in mechanical discussions without figure, because they all express notions which relate to sentient beings; and the unguarded indulgence of this figurative language has so much affected the imagination of philosophers, that many have almost animated all matter. Perhaps the word *reaction*, introduced by Newton, is the best term for expressing that mutual force which is perceived in all the operations of nature that we have investigated with success. As the magnet attracts iron, and in so doing is said to *act* on it; so the iron attracts the magnet, and may be said to *re-act* on it.

We need not suppose action at a distance. Tendency

15. With respect to the difficulty that has been objected to the opinion of those who maintain that all the mechanical phenomena are produced by the agency of attracting or repelling forces; namely, that this supposes the bodies to act on each other at a distance, however small those distances may be, which is thought to be absurd, we may observe, that we may ascribe the mutual approaches or recesses to tendencies to or from each other. What we call *the attraction of the magnet* may be considered as a tendency of the iron to the magnet, somewhat similar to the gravitation of a stone toward the earth. We surely (at least the unlearned) can and do conceive the iron to be affected by the magnet, *without thinking* of any intermedium. The thing is not therefore inconceivable, which is all that we know about absurdity; and we do not

Dynamics. know any thing about the nature or essence of matter which renders this tendency to the magnet impossible. That we do not see intuitively any reason why the iron should approach the magnet, must be granted; but this is not enough to entitle us to say that such a thing is impossible, or inconsistent with the nature of matter. It appears, therefore, to be very hasty and unwarrantable to suppose the impulse of an invisible fluid, of which we know nothing, and of the existence of which we have no proof. Nay, if it be true that bodies do not come into contact, even when one ball hits another, and drives it before it, this invisible fluid will not solve the difficulty, because the same difficulty occurs in the action of any particle of the fluid on the body. We are obliged to say that the production of motion without any *observed* contact, is a much more familiar phenomenon than the production of motion by impulsion. More motion has been produced in this way by the gravitation of a small stream of water, running ever since the creation, than by all the impulses in the world twice told. We do not mean by this to say, that the giving to this observed mutual relation between iron and a loadstone the name *tendency* makes it less absurd than when we say that the loadstone attracts the iron; it only makes it more conceivable. It suggests a very familiar analogy; but both are equally figurative expressions, at least as the word tendency is used at present. In the language of ancient Rome, there was no metaphor when Virgil's hero said, *Tendimus in Latium. Tendere versus solem* means, in plain Latin, to *approach the sun*. The safe way of conceiving the whole is to say that the condition of the iron depends on the vicinity of the magnet.

Attraction, repulsion, are figurative terms.

16. When the exertions of a mechanical power are observed to be always directed toward a body, that body is said to attract; but when the other body always moves off from it, it is said to repel. These also are metaphorical expressions. I attract a boat when I pull it toward me by a rope; this is purely *Attraction:* and it is pure, unfigurative *Repulsion*, when I push any body from me. The same words are applied to the mechanical phenomena, merely because they resemble the results of real attraction or repulsion. We must be much on our guard to avoid metaphor in our conceptions, and never allow those words to suggest to our mind any opinion about the *manner* in which the mechanical forces produce their effects. It is plain, that if the opinion of those who maintain the existence and action of the above-mentioned invisible fluid be just, there is nothing like attraction or repulsion in the universe. We must always recur to the simple phenomenon, the motion to or from the attracting or repelling body; for this is all we see, and generally all that we know.

Forces are conceived as measurable quantities.

17. We conceive one man to have twice the strength of another man, when we see that he can withstand the united effort of two others. Thus animal force is conceived as a quantity, made up of and measured by its own parts. But we doubt exceedingly whether this be an accurate conception. We have not a distinct notion of one strain added to another, though we have of their being joined or combined. We want words to express the difference of these two notions in our own minds, but we imagine that others perceive the same difference. We conceive clearly the addition of two lines or of two minutes; we can conceive them apart, and perceive their boundaries, common to both, where one ends and the other begins. We cannot conceive thus of two forces combined; yet we cannot say that two equal forces are *not* double of one of them. We measure them by the effects which they are known to produce. Yet there are not wanting many cases where the action of two men, equally strong, does not produce a double motion.

In like manner, we conceive all mechanical forces as measurable by their effects; and thus they are made the subjects of mathematical discussion. We talk of the proportions of gravity, magnetism, electricity, &c.; nay, we talk of the proportion of gravity to magnetism: yet these, considered in themselves, are disparate, and do not admit of any proportion; but they produce effects, some of which are measurable, and whose assumed measures are susceptible of comparison, being quantities of the same kind. Thus, one of the effects of gravity is the acceleration of motion in a falling body: magnetism will also accelerate the motion of a piece of iron; these two accelerations are comparable. But we cannot compare magnetism with heat, because we do not know any measurable effects of magnetism that are of the same kind with any effects of heat. Dynamics. How measured.

When we say that the gravitation of the moon is the 3600th part of the gravitation at the sea-shore, we mean that the fall of a stone in a second is 3600 times greater than the fall of the moon in the same time. But we also mean (and this expresses the proportion of the *tendency* of gravitation more purely), that if a stone, when hung on a spring steelyard, draw out the rod of the steelyard to the mark 3600, the same stone, taken up to the distance of the moon, will draw it out no farther than the mark 1. We also mean, that if the stone at the sea-shore draw out the rod to any mark, it will require 3600 such stones to draw it out to that mark when the trial is made at the distance of the moon. It is not, therefore, in consequence of any immediate perception of the proportion of the gravitation at the moon to that at the surface of the earth that we make such an assertion; but these motions, which we consider as its effects in these situations, being magnitudes of the same kind, are susceptible of comparison, and have a proportion which can be ascertained by observation. It is these proportions that we contemplate; although we speak of the proportions of the unseen causes, the forces, or endeavours to descend. It will be of material service to the reader to peruse the judicious and acute dissertation on *quantity* in the works of Dr Reid (vol. ii.), where he will see clearly how force, velocity, density, and many other magnitudes of very frequent occurrence in mechanical philosophy, may be made the subjects of mathematical discussion, by means of some of those proper quantities, measurable by their own parts, which are to be assumed as their measures. Pressures are measurable only by pressures. When we consider them as moving powers, we should be able to measure them by *any* moving powers, otherwise we cannot compare them; therefore it is not as pressures that we then measure them. This observation is momentous. By their effects.

One circumstance must be carefully attended to. That those assumed measures may be accurate, they must be invariably connected with the magnitudes which they are employed to measure, and so connected that the degrees of the one must change in the same manner with the degrees of the other. This is evident, and is granted by all. But we must also *know* this of the measure we employ; we must see this constant and precise relation. How can we know this? We do not perceive force as a separate existence, so as to see its proportions, and to see that these are the same with the proportions of the measures, in the same manner that Euclid sees the proportions of triangles and those of their bases, and that these proportions are the same when the triangles are of equal altitudes. How do we discover that to every magnitude which we call *force* is invariably attached a corresponding magnitude of acceleration or deflection? Clearly. In fact, the very existence of the force is an inference that we make from the observed acceleration; and the degree of

Dynamics.

the force is, in like manner, an inference from the observed magnitude of the acceleration. Our measures are therefore necessarily connected with the magnitudes which they measure, and their proportions are the same; because the one is always an inference from the other, both in species and in degree.

Dynamics is a demonstrative science.

18. It is now evident that these disquisitions are susceptible of mathematical accuracy. Having selected our measures, and observed certain mathematical relations of those measures, every inference that we can draw from the mathematical relations of the proportions of those representations is true of the proportions of the motions, and therefore of the proportions of the forces. And thus dynamics becomes a demonstrative science, one of the *disciplinæ accuratæ*.

19. But moving forces are considered as differing and in kind; that is, in direction. We assign to the force the direction of the observed change of motion, which is not only the indication, but also the characteristic, of the changing force. We call it an *accelerating*, *retarding*, *deflecting force*, according as we observe the motion to be accelerated, retarded, or deflected.

These denominations show us incontestably that we have no knowledge of the forces different from our knowledge of the effects. The denominations are all either descriptive of the effects, as when we call them accelerating, penetrating, protrusive, attractive, or repulsive forces; or they are names of reference to the substances in which the accelerating, protrusive, &c. forces are supposed to be inherent, as when we call them *magnetism*, *electricity*, *corpuscular*, &c.

Forces are discovered by their opposition to other forces.

20. When I struggle with another, and feel, that in order to prevent being thrown, I must exert force, I learn that my antagonist is exerting force. This motion is transferred to matter; and when a moving power which is *known* to operate produces no motion, we conceive it to be opposed by another equal force, the existence, agency, and intensity of which is detected and measured by these means. The quiescent state of the body is considered as a change on the state of things that would have been exhibited in consequence of the known action of one power, had this other power not acted; and this change is considered as the indication, characteristic, and measure, of another power, detected in this way. Thus forces are recognised not only by the changes of motion which they produce, but also by the changes of motion which they prevent. The cohesion of matter in a string is inferred not only by its giving motion to a ball which I pull toward me by its intervention, but also by its suspending that ball, and hindering it from falling. I know that gravity is acting on the ball, which, however, does not fall. The solidity of a board is equally inferred from its stopping the ball which strikes it, and from the motion of the ball which it drives before it. In this way we learn that the particles of tangible matter cohere by means of moving forces, and that they resist compression with force; and in making this inference, we find that this corpuscular force exerted between the particles is mutual, opposite, and equal; for we must apply force equally to *a* or to *b*, in order to produce a separation or a compression. We learn their equality, by observing that no motion ensues while these mutual forces are known to act on the particles; that is, each is opposed by another force, which is neither inferior nor superior to it.

OF THE LAWS OF MOTION.

Such, then, being our notions of mechanical forces, the causes of the sensible changes of motion, there will result certain consequences from them, which may be called axioms or laws of motion. Some of these may be intuitive, offering themselves to the mind as soon as the notions which they involve are presented to it. Others may be as necessary results from the relations of these notions, but may not readily offer themselves without the mediation of axioms of the first class. We shall select those which are intuitive, and may be taken for the first principles of all discussions in mechanical philosophy.

First Law of Motion.

FIRST LAW OF MOTION.

Every body continues in a state of rest, or of uniform rectilineal motion, unless affected by some mechanical force.

21. This is a proposition, on the truth of which the whole science of mechanical philosophy ultimately depends. It is therefore to be established on the firmest foundation; and a solicitude on this head is the more justifiable, because the opinions of philosophers have been extremely different, both with respect to the truth of this law, and with respect to the foundation on which it is built. These opinions are, in general, very obscure and unsatisfactory; and, as is natural, they influence the discussions of those by whom they are held through the whole science. Although of contradictory opinions one only can be just, and it may appear sufficient that this one be established and uniformly applied; yet a short exposition, at least, of the rest is necessary, that the greatest part of the writings of the philosophers may be intelligible, and that we may avail ourselves of much valuable information contained in them, by being able to perceive the truth in the midst of their imperfect or erroneous conceptions of it.

Does continued motion indicate continued action?

22. It is not only the popular opinion that rest is the natural state of body, and that motion is something foreign to it, but it has been seriously maintained by the greatest part of those who are esteemed philosophers. They readily grant that matter will continue at rest unless some moving force act upon it. Nothing seems necessary for matter's remaining where it is, but its continuing to exist. But it is far otherwise, say they, with respect to matter in motion. Here the body is continually changing its relations to other things; therefore the continual agency of a changing cause is necessary (by the fundamental principle of all philosophical discussion), for there is here the continual production of an effect. They say that this metaphysical argument receives complete confirmation (if confirmation of an intuitive truth be necessary) from the most familiar observation. We see that all motions, however violent, terminate in rest, and that the continual exertion of some force is necessary for their continuance.

Whimsical notion of elemental minds.

23. These philosophers therefore assert, that the continual action of the moving cause is *essentially* necessary for the continuance of the motion; but they differ among themselves in their notions and opinions about this cause. Some maintain that all the motions in the universe are produced and continued by the immediate agency of Deity; others affirm, that in every particle of matter there is inherent a sort of mind, the φυσις and ὁσπερ ψυχη of Aristotle, which they call an *Elemental Mind*, which is the cause of *all* its motions and changes. An overweening reverence for Greek learning has had a great influence in reviving this doctrine of Aristotle. The Greek and Roman languages are affirmed to be more accurate expressions of human thought than the modern languages are. In those ancient languages, the verbs which express motion are employed both in the active and passive voice; whereas we have only the active verb *to move*, for expressing both the state of motion and the act of putting in motion. "The stone *moves* down the slope, and *moves* all the pebbles which lie in its way;" but in the ancient lan

First Law of Motion.

guages, the mere state of motion is always expressed by the passive or middle voice. The accurate conception of the speakers is therefore extolled. The state of motion is expressed as it ought to be, as the result of a continual action. Κινειται, *movetur*, is equivalent to "it is moved." According to these philosophers, every thing which *moves* is mind, and every thing that *is moved* is body.

The argument is futile, and it is false; for the modern languages are, in general, equally accurate in this instance: "*se mouvoir*," in French; "*sich bewegen*," in German; "*dvigatsu*," in Slavonic; are all passive or reflected. And the ancients said that "rain falls, water runs, smoke rises," just as we do. The ingenious author of *Ancient Metaphysics* has taken much pains to give us, at length, the procedures of those elementary minds in producing the ostensible phenomena of local motion; but it seems to be merely an abuse of language, and a very frivolous abuse. This elemental mind is known and characterised only by the effect which we ascribe to its action; that is, by the motions or changes of motions. Uniform and unexcepted experience shows us that these are regulated by laws as precise as those of mathematical truth. We consider nothing as more fixed and determined than the common laws of mechanism. There is nothing here that indicates any thing like spontaneity, intention, purpose; none of those marks by which mind was first brought into view; but they are very like the effects which we produce by the exertions of our corporeal forces; and we have accordingly given the name *force* to the causes of motion. It is surely much more apposite than the name mind, and conveys with much more readiness and perspicuity the very notions that we wish to convey.

Action not necessary for the continuance of motion.

24. We now wish to know what reason we have to think that the continual action of some cause is necessary for continuing matter in motion, or for thinking that rest is its natural state. If we pretend to draw any argument from the nature of matter, that matter must be known, as far as is necessary for being the foundation of argument. Its very existence is known only from observation; all our knowledge of it must therefore be derived from the same source.

If we take this way to come at the origin of this opinion, we shall find that experience gives us no authority for saying that rest is the natural condition of matter. We cannot say that we have ever seen a body at rest; this is evident to every person who allows the validity of the Newtonian philosophy, and the truth of the Copernican system of the sun and planets; all the parts of this system are in motion. Nay, it appears from many observations, that the sun, with his attending planets, is carried in a certain direction, with a velocity which is very great. We have no unquestionable authority for saying that any one of the stars is absolutely fixed; but we are *certain* that many of them are in motion. Rest is therefore so rare a condition of body, that we cannot say, from any experience, that it is its natural state.

25. It is easy, however, to see that it is from observation that this opinion has been derived; but the observation has been limited and careless. Our experiments in this sublunary world do indeed always require continued action of some moving force to continue the motion; and if this be not employed, we see the motions slacken every minute, and terminate in rest after no long period. Our first notions of sublunary bodies are indicated by their operation in cases where we have some interest. Perpetually seeing our own exertions necessary, we are led to consider matter as something not only naturally quiescent and inert, but sluggish, averse from motion, and prone to rest (we must be pardoned this metaphorical language, because we can find no other term). What is expressed by it, on this occasion, is precisely one of the erroneous or inadequate conceptions that are suggested to our thoughts by reason of the poverty of language. We animate matter in order to give it motion, and then we endow it with a sort of moral character in order to explain the appearance of those motions.

26. But more extended observation has made men gradually desert their first opinions, and at last allow that matter has no peculiar aptitude to rest. All the retardations that we *observe* have been discovered, one after another, to have a distinct reference to some external circumstances. The diminution of motion is always observed to be accompanied by the removal of obstacles, as when a ball moves through sand, or water, or air; or it is owing to opposite motions which are destroyed; to roughness of the path, or to friction, &c. We find that the more we can keep these things out of the way, the less are the motions diminished. A pendulum will vibrate but a short while in water; much longer in air; and in the exhausted receiver it will vibrate a whole day. We know that we cannot remove *all* obstacles; but we are led by such observations to conclude that, if they *could be completely removed*, our motions would continue for ever. And this conclusion is almost demonstrated by the motions of the heavenly bodies, to which we know of no obstacles, and which we really observe to retain their motions for many thousand years, without the smallest sensible diminution.

Inactivity of matter denied by Leibnitz.

27. Another set of philosophers maintain an opinion directly opposite to that of the inactivity of matter, and assert, that it is essentially active, and continually changing its state. Faint traces of this are to be found in the writings of Plato, Aristotle, and their commentators. Mr Leibnitz is the person who has treated this question most systematically and fully. He supposes every particle of matter to have a principle of individuality, which he therefore calls a *Monad*. This monad has a sort of *perception* of its situation in the universe, and of its relation to every other part of this universe. Lastly, he says that the monad acts on the material particle much in the same way that the soul of man acts on his body. It modifies the motion of the material atom (in conformity, however, to unalterable laws), producing all those modifications of motion that we observe. Matter, therefore, or at least particles of matter, are continually active, and continually changing their situation.

Monads, what.

This opinion ill founded.

It is quite unnecessary to enter on a formal confutation of Mr Leibnitz's system of monads, which differs very little from the system of elemental minds, and is equally whimsical and frivolous; because it only makes the unlearned reader stare, without giving him any information. Should it even be granted, it would not, any more than the action of animals, invalidate the general proposition which we are endeavouring to establish as the fundamental law of motion. Those powers of the monads, or of the elemental minds, are the causes of all the changes of motion; but the mere material particle is subject to the law, and requires the exertion of the monad in order to exhibit a change of motion.

28. A third sect of philosophers, at the head of which we may place Sir Isaac Newton, maintain the doctrine enounced in the proposition. But they differ much in respect of the foundation on which it is built.

Some philosophers deduce this law of motion from the want of a determining cause.

Some assert that this truth flows from the nature of the thing. If a body be at rest, and you assert that it will not remain at rest, it must move in some one direction. If it be in motion in any direction, and with any velocity, and do not continue its equable, rectilineal motion, it must either be accelerated or retarded; it must turn either to one side or to some other side. The event, whatever it be, is individual and determinate; but no cause which

First Law of Motion.

can determine it is supposed; therefore the determination cannot take place, and no change will happen in the condition of the body with respect to motion. It will continue at rest, or persevere in its rectilineal and equable motion.

But considerable objections may be made to this argument of *sufficient reason*, as it is called. In the immensity and perfect uniformity of space and time, there is no determining cause why the visible universe should exist in the place in which we see it rather than in another, or at this time rather than at another. Nay, the argument seems to beg the question. A cause of determination is required as essentially necessary—a determination may be without a cause, as well as a motion without a cause.

Others deduce it from experience.

29. Other philosophers, who maintain this doctrine, consider it merely as an experimental truth; and proofs of its universality are innumerable.

When a stone is thrown from the hand, we press it forward while in the hand, and let it go when the hand has acquired the greatest rapidity of motion that we can give it. The stone continues in that state of motion which it acquired gradually along with the hand. We can throw a stone much farther by means of a sling, because, by a very moderate motion of the hand, we can whirl the stone round till it acquire a very great velocity, and then we let go one of the strings, and the stone escapes, *by continuing* its rapid motion. We see it still more distinctly in shooting an arrow from a bow. The string presses hard on the notch of the arrow, and it yields to this pressure and goes forward. The string alone would go faster forward. It therefore *continues* to press the arrow forward, and accelerates its motion. This goes on till the bow is as much unbent as the string will allow. But the string is now a straight line. It came into this position with an accelerated motion, and it therefore goes a little beyond this position, but with a retarded motion, being checked by the bow. But there is nothing to check the arrow, therefore the arrow quits the string and flies away.

These are simple cases of perseverance in a state of motion, where the procedure of nature is so easily traced that we perceive it almost intuitively. It is no less clear in other phenomena which are more complicated; but it requires a little reflection to trace the process. We have often seen an equestrian showman ride a horse at a gallop, standing on the saddle, and stepping from it to the back of another horse that gallops alongside at the same rate; and he does this seemingly with as much ease as if the horses were standing still. The man has the same velocity with the horse that gallops under him, and keeps this velocity while he steps to the back of the other. If that other were standing still, the man would fly over his head. And if a man should step from the back of a horse that is standing still, to the back of another that gallops past him, he would be left behind. In the same manner, a slack-wire dancer tosses oranges from hand to hand while the wire is in full swing. The orange, swinging along with the hand, retains the velocity; and when in the air, follows the hand, and falls into it when it is in the opposite extremity of its swing. A ball dropped from the mast-head of a ship that is sailing briskly forward, falls at the foot of the mast. It retains the motion which it had while in the hand of the person who dropped it, and follows the mast during the whole of its fall.

We also have familiar instances of the perseverance of a body in a state of rest. When a vessel filled with water is drawn suddenly along the floor, the water dashes over the posterior side of the vessel. It is left behind. In the same manner, when a coach or boat is dragged forward, the persons in it find themselves strike against the hinder part of the carriage or boat. Properly speaking, it is the carriage that strikes on them. In like manner, if we lay a card on the tip of the finger, and a piece of money on the card, we may nick away the card, by hitting it neatly on its edge; but the piece of money will be left behind, lying on the tip of the finger. A ball will go through a wall and fly onward; but the wall is left behind. Buildings are thrown down by earthquakes; sometimes by being tossed from their foundations, but more generally by the ground on which they stand being hastily drawn sidewise from under them, &c.

Common experience insufficient.

30. But common experience seems insufficient for establishing this fundamental proposition of mechanical philosophy. We must, on the faith of the Copernican system, grant that we never saw a body at rest, or in uniform rectilineal motion; yet this seems absolutely necessary before we can say that we have established this proposition experimentally.

What we imagine, in our experiments, to be putting a body, formerly at rest, into motion, is, in fact, only changing a most rapid motion, not less, and probably much greater, than 90,000 feet per second. Suppose a cannon pointed east, and the bullet discharged at noon day with sixty times greater velocity than we have ever been able to give it: it would appear to set out with this unmeasurable velocity to the eastward, to be gradually retarded by the resistance of the air, and at last brought to rest by hitting the ground. But, by reason of the earth's motion round the sun, the fact is quite the reverse. Immediately before the discharge, the ball was moving to the westward with the velocity of 90,000 feet per second nearly. By the explosion of the powder, and its pressure on the ball, some of this motion is destroyed, and at the muzzle of the gun the ball is moving slower, and the cannon is hurried away from it to the westward. The air, which is also moving to the westward 90,000 feet in a second, gradually communicates motion to the ball, in the same manner as a hurricane would do. At last (the ball dropping all the while) some part of the ground hits the ball, and carries it along with it.

Other observations must therefore be resorted to, in order to obtain an experimental proof of this proposition; and such are to be found. Although we cannot measure the absolute motions of bodies, we can observe and measure accurately their relative motions, which are the differences of their absolute motions. Now, if we can show experimentally that bodies show equal tendencies to resist the augmentation and the diminution of their relative motions, they, *ipso facto*, show equal tendencies to resist the augmentation or diminution of their absolute motions. Therefore let two bodies, A and B, be put into such a situation that they cannot (by reason of their impenetrability, or the action of their mutual powers) persevere in their relative motions. The change produced on A is the effect and the measure of B's tendency to persevere in its former state; and therefore the proportion of these changes will show the proportion of their tendencies to maintain their former states. Therefore let the following experiment be made at noon.

Experiments proper for the purpose.

Let A, apparently moving westward three feet per second, hit the equal body B apparently at rest. Suppose, 1*st*, that A impels B forward without any diminution of its own velocity. This result would show that B manifests no tendency to maintain its motion unchanged, but that A retains its motion undiminished.

2*dly*, Suppose that A stops, and that B remains at rest. This would show that A does not resist a diminution of motion, but that B retains its motion unaugmented.

3*dly*, Suppose that both move westward with the velocity of one foot per second. The change on A is a diminution of velocity, amounting to two feet per second.

First Law of Motion.

This is the effect and the measure of B's tendency to maintain its velocity unaugmented. The change on B is an augmentation of one foot per second made on its velocity; and this is the measure of A's tendency to maintain its velocity undiminished. This tendency is but half of the former; and this result would show that the resistance to a diminution of velocity is but half of the resistance to augmentation. It is perhaps but one quarter, for the change on B has produced a double change on A.

4thly, Suppose that both move westward at the rate of one and a half foot per second. It is evident that their tendencies to maintain their states unchanged are now equal.

5thly, Suppose A = 2 B, and that both move, after the collision, two feet per second; B has received an addition of two feet per second to its former velocity. This is the effect and the measure of A's whole tendency to retain its motion undiminished. Half of this change on B measures the persevering tendency of the half of A; but A, which formerly moved with the apparent or relative velocity three, now moves (by the supposition) with the velocity two, having lost a velocity of one foot per second. Each half of A therefore has lost this velocity, and the whole loss of motion is two. Now this is the measure of B's tendency to maintain its former state unaugmented; and this is the same with the measure of A's tendency to maintain its own former state undiminished. The conclusion from such a result would therefore be, that bodies have equal tendencies to maintain their former states of motion without augmentation and without diminution.

What is supposed in the fourth and fifth cases is really the result of all the experiments which have been tried; and this law regulates all the changes of motion which are produced by the mutual actions of bodies in impulsions. This assertion is true without exception or qualification. Therefore it appears that bodies have no preferable tendency to rest, and that no fact can be adduced which should make us suppose that a motion once begun should suffer any diminution without the action of a changing cause.

But experience is not the proper foundation of an axiom.

But we must now observe, that this way of establishing the first law of motion is very imperfect, and altogether unfit for rendering it the fundamental principle of a whole and extensive science. It is subject to all the inaccuracy that is to be found in our best experiments; and it cannot be applied to cases where scrupulous accuracy is wanted, and where no experiment can be made.

Let us therefore examine the proposition by means of principles which contain the foundation of all our knowledge of active nature. These will, we imagine, give a decision of this question that is speedy and accurate; showing the proposition to be an axiom or intuitive consequence of the relations of those ideas which we have of motion, and of the causes of its production and changes.

Logical proof.

31. It has been fully demonstrated that the powers or forces of which we speak so much are never the immediate objects of our perception. Their very existence, their kind, and their degree, are instinctive inferences from the motions which we observe and class. It evidently follows from this experimental and universal truth, 1*st*, that where no change of motion is observed, no such inference is made, that is, no power is *supposed* to act. But whenever any change of motion is observed, the inference is made; that is, a power or force is supposed to have acted.

In the same form of logical conclusion, we must say that, 2*dly*, when no change of motion is *supposed* or thought of, no force is *supposed;* and that whenever we *suppose* a change of motion, we in fact, though not in terms, suppose a changing force. And, on the other hand, whenever we suppose the action of a changing force, we suppose the change of motion; for the action of this force, and the change of motion, is one and the same thing. We cannot think of the action without thinking of the indication of that action; that is, the change of motion. In the same manner, when we do not think of a changing force, or suppose that there is no action of a changing force, we in fact, though not in terms, suppose that there is no indication of this changing force; that is, that there is no change.

It is a law of human thought,

Whenever, therefore, we suppose that no mechanical force is acting on a body, we in fact suppose that the body continues in its former condition with respect to motion. If we suppose that nothing accelerates, or retards, or deflects the motion, we suppose that it is not accelerated, nor retarded, nor deflected. Hence follows the proposition in express terms—*We suppose that the body continues in its former state of rest or motion, unless we suppose that it is changed by some mechanical force.*

Thus it appears that this proposition is not a matter of experience or contingency, depending on the properties which it has pleased the Author of nature to bestow on body; it is to us a necessary truth. The proposition does not so much express any thing with regard to body, as it does the operations of our mind when contemplating body. It may perhaps be essential to body to move in some particular direction. It may be essential to body to stop as soon as the moving cause has ceased to act; or it may be essential to body to diminish its motion gradually, and finally come to rest. But this will not invalidate the truth of this proposition. These circumstances in the nature of body, which render those modifications of motion essentially necessary, are the causes of those modifications and in our study of nature they will be considered by us as changing forces, and will be known and called by that name. And if we should ever see a particle of matter in such a situation that it is affected by those essential properties alone, we shall, from observation of its motion, discover what those essential properties are.

and almost an identical proposition.

This law turns out at last to be little more than a tautological proposition; but mechanical philosophy, as we have defined it, requires no other sense of it; for even if we should suppose that body, of its own nature, is capable of changing its state, this change must be performed according to some law which characterizes the nature of body; and the knowledge of the law can be had in no other way than by observing the deviations from uniform rectilineal motion. It is therefore indifferent whether those changes are derived from the nature of the thing or from external causes; for, in order to consider the various motions of bodies, we must first consider this nature of matter as a mechanical affection of matter, operating in every instance; and thus we are brought back to the law enounced in this proposition. This becomes more certain when we reflect that the external causes (such as gravity or magnetism), which are acknowledged to operate changes of motion, are equally unknown to us with this essential original property of matter, and are, like it, nothing but inferences from the phenomena.

The above very diffuse discussions may appear superfluous to many readers, and even cumbersome; but we trust that the philosophical reader will excuse our anxiety on this head, when he reflects on the complicated, indistinct, and inaccurate notions commonly had of the subject. We may include Sir Isaac Newton in the number of those who have at least introduced modes of expression which mislead the minds of incautious persons, and suggest inadequate notions, incompatible with the pure doctrine of the proposition. Although in words they disclaim the doctrine that rest is the natural state of body, and that force is necessary for the continuation of its motion,

First Law of Motion.

yet in words they (and most of them in thought) likewise abet that doctrine: for they say that there resides in a moving body a *power* or *force*, by which it perseveres in its motion. They call it the *vis insita*, the *inherent force, of a moving body.* This is surely giving up the question: for if the motion is supposed to be continued in consequence of a force, that force is *supposed* to be exerted; and it is supposed that if it were not exerted, the motion would cease; and therefore the proposition must be false. Indeed it is sometimes expressed so as seemingly to ward off this objection. It is said that the body continues in uniform rectilineal motion, unless affected by some *external cause.* But this way of speaking obliges us, at first setting out in natural philosophy, to assert that gravity, magnetism, electricity, and a thousand other mechanical powers, are external to the matter which they put in motion. This is quite improper. It is the business of philosophy to discover whether they be external or not; and if we assert that they are, we have no principles of argumentation with those who deny it. It is this one thing that has filled the study of nature with all the jargon of ethers, and other invisible, intangible fluids, which has disgraced philosophy, and greatly retarded its progress.

Vis insita, inherent force, are improper terms in their usual acceptation.

32. We must observe, that the terms *vis insita*, inherent force, are very improper. There is no dispute among philosophers in calling every thing a force that produces a change of motion, and in inferring the action of such a force whenever we observe a change of motion. It is surely incongruous to give the same name to what has not this quality of producing a change, or to infer (or rather to suppose) the energy of a force when no change of motion is observed. This is one among many instances of the danger of mistake when we indulge in analogical discussions. All our language, at least, on this subject is analogous. I feel that in order to oppose animal force I must exert force. But I must exert force in order to oppose a body in motion; therefore I imagine that the moving body possesses force. A bent spring will drive a body forward by unbending; therefore I say that the spring exerts force. A moving body impels the body which it hits; therefore I say that the impelling body possesses and exerts force. I imagine farther, that it possesses force only by being in motion, or because it is in motion; because I do not find that a quiescent body will put another into motion by touching it. But we shall soon find this to be false in many, if not in all cases, and that the communication of motion depends on the mere vicinity, and not on the motion of the impelling body; yet we ascribe the exertion of the *vis insita* to the circumstance of the continued motion. We therefore conceive the force as arising from or as consisting in the impelling body's being in motion; and, with a very obscure and indistinct conception of the whole matter, we call it *the force by which the body preserves itself in motion.* Thus, taking it for granted that a force resides in the body, and being obliged to give it some office, this is the only one that we can think of.

33. But philosophers imagine that they perceive the necessity of the exertion of a force in order to the continuation of a motion. Motion (say they) is a continued action; the body is every instant in a new situation; there is the continual production of an effect, therefore the continual action of a cause.

Motion is not the continual production of an effect.

This, however, is a very inaccurate way of thinking. We have a distinct conception of motion; and we conceive that there is such a thing as a moving cause, which we distinguish from all other causes by the name *force.* It produces motion. If it does this, it produces the character of motion, which is a continual change of place. Motion is not action, but the effect of an action; and this action is as complete in the instant immediately succeeding the beginning of the motion as it is a minute after. The subsequent change of place is the continuation of an effect already produced. The *immediate* effect of the moving force is a *determination*, by which, if not hindered, the body would go on for ever from place to place. It is in this determination only that the state or condition of the body can differ from a state of rest; for in any instant the body does not describe any space, but has a determination by which it will describe a certain space uniformly in a certain time. Motion is a condition, a state, or mode of existence, and no more requires the continued agency of the moving cause than yellowness or roundness does. It requires some chemical agency to change the yellowness to greenness; and it requires a mechanical cause or a force to change this motion into rest. When we see a moving body stop short in an instant, or be gradually but quickly brought to rest, we never fail to speculate about a cause of this cessation or retardation. The case is no way different in itself although the retardation should be extremely slow. We should always attribute it to a cause. It requires a cause to put a body out of motion, as much as to put it into motion. This cause, if not external, must be found in the body itself; and it must have a self-determining power, and may as well be able to put itself into motion as out of it.

If this reasoning be not admitted, we do not see how any effect can be produced by any cause. Every effect supposes something *done;* and any thing done implies that the thing done may remain till it be *undone* by some other cause. Without this it would have no existence. If a moving cause did not produce continued motion by its instantaneous action, it could not produce it by any continuance of that action; because in no instant of that action does it produce continued motion.

We must therefore give up the opinion, that there resides in a moving body a force *by which it is kept in motion;* and we must find some other way of explaining that remarkable difference between a moving body and a body at rest, by which the first causes other bodies to move by hitting them, while the other does not do this by merely touching them. We shall see, with the clearest evidence, that motion is necessary in the impelling body, in order that it may permit the forces inherent in one or both bodies to continue this pressure long enough for producing a sensible or considerable motion. But these moving forces are inherent in bodies, whether they are in motion or at rest.

Communication of motion is an improper phrase;

34. The foregoing observations show us the impropriety of the phrase *communication of motion.* By thus reflecting on the notions that are involved in the general conception of one body being made to move by the impulse of another, we perceive that there is nothing individual transferred from the one body to the other. The determination to motion, indeed, existed only in the impelling body before collision; whereas, afterwards, both bodies are so conditioned or determined. But we can form no notion of the thing transferred. With the same metaphysical impropriety we speak of the communication of joy, of fever.

so is vis inertiæ.

35. Kepler introduced a term *inertia, vis inertiæ,* into mechanical philosophy; and it is now in constant use. But writers are very careless and vague in the notions which they affix to these terms. Kepler and Newton seem generally to employ it for expressing the fact, the perseverance of the body in its present state of motion or rest: but they also frequently express by it something like an indifference to motion or rest, *manifested by its requiring the same quantity of force to make an augmentation of its motion as to make an equal diminution of it.* The popular notion is

First Law of Motion.

like that which we have of actual resistance; and it always implies the notion of force *exerted* by the resisting body. We suppose this to be the exertion of the *vis insita*, or the *inherent force* of a body in motion. But we have the same notion of resistance from a body at rest which we set in motion. Now surely it is in direct contradiction to the common use of the word *force*, when we suppose resistance from a body at rest; yet *vis inertiæ* is a very common expression. Nor is it more absurd (and it is very absurd) to say, that a body maintains its state of rest by the exertion of a *vis inertiæ*, than to say that it maintains its state of motion by the exertion of an *inherent force.* We should avoid all such metaphorical expressions as *resistance, indifference, sluggishness*, or *proneness to rest* (which some express by *inertia*) because they seldom fail to make us indulge in metaphorical notions, and thus lead us to misconceive the *modus operandi*, or procedure of nature.

There is *no resistance whatever observed* in these phenomena, for the force employed always produces its *complete* effect. When I throw down a man, and find that I have employed no more force than was sufficient to throw down a similar and equal mass of dead matter, I know by this that he *has not* resisted; but I conclude that he *has* resisted if I have been obliged to employ much more force. There is therefore no resistance, properly so called, when the exerted force is observed to produce its full effect. To say that there *is* resistance, is therefore a real misconception of the way in which mechanical forces have operated in the collision of bodies. There is no more resistance in these cases than in any other natural changes of condition. We are guilty, however, of the same impropriety of language in other cases, where the cause of it is more evident. We say that colours in grain *resist* the action of soap and of the sun, but that Prussian blue does not. We all perceive that in this expression the word resistance is entirely figurative; and we should say that Prussian blue *resists* soap, if we are right in saying that a body resists any force employed to change its state of motion; for soap must be employed to discharge or change the colour, *and it does change it.* Force must be employed to change a motion, *and it does change it.* The impropriety, both of thought and language, is *plain* in the one case, and it is no less *real* in the other. Both of the terms *inherent force* and *inertia* may be used with safety for abbreviating language, if we be careful to employ them only for expressing *either the simple fact of persevering in the former state*, or *the necessity of employing a certain determinate force in order to change that state, and if we avoid all thought of resistance.*

Deviations from uniform rectilineal motion are the only indications of force.

36. From the whole of this discussion we learn that the deviations from uniform motions are the indications of the existence and agency of mechanical forces, and that they are the only indications. The indication is very simple—mere change of place; it can therefore indicate nothing but what is very simple, the something competent to the production of the very motion that we observe; and when two changes of motion are precisely similar, they indicate the same thing. Suppose a mariner's compass on the table, and that by a small tap with my finger I cause the needle to turn off from its quiescent position ten degrees. I can do the same thing by bringing a magnet near it, or by bringing an electrified body near it, or by the unbending of a fine spring pressing it aside, or by a puff of wind, or by several other methods. In all these cases the indication is the same; therefore the thing indicated is the same, namely, a certain intensity and direction of a moving power. How it operates, or in what manner it exists and exerts itself in these instances, outwardly so different, is not under consideration at present. Impulsiveness, intensity, and direction, are all the circumstances of resemblance by which the affections of matter are to be characterized; and it is to the discovery and determination of these alone that our attention is now to be directed. We are directed in this research by the

Second Law of Motion.

SECOND LAW OF MOTION.

Every change of motion is proportional to the force impressed, and is made in the direction of that force.

37. This law also may almost be considered as an identical proposition; for it is equivalent to saying that the changing force is to be measured by the change which it produces, and that the direction of this force is the direction of the change. Of this there can be no doubt, when we consider the force in no other sense than that of the cause of motion, paying no attention to the form or manner of its exertion. Thus, when a pellet of tow is shot from a pop-gun by the expansion of the air compressed by the rammer, or where it is shot from a toy pistol by the unbending of the coiled wire, or when it is nicked away by the thumb like a marble—if, in all these cases, it moves off in the same direction, and with the same velocity, we cannot consider or think of the force, or at least of its exertion, as any how different. Nay, when it is driven forward by the instantaneous percussion of a smart stroke, although the manner of producing this effect (if possible) is essentially different from what is conceived in the other cases, we must still think that the propelling force, considered as a propelling force, is one and the same. In short, this law of motion, as thus expressed by Sir Isaac Newton, is equivalent to saying, " that we take the changes of motion as the measures of the changing forces, and the direction of the change for the indication of the direction of the forces:" for no reflecting person can pretend to say that it is a deduction from the acknowledged principle, that effects are proportional to their causes. We do not affirm this law from having observed the proportion of the forces and the proportion of the changes, and that these proportions are the same; and from having observed that this has obtained through the whole extent of our study of nature. This would indeed establish it as a physical law, an universal fact; and it is, in fact, so established. But this does not establish it as a law of motion, according to our definition of that term; as a law of human thought, the result of the relations of our ideas, as an intuitive truth. The injudicious attempts of philosophers to prove it as a matter of observation, have occasioned the only dispute that has arisen in mechanical philosophy. It is well known that a bullet moving with double velocity penetrates four times as far. Many other similar facts corroborate this: and the philosophers observe, that four times the force has been expended to generate this double velocity in the bullet; it requires four times as much powder. In all the examples of this kind it would seem that the ratio of the forces employed has been very accurately ascertained; yet this is the invariable result. Philosophers, therefore, have concluded that moving forces are not proportional to the velocities which they produce, but to the squares of those velocities. It is a strong confirmation to see that the bodies in motion seem to possess forces in this very proportion, and produce effects in this proportion; penetrating four times as deep when the velocity is only twice as great, &c.

But if this be a just estimation, we cannot reconcile it to the concession of the same philosophers, who grant that the velocity is proportional to the force impressed, in the cases where we have no previous observation of the ratio of the forces, and of its equality to the ratio of the velocities. This is the case with gravity, which these

Second Law of Motion.

philosophers always measure by its accelerating power, or the velocity which it generates in a given time. And this cannot be refused by them; for cases occur where the force can be measured in the most natural manner by the actual pressure which it exerts. Gravity is thus measured by the pressure which a stone exerts on its supports. A weight which at Quito will pull out the rod of a spring steelyard to the mark 312, will pull it to 313 at Spitzbergen; and it is a fact, that a body will fall 313 inches at Spitzbergen in the same time that it falls 312 at Quito. Gravitation is the cause both of the pressure and the fall, and it is a matter of unexcepted observation that they have always the same ratio. The philosophers who have so strenuously maintained the other measure of forces are among the most eminent of those who have examined the motions produced by gravity, magnetism, electricity, &c.; and they never think of measuring those forces any other way than by the velocity. It is in this way that the whole of the celestial phenomena are explained in perfect uniformity with observation, and that the Newtonian philosophy is considered as a demonstrative science.

There must, therefore, be some defect in the principle on which the other measurement of forces is built, or in the method of applying it. Pressure is undoubtedly the immediate and natural measure of force; yet we know that four springs, or a bow four times as strong, give only a double velocity to an arrow.

The truth of our law rests on this only, that we assume the changes of motion as the measure of the changing forces, or at least as the measures of their exertions in producing motion. In fact, they are the measures only of a certain circumstance, in which the actions of very different natural powers may resemble each other, namely, the competency to produce motion. They do not, perhaps, measure their competency to produce heat, or even to bend springs. We can surely consider this apart from all other circumstances, and it is worthy of separate consideration. Let us see what can be, and what ought to be, deduced from this way of treating the subject.

Change of motion is itself a motion.

38. The motion of a body may certainly remain unchanged. If the direction and velocity remain the same, we perceive no circumstance in which its condition with respect to motion differs. Its change of place or situation can make no difference; for this is implied in the very circumstance of the bodies being in motion.

But if either the velocity or direction change, then surely is its mechanical condition no longer the same; a force has acted on it, either intrinsic or from without, either accelerating, or retarding, or deflecting it. Supposing the direction to remain the same, its difference of condition can consist in nothing but its difference of velocity. This is the only circumstance in which its condition can differ, as it passes through two different points of its rectilineal path. It is this determination by which the body will describe a certain determinate space uniformly in a given time, which defines its condition as a moving body; the changes of this determination are the measures of their own causes, and to those causes we have given the name *force*. Those causes may reside in other bodies, which may have other properties, characterized and measured by other effects. Pressure may be one of those properties, and may have its own measures; these may or may not have the same proportion with that property which is the cause of a change of velocity; and therefore changes of velocity may not be a measure of pressure. This is a question of fact, and requires observation and experience; but, in the mean time, velocity, and the change of velocity, is the measure of moving force and of changing force. When, therefore, the change of velocity is the same whatever the previous velocity may be, the changing force must be considered as the same. Therefore, finally, if the previous velocity is nothing, and consequently the change on that body is the very velocity or motion that it acquires, we must say, that the force which produces a certain change in the velocity of a moving body is the same with the force which would impart to a body at rest a velocity equal to this change or difference of velocity produced on the body already in motion.

39. This manner of estimating force is in perfect conformity to our most familiar notions on these subjects. We conceive the weight or downward pressure of a body as the cause of its motion downwards; and we conceive it as belonging to the body at all times, and in all places, whether falling, or rising upwards, or describing a parabola, or lying on a table; and, accordingly, we observe, that in every state of motion it receives equal changes of velocity in the same or an equal time, and all in the direction of its pressure.

40. All that we have now said of a change of velocity might be repeated of a change of direction. It is surely possible that the same change of direction may be made on any two motions. Let one of the motions be considered as growing continually slower, and terminating in rest. In every instant of this motion it is possible to make one and the same change on it. The same change may therefore be made at the very instant that the motion is at an end. In this case the change is the very motion which the body acquires from the changing force. Therefore, in this case also, we must say that a change of motion is itself a motion, and that it is the motion which the force would produce in a body that was previously at rest.

How ascertained and measured.

41. The result of these observations is evidently this, that we must ascertain, in every instance, what is the change of motion, and mark it by characters that are conspicuous and distinguishing; and this mark and measure of change must be a motion. Then we must say, that the changing force is that which would produce this motion in a body previously at rest. We must see how this is manifest as a motion in the difference between the former motion and the new motion; and, on the other hand, we must see how the motion produceable in a quiescent body may be so combined with a motion already existing as to exhibit a new motion, in which the agency of the changing force may appear.

Suppose a ship at anchor in a stream, while one man walks forward on the quarter deck at the rate of two miles per hour, another walks from stem to stern at the same rate, a third walks athwart ship, and a fourth stands still. Let the ship be supposed to cut or part her cable, and float down the stream at the rate of three miles per hour. We cannot conceive any difference in the change made on each man's motion in absolute space; but their motions are now exceedingly different from what they were: the first man, whom we may suppose to have been walking westward, is now moving eastward one mile per hour; the second is moving eastward four miles per hour, and the third is moving in an oblique direction, about three points north or south of due east. All have suffered the same change of condition with the man who had been standing still. He has now got a motion eastward three miles per hour. In this instance, we see very well the circumstance of sameness that obtains in the change of these four conditions. It is the motion of the ship which is blended with the other motions. But this circumstance is equally present whenever the same previous motions are changed into the same new motions. We must learn to expiscate this; which we shall do by considering the manner in which the motion of the ship is blended with each of the men's motions.

Second Law of Motion.

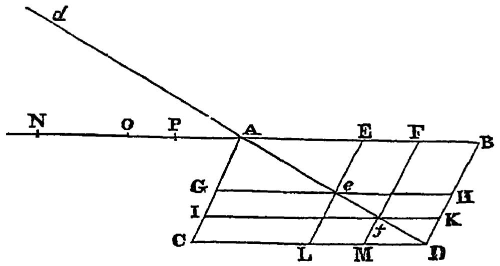
Composition of motion.

42. This kind of combination has been called the *composition of motion;* because, in every point of the motion really pursued, the two motions are to be found.

The fundamental theorem on this subject is this: Two uniform motions in the sides of a parallelogram compose an uniform motion in the diagonal.

Suppose that a point A (fig. 1) describes AB uniformly in some given time, while the line AB is carried uniformly along AC in the same time, keeping always parallel to its first position AB. The point A, by the combination of these motions, will describe AD, the diagonal of the parallelogram ABDC, uniformly in the same time.

Fig. 1.



For it is plain that the velocities in AB and AC are proportional to AB and AC, because they are uniformly described in the same time. When the point has got to E, the middle of AB, the line AB has got into the situation GH, half way between AB and CD, and the point E is in the place *e*, the middle of GH. Draw E*e*L parallel to AC. It is plain that the parallelograms ABDC and AE*e*G are similar; because AE and AG are the halves of AB and AC, and the angle at A is common to both. Therefore, by a proposition in the elements, they are about the same diagonal, and the point *e* is in the diagonal of AD. In like manner, it may be shown, that when A has described AF, three fourths of AB, the line AB will be in the situation IK; so that AI is three fourths of AC, and the point *f*, in which A is now found, is in the diagonal AD. It will be the same in whatever point of AB the describing point A be supposed to be found. The line AB will be on a similar point of AC, and the describing point will be in the diagonal AD.

Moreover, the motion in AD is uniform; for A*e* is described in the time of describing AE; that is, in half the time of describing AB, or in half the time of describing AD. In like manner, A*f* is described in three fourths of the time of describing AD, &c. &c.

Lastly, the velocity in the diagonal AD is to the velocity in either of the sides as AD is to that side. This is evident, because they are uniformly described in the same time.

This is justly called *a composition of the motions* AB *and* AC, as will appear by considering it in the following manner: Let the lines AB, AC be conceived as two material lines like wires. Let AB move uniformly from the situation AB into the situation CD, while AC moves uniformly into the situation BD. It is plain that their intersection will always be found on AD. The point *e*, for example, is a point common to both lines. Considered as a point of EL, it is then moving in the direction *e*H or AB; and considered as a point of GH, it is moving in the direction *e*L. Both of these motions are therefore blended in the motion of the intersection along AD. We can conceive a small ring at *e* embracing loosely both of the wires. This material ring will move in the diagonal, and *will really partake* of both motions.

Thus we see how the motion of the ship is actually blended with the motions of the three men; and the circumstance of sameness which is to be found in the four changes of motion is this motion of the ship, or of the man who was standing still. By composition with each of the three former motions, it produces each of the three new motions. Now, when each of two primitive motions is the same, and each of the new motions is the same, the change is surely the same. If one of the changes has been brought about by the actual composition of motions, we know precisely what that change is; and this informs us what the other is, in whatever way it was produced.

Hence we infer that,

Its mark and measure.

43. *When a motion is any how changed, the change is that motion which, when compounded with the former motion, will produce the new motion.* Now, because we assume the change as the measure and characteristic of the changing force, we must do so in the present instance; and we must say,

Changing force.

44. *That the changing force is that which will produce in a quiescent body the motion which, by composition with the former motion of a body, will produce the new motion.*

And, on the other hand,

Its effect.

When the motion of a body is changed by the action of any force, the new motion is that which is compounded of the former motion, and of the motion which the force would produce in a quiescent body.

Deflecting force.

When a force changes the direction of a motion, we see that its direction is transverse in some angle BAC; because a diagonal AD always supposes two sides. As we have distinguished any change of direction by the term *deflection*, we may call the transverse force a *deflecting force.*

In this way of estimating a change of motion, all the characters of both motions are preserved, and it expresses every circumstance of the change; the mere change of direction, or the angle BAD, is not enough, because the same force will make different angles of deflection, according to the velocity of the former motion, or according to its direction. But in this estimation the full effect of the deflecting force is seen; it is seen *as a motion;* for when half of the time is elapsed, the body is at *e* instead of E; when three fourths are elapsed it is at *f* instead of F; and at the end of the time it is at D instead of B. In short, the body has moved uniformly away from the points at which it would have arrived independent of the change; and this motion has been in the same direction, and at the same rate, as if it had moved from A to C by the changing force alone. Each force has produced its full effect; for when the body is at D, it is as far from AC as if the force AC had not acted on it; and it is as far from AB as it would have been by the action of AC alone.

For all these reasons, therefore, it is evident, that if we are to abide by our measure and character of force as a mere producer of motion, we have selected the proper characteristic and measure of a changing force; and our descriptions, in conformity to this selection, must be agreeable to the phenomena of nature, and retain the accuracy of geometrical procedure; because, on the other hand, the results which we deduce from the supposed influence of those forces are formed in the same mould. It is not even requisite that the real exertions of the natural forces, such as pressure of various kinds, &c. shall follow these rules; for their deviations will be considered as new forces, although they are only indications of the differences of the real forces from our hypothesis. We have obtained the precious advantage of mathematical investigation, by which we can examine the law of exertion which characterizes every force in nature.

45. On these principles we establish the following fundamental elementary proposition, of continual and indispensable use in all mechanical inquiries.

Second Law of Motion.

Fundamental theorem.

If a body or material particle be subjected at the same time to the action of two moving forces, each of which would separately cause it to describe the side of a parallelogram uniformly in a given time, the body will describe the diagonal uniformly in the same time.

For the body, whose motion AB was changed into AD, had gotten its motion by the action of some force. It was moving along NAB, and when it reached the point A, the force AC acted on it. The primitive motion is the same, or the body is in the same condition in every instant of the primitive motion. It may have acquired this motion when it was in N, or when at O, or any other point of NA. In all these cases, if AC act on it when it is in A, it will always describe AD; therefore it will describe AD when it acquires the primitive motion also in A; that is, if the two forces act on it at one and the same instant. The demonstration may be neatly expressed thus: The change induced by each force on the motion produced by the other is the motion which it would produce in the body if previously at rest. Therefore the motion resulting from joint action is the motion which is compounded of these two motions, or it is a motion in the diagonal of the parallelogram, of which these motions are the sides.

Composition of forces.

This is called the *composition of forces.* The forces which produce the motions along the sides of the parallelogram are called the *simple forces*, or the *constituent forces;* and the force which would alone produce the motion along the diagonal is called the *compound force*, the *resulting force*, the *equivalent force.*

46. On the other hand, the force which produces a motion along any line whatever may be conceived as resulting from the combined action of two or more forces. We may *know* or *observe* it to be so; as when we see a lighter dragged along a canal by two horses, one on each side. Each pulls the boat directly toward himself in the direction of the track-rope; the boat cannot go both ways, and its real motion, whatever it is, results from this combined action. This might be produced by a single force; for example, if the lighter be dragged along the canal by a rope from another lighter which precedes it, being dragged by one horse, aided by the helm of the foremost lighter. Here the real force is not the resulting, or the compound, but the equivalent force.

Resolution of forces.

This view of a motion mechanically produced is called the *resolution of forces.* The force in the diagonal is said to be *resolved* into the two forces, having the directions and velocities represented by the sides. This practice is of the most extensive and multifarious use in all mechanical disquisitions. It may frequently be exceedingly difficult to manage the complication of the many real forces which concur in producing a phenomenon; and by substituting others, whose combined effects are equivalent, our investigation may be much expedited. But more of this afterwards.

We must carefully remember, that when the motion AD is once begun, all composition is at an end, and the motion is a simple motion. The two determinations, by one of which the body would describe AB, and by the other of which it would describe AC, no longer *co-exist* in the body. This was the case only *in the instant*, in the very act of changing the motion AB into the motion BD; yet is the motion AD equivalent to a motion which is produced by the *actual composition* of two motions AB and AC; in which case the two motions co-exist in every point of AD.

Usual demonstration inconclusive.

47. Accordingly this is the way in which the composition of forces is usually illustrated, and thought to be demonstrated. A man is supposed (for instance) to walk uniformly from A to C on a sheet of ice, while the ice is carried uniformly along AB by the stream. The man's real motion is undoubtedly along AD; but this is by no means a demonstration that the instantaneous or short-lived action of two forces would produce that motion; the man must continue to exert force in order to walk; and the ice is dragged along by the stream. Some indeed express this proof in another way, saying, let a body describe AB, while the space in which this motion is performed is carried along AC. The ice may be carried along, and may, by friction or otherwise, drag the man along with it; but a space cannot be removed from one place to another, nor, if it could, would it take the man with it. Should a ship start suddenly forward while a man is walking across the deck, he would be left behind, and fall toward the stern. We must *suppose* a transverse force, and we must *suppose* the composition of this force without proof. This is no demonstration.

We apprehend, that the demonstration given above of this fundamental proposition is unexceptionable, when the terms force and deflection are used in the abstract sense which we have affixed to them. The only circumstance in it which can be the subject of discussion is, whether we have selected the proper measure and characteristic of a change of motion. We never met with any objection to it.

Objections to the demonstration of No. 45. It will not apply to pressures.

48. But some have still maintained that it does not evidently appear from these principles, that the motion which results from the joint action of two natural powers, whose known and measurable intensities have the same proportions with AB and BC, and which also exert themselves in those directions, will produce a motion having the direction and proportion of AD. They will not, if the velocities produced by these forces are not in the proportion of those intensities, but in the subduplicate ratio of them. Nay, they say that it is not so. If a body be impelled along AC by one spring, and along AB by two springs equally strong, it will not describe the diagonal of a parallelogram of which the side AB is double the side AC. They add, that an indefinite number of examples can be given where a body *does not* describe the diagonal of the parallelogram by the joint action of two forces, which separately would cause it to describe the sides. And lastly, they say that at any rate it does not appear evident to the mind, that two *incitements* to motion, having the directions and the same proportion of intensity with that of the sides of a parallelogram, actually generate a third, which is the immediate cause of the motion in the diagonal. An equivalent force is not the same with a resulting force.

49. Yet we see numberless cases of the composition of incitements to motion, and they seem as determinate and as susceptible of being combined by composition, as the things called moving forces, which are measured by the velocities. We see them actually so combined in a thousand instances, as in the example already given of a lighter dragged by two horses pulling in different directions. Experiment even shows, that this composition follows precisely the same rule as the composition of the forces which are measured by the velocities; for if the point A (fig. 1) be pulled by a thread or pressed by a spring in the direction AB, and by another in the direction AC, and if the pressures are proportional to AB and AC, then it will be withheld from moving, if it be pulled or pressed by a third force, acting in the direction A*d*, opposite to AD, the pressure being also proportional to AD. This force acting in the direction A*d*, would certainly withstand an equal force acting in the direction AD; therefore we must conclude that the two pressures AB and AC really generate a force AD. This uniform agreement shows that the composition is deducible from fixed principles; but it does not appear that it can be held as demonstrated by the arguments employed in the case of motions. A demonstration of the composition of pressures is farther

Second Law of Motion.

This composition is of more difficult investigation.

wanted, in order to render mechanics a demonstrative science.

Accordingly, philosophers of the first eminence have turned their attention to this problem. It is by no means easy; being so nearly allied to first principles, that it must be difficult to find axioms of greater simplicity by which it may be proved.

Mechanicians generally contented themselves with the solution given by Aristotle; but this is merely a composition of motions; indeed he does not give it for any thing else, and calls it συνθεσις των φυ ϙν. The first writer who appears to have considered it as different from the mere composition of motions, was the celebrated Dutch engineer Stevinus, in his work *on Sluices;* but his solution is obscure. It was sufficient, however, to convince Daniel Bernoulli of the necessity and the difficulty of the problem. He has given the first complete demonstration of it in the first volume of the commentaries of the Imperial Academy of Sciences at St Petersburg. It is extremely ingenious; but it is tedious and intricate, requiring a series of fifteen propositions to demonstrate that two pressures, having the directions and magnitudes of the sides of any parallelogram, compose a third, which has the direction and magnitude of its diagonal. His first proposition is, that *two equal pressures, acting at right angles, compose a third, in the direction of the diagonal of a square, and having to either of the other two the proportion of the diagonal of a square to its sides.*

M. d'Alembert has greatly simplified and improved this demonstration, by beginning with a case that is self-evident; namely, *if three equal forces are inclined to each other in equal angles of* 120°, *any one of them will balance the combined action of the other two.* Surely; for neither of them can prevail. Therefore *two* equal forces, inclined in an angle of 120°, produce a third, which has the direction and proportion of the diagonal of the rhombus; for this is equal and opposite to one of the three above mentioned. He then demonstrates the same thing of two equal forces inclined in *any* angle; and by a series of eight propositions more, demonstrates the general theorem. This dissertation is in the Memoirs of the Academy at Paris for 1769. He improves it still farther in a subsequent memoir.

Mr Riccati and Mr Fonsenex, in the Commentaries of me Academy of Turin, have given analytical demonstrations, which are also very ingenious and concise, but require acquaintance with the higher mathematics. There is another very ingenious demonstration in the *Journal des Sçavans* for June 1764, but too obscure for an elementary proposition. It is somewhat simplified by Belidor in his *Ingenieur François.* Frisius, in his *Cosmographia,* has given one, which is perhaps the best of all those that are easily comprehended without acquaintance with the higher mathematics; but we imagine that, although no one can doubt of the conclusion, it has not that intuitive evidence for every step of the process that seems necessary.

Composition of pressures.

50. We here offer another, composed by blending together the methods of Bernoulli and D'Alembert; and we imagine that no objection can be made to any step of it. We limit it entirely to pressures, and do not at all consider nor employ the motions which they may be supposed to produce.

(A.) If two equal and opposite pressures or incitements to motion act at once on a material particle, it suffers no change of motion; for if it yields in either direction by their joint action, one of the pressures prevails, and they are not equal.

Equal and opposite pressures are said to *balance* each other; and such as balance must be esteemed equal and opposite.

(B.) If a and b are two magnitudes of the same kind, proportional to the intensities of two pressures which act in the same direction, then the magnitude $a+b$ will measure the intensity of the pressure, which is equivalent, and may be called equal to the combined effort of the other two; for when we try to form a notion of pressure as a measurable magnitude, distinct from motion or any other effect of it, we find nothing that we can measure it by but another pressure. Nor have we any notion of a double or triple pressure different from a pressure that is equivalent to the joint effort of two or three equal pressures. A pressure a is accounted triple of a pressure b, if it balances three pressures, each equal to b, acting together. Therefore, in all proportions which can be expressed by numbers, we must acknowledge the legitimacy of this measurement; and it would surely be affectation to omit those which the mathematicians call *incommensurable.*

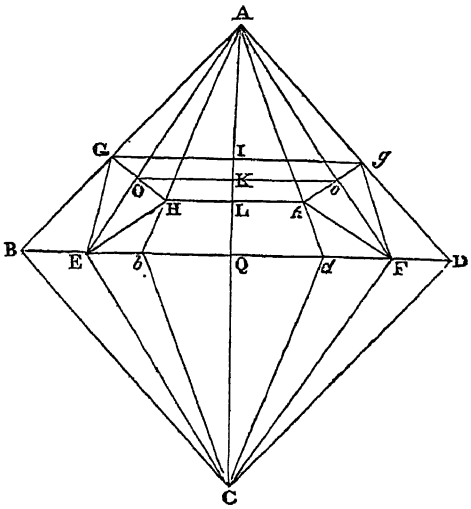
Second Law of Motion.

In like manner, the magnitude $a-b$ must be acknowledged to measure that pressure which arises from the joint action of two pressures a and b acting in opposite directions, of which a is the greatest.

(C.) Let ABCD and AbCd (fig. 2) be two rhombuses, which have the common diagonal AC. Let the angles BAb, DAd, be bisected by the straight lines AE and AF.

If there be drawn from the points E and F the lines EG, EH, Fg, Fh, making equal angles on each side of EA and FA, and if Gg, Hh be drawn, cutting the diagonal AC in I and L: then AI + AL will be greater or less than AQ, the half of AC, according as the angles GEH, gFh, are greater or less than GAH, gAh.

Fig. 2.



Draw GH, gh, cutting AE, AF, in O and o, and draw Oo, cutting AC in K.

Because the angles AEG and EAG are respectively equal to AEH and EAH, and AE is common to both triangles, the sides AG, GE, are respectively equal to AH, HE, and GH is perpendicular to AE, and is bisected in O; for the same reasons gh is bisected in o. Therefore the lines Gg, Oo, Hh, are parallel, and IL is bisected in K. Therefore AI + AL is equal to twice AK. Moreover, if the angle GEH be greater than GAH, AO is greater than EO, and AK is greater than KQ. Therefore AI + AL is greater than AQ; and if the angle GEH be less than GAH, AI + AL is less than AQ.

(D.) Two equal pressures, acting in the directions AB and AC (fig. 3), at right angles to each other, compose a pressure in the direction AD, which bisects the right angle; and its intensity is to the intensity of each of the constituent pressures as the diagonal of a square to one of the sides.

Second Law of Motion.

Fig. 3.

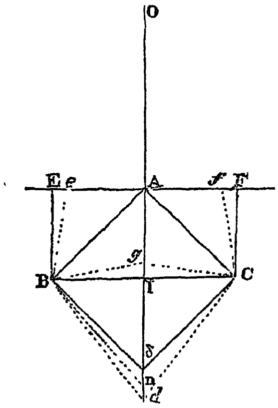
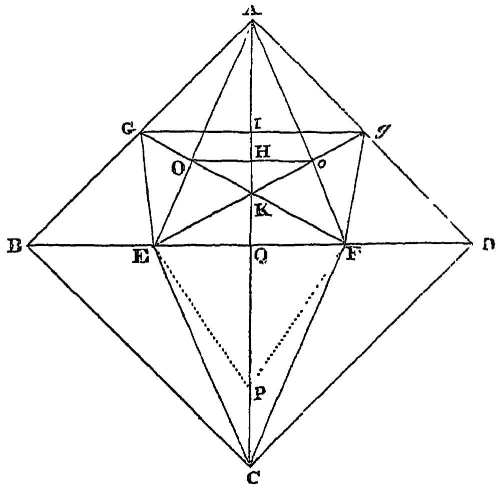


Fig. 4.



It is evident, that the direction of the pressure, generated by their joint action, will bisect the angle formed by their directions; because no reason can be assigned for the direction inclining more to one side than to the other.

In the next place, since a force in the direction AD does, in fact, arise from the joint action of the equal pressures AB and AC, the pressure AB may be conceived as arising from the joint action of two equal forces similarly inclined and proportioned to it. Draw EAF perpendicular to AD. One of these forces must be directed along AD, and the other along AE. In like manner, the pressure AC may arise from the joint action of a pressure in the direction AD, and an equal pressure in the direction AF. It is also plain that the pressures in the directions AE and AF, and the two pressures in the direction AD, must be all equal. And also, any one of them must have the same proportion to AB or to AC, that AB or AC has to the force in the direction AD, arising from their joint action.

Therefore, if it be said that AD does not measure the pressure arising from the joint action of AB and AC, let A*d*, greater than AD, be its just measure, and make A*d* : AB = AB : A*g* = AB : A*e*. Then A*g* and A*e* have the same inclination and proportion to AB that AB and AC have to A*d*. We determine, in like manner, two forces A*f* and A*g* as constituents of AC.

Now A*d* is equivalent to AB and AC, and AB is equivalent to A*e* and A*g*; and AC is equivalent to A*f* and A*g*. Therefore A*d* is equivalent to A*e*, A*f*, A*g*, and A*g*. But (A) A*e* and A*f* balance each other, or annihilate each other's effect; and there remain only the two forces or pressures A*g*, A*g*. Therefore (B) their measure is a magnitude equal to twice A*g*. But if A*d* be greater than the diagonal AD of the square, whose sides are AB and AC; then A*g* must be less than AI, the side of the square whose diagonal is AB. But twice A*g* is less than AD, and much less than A*d*. Therefore the measure of the equivalent of AB and AC cannot be a line A*d*, greater than AD. In like manner, it cannot be a line Aδ that is less than AD. Therefore it must be equal to AD, and the proposition is demonstrated.

(E.) *Cor.* Two equal forces, AB, AC, acting at right angles, will be balanced by a force AO, equal and opposite to AD, the diagonal of the square whose sides are AB and AC; for AO would balance AD, which is the equivalent of AB and AC.

(F.) Let AECF (fig. 4), be a rhombus, the acute angle of which, EAF, is half of a right angle. Two equal pressures, which have the directions and measures AE, AF, compose a pressure having the direction and measure AC, which is the diagonal of the rhombus.

It is evident, in the first place, that the compound force has the direction AC, which bisects the angle EAF. If AC be not its just measure, let it be AP less than AC. Let ABCD be a square described on the same diagonal, and make AP : AQ = AE : AO, = AF : A*o*. Draw KOG, K*og* perpendicular to AE, AF; draw GI*g*, OH*o*, EG, EK, F*g*, FK, PF, and PE.

The angles CAB and FAE are equal, each being half of a right angle. Also the figures AEPF and AGEK are similar; because AP : AQ = AE : AO. Therefore FA : AP = KA : AE, and EA : AP = GA : AE. Therefore, in the same manner that the forces AE, AF are affirmed to compose AP, the forces AG and AK may compose the force AE, and the forces A*g* and AK may compose the force AF. Therefore (B) the force AP is equivalent to the four forces AG, AK, A*g*, AK. But (D) AG and A*g* are the sides of a square, whose diagonal is equal to twice AI; and the two forces AK, AK are equal to, or are measured by, twice AK. Therefore the four forces AG, AK, A*g*, AK, are equivalent to 2 AI + 2 AK = 4 AH.

But because AP was supposed less than AC, the angle FPE is greater than FAE, and GEK is greater than GAK, AO is greater than OE, and AH is greater than HQ, and 2AH is greater than AQ; and therefore 4AH is greater than AC, and much greater than AP. Therefore AP is not the just measure of the force composed of AE and AF.

In like manner it is shown that AE and AF do not compose a force whose measure is greater than AC. It is therefore equal to AC; and the proposition is demonstrated.

(G.) By the same process it may be demonstrated, that if BAD be half a right angle, and EAF be the fourth of a right angle, two forces AE, AF will compose a force measured by AC. And the process may be repeated for a rhombus, whose acute angle is $\frac{1}{8}$th, $\frac{1}{16}$th, &c. of a right angle; that is, any portion of a right angle that is produced by continual bisection. Two forces, forming the sides of such a rhombus, compose a force measured by the diagonal.

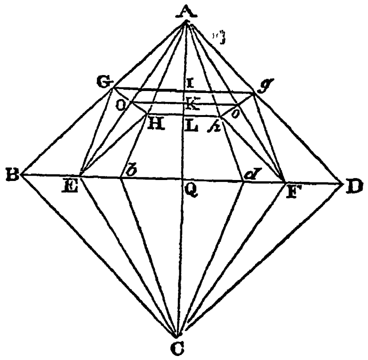
(H.) Let ABCD, A*b* C*d*, (fig. 5), be two rhombuses, formed by two consecutive bisections of a right angle. Let AECF be another rhombus, whose sides AE and AF bisect the angles BA*b* and DA*d*.

The two forces AE, AF, compose a force AC.

Bisect AE and AF in O and *o*. Draw the perpendiculars GOH, *goh*, and the lines GI*g*, OK*o*, HL*h*, and the lines EG, EH, F*g*, F*h*.

Second Law of Motion.

Fig. 5.



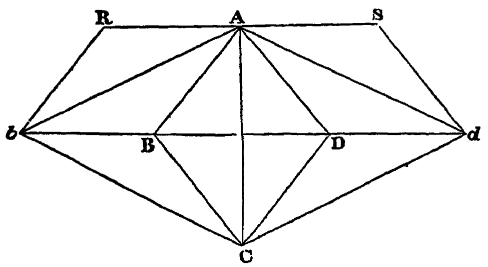
It is evident that AGEH and AgFh are rhombuses; because AO = OE, and Ao = oF. It is also plain, that since bAd is half of BAD, the angle GAH is half of bAd. It is therefore formed by a continual bisection of a right angle. Therefore (G) the forces AG, AH, compose a force AE; and Ag, Ah, compose the force AF. Therefore the forces AG, AH, Ag, Ah, acting together, are equivalent to the forces AE, AF, acting together. But AG, Ag compose a force = 2 AI; and the forces AH, Ah compose a force = 2 AL. Therefore the four forces acting together are equivalent to 2 AI + 2 AL, or to 4 AK. But because AO is $\frac{1}{2}$ AE, and the lines Gg, Oo, Hh, are evidently parallel, 4 AK is equal to 2 AQ, or to AC; and the proposition is demonstrated.

(I.) *Cor.* Let us now suppose that by continual bisection of a right angle we have obtained a very small angle a of a rhombus; and let us name the rhombus by the multiple of a, which forms its acute angle.

The proposition (G) is true of a, 2 a, 4 a, &c. The proposition (H) is true of 3 a. In like manner, because (G) is true of 4 a and 8 a, proposition (H) is true of 6 a; and because it is true of 4 a, 6 a, and 8 a, it is true of 5 a and 7 a. And so on continually till we have demonstrated it of every multiple of a that is less than a right angle.

(K.) Let RAS (fig. 6) be perpendicular to AC, and let ABCD be a rhombus, whose acute angle BAD is some multiple of 2 a that is less than a right angle. Let Ab, Cd be another rhombus, whose sides Ab, Ad bisect the angles RAB, SAD. Then the forces Ab, Ad compose a force AC.

Fig. 6.



Draw bR, dS parallel to BA, DA. It is evident that ARbB and ASdD are rhombuses, whose acute angles are multiples of a, that are each less than a right angle. Therefore (I) the forces AR and AB compose the force Ab and AS, AD compose Ad; but AR and AS annihilate each other's effect, and there remains only the forces AB, AD. Therefore Ab and Ad are equivalent to AB and AD, which compose the force AC; and the proposition is demonstrated.

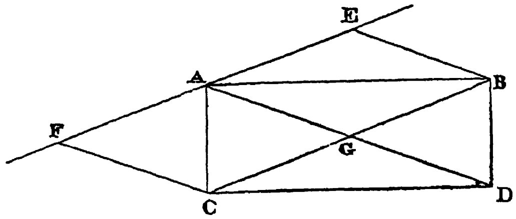
(L.) *Cor.* Thus is the corollary of last proposition extended to every rhombus, whose angle at A is some multiple of a less than two right angles. And since a may be taken less than any angle that can be named, the proposition may be considered as demonstrated of every rhombus; and we may say,—

Second Law of Motion.

(M.) *Two equal forces, inclined to each other in any angle, compose a force which is measured by the diagonal of the rhombus, whose sides are the measures of the constituent forces.*

(N.) Two forces AB, AC (fig. 7) having the direction and proportion of the sides of a rectangle, compose a force AD, having the direction and proportion of the diagonal.

Fig. 7.

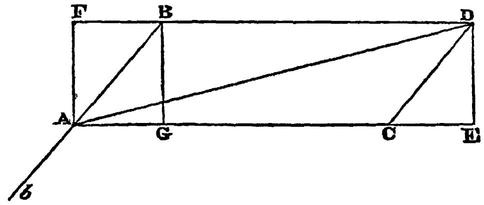


Draw the other diagonal CB, and draw EAF parallel to it: draw BE, CF parallel to DA.

AEBG is a rhombus; and therefore the forces AE and AG compose the force AB. AFCG is also a rhombus, and the force AC is equivalent to AF and AG. Therefore the forces AB and AC, acting together, are equivalent to the forces AE, AF, AG, and AG acting together, or to AE, AF, and AD acting together; but AE and AF annihilate each other's action, being opposite and equal (for each is equal to the half of BC). Therefore AB and AC acting together are equivalent to AD, or compose the force AD.

(O.) Two forces, which have the direction and proportions of AB, AC (fig. 8) the sides of any parallelogram, compose a force having the direction and proportion of the diagonal AD.

Fig. 8.



Draw AF perpendicular to BD, and BG and DE perpendicular to AC.

Then AFBG is a rectangle, as is also AFDE; and AG is equal to CE. Therefore (N) AB is equivalent to AF and AG. Therefore AB and AC acting together, are equivalent to AF, AG, and AC acting together; that is, to AF and AE acting together; that is (N) to AD; or the forces AB and AC compose the force AD.

51. Hence arises the most general proposition.

Composition of all incitements to motion.

If a material particle be urged at once by two pressures or incitements to motion, whose intensities are proportional to the sides of any parallelogram, and which act in the directions of those sides, it is affected in the same manner as if it were acted on by a single force, whose intensity is measured by the diagonal of the parallelogram, and which acts in its direction: Or, two pressures, having the direction and proportion of the sides of a parallelogram, generate a pressure having the direction and proportion of the diagonal.

52. Thus have we endeavoured to demonstrate from abstract principles the perfect similarity of the composition of pressures, and the composition of forces measured by the motions which they produce. We cannot help being of the opinion that a separate demonstration is indispen-

Second Law of Motion.

Seeming difference of the compositions of motion and of pressure disappear when carefully examined.

sably necessary. What may be fairly deduced from the one case cannot always be applied to the other. No composition of pressures can explain the change produced by a deflecting force on a motion already existing; for the changing pressure is the only one that exists, and there is none to be compounded with it. And, on the other hand, our notions and observations of the composition of motions will not explain the composition of pressures, unless we take it for granted that the pressures are proportional to the velocities; but this is perhaps a gratuitous assumption. At any rate, it is not an intuitive proposition; and we have mentioned some facts where it seems that they do not follow the same proportion. The pressure of four equal springs produces only a double velocity. It would appear, therefore, that there are circumstances which oblige us to say, that the *exertion* of pressure, as a cause of motion, is not (always at least) proportional to the real measurable pressure. We are therefore anxious to discover in what the difference consists; and in the mean time must allow, that the pressure exerted on a body at rest is different from its exertion in producing motion. We cannot indeed state any immediate comparison between pressure and motion, nor have we any clear conception of the connection between them. It is only by our own sensations of touch that we have any notion of pressure, and it is experience that teaches us that it always accompanies every cause of motion. We can, however, observe the proportions of pressures, and compare them with the proportions of motion. We very often observe them different; and therefore it was indispensably necessary to investigate the laws of combined pressure as we did the laws of combined motion in consequence of pressure. Yet we should err if we hastily asserted that pressures are not proportional to the motions which they produce; all that we are entitled to call in doubt is, whether the pressures in their exertion, while they actually produce motion, or changes of motion, continue to be the same as when they do not produce motion, being withstood or balanced by opposite pressures. Considered as causes of motion, we ought to think that they do not vary while they produce motion, and that the actual pressure, while it produces a double motion, is really double, although it may be quadruple when the body exerting it is made to act on a body that it cannot move. We are confirmed in this opinion by observing, that other facts show us, that even while producing motion, the pressure which we call quadruple, because we have measured it by four equal pressures balancing it, is really quadruple, considered as the cause of motion, and produces a quadruple motion. A bow which requires four times the force to draw it to any given extent, will communicate the same velocity to a bundle of four arrows that a bow four times more easily drawn communicates to one arrow, and will therefore produce a quadruple motion. Yet it will only produce a double velocity in the arrow that acquired a simple velocity from a bow having one fourth of the strength.

These discrepancies should excite the endeavours of mechanicians to investigate the laws observed in the action of pressures producing motion. Had this been done with care and with candour, we should not have had the great difference of opinion which still divides philosophers about the measures of moving forces. But a spirit of party, which had arisen from other causes, gave importance to what was at first only a difference of expression, and made the partizans of Mr Leibnitz avail themselves of the figurative language which has done so much harm in all the departments of philosophy. Notwithstanding all our caution, it is hardly possible to avoid metaphorical conceptions when we employ the language of metaphor. The abettors of the Leibnitzian measure of moving forces, or perhaps, to speak more properly, the abettors of the Leibnitzian measure of that force which is supposed to preserve bodies in their condition of motion, insist that the force which is exerted in producing any change of motion is greater in proportion as the motion changed is greater; and they give a very specious argument for their assertion. They appeal to the exertions which we ourselves make. Here we are conscious of the fact. Then they give similar examples of the action of bodies. A clay ball, moving six feet per second, will make the addition of one foot to the velocity of an equal clay ball that is already moving four feet per second in the same direction. But if this last ball be already moving ten feet per second, we must follow it with a velocity of twelve feet in order to increase its velocity one foot. But, without insisting on the numberless paralogisms and inconsistencies which this way of conceiving the matter would lead us into, it suffices to observe, that the phenomena give us abundant assurance that there has been the same exertion in both these cases. This acceleration is always accompanied by a compression of the balls, and the compression is the same in both. This compression is a very good measure of the force employed to produce it; and, in the present case, we need not even trouble ourselves with any rule for its measurement: for surely, when the compression is not different, but the same, the force exerted is the same. This is farther confirmed by observing, that it requires the same force to make the same pit, or to give the same motion, to a piece of clay lying on the table of a ship's cabin, whether the ship be sailing two miles or ten miles per hour.

Thus we see that there are strong reasons for believing, that the exertions of pressure in producing motion, or that the pressures *actually exerted*, are proportional to the changes of motion observed, and that they coincide in this respect with our abstract conceptions of moving forces.

But we have still better arguments. None of the Leibnitzians think of denying the equal exertions of gravity, or of any of those powers which they call *solicitations or accelerating forces.* They all admit that gravity, or any constant accelerating force, produces equal increments of velocity in equal times, and that a double gravity will produce a double increment in an equal time, and an equal increment in half of the time: and that a quadruple gravity will produce a double velocity in half the time. All these things are granted by them, and their writings are full of reasonings from this principle. Now, from the fact, acknowledged by the Leibnitzians, that the quadruple force of a bow gives a double velocity to the arrow, in every instant of its action, it indisputably follows, that it has acted on it only for half the time of the action of the four times weaker bow, which gives the arrow only half the velocity; and thus has the discrepancy between the effects of pressures and of our abstract moving forces entirely disappeared. For this circumstance of the difference in the time of acting will be found, on strict examination, in all the cases of the change of motion by pressures which we measure by their effects on a body at rest. When this and the appreciable changes of actual pressure, during the time of producing the motion, are taken into consideration, all difference vanishes, and the composition of pressures is in perfect harmony with the composition of motions, or of abstract moving forces. Dynamics is thus made a demonstrative science, and affords the opportunity of investigating, by observation and experiment, the nature of those mechanical powers which reside in bodies, and which appear to us under the form of pressure, inducing us to consider pressure as a cause of motion.

In this, however, we are rather inaccurate. Pressure is one of the sensible effects of that property which is also

Second Law of Motion.

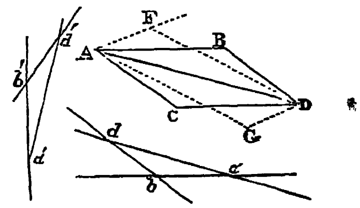
the cause of motion. It is not the pressure of a piece of lead, but its heaviness, that is the reason that it gives motion to a kitchen jack. Pressure is merely a generic name, borrowed from a similar instance, and given to moving forces, which have the same nature, but different names that serve to mark their connection with certain substances, in which they may be supposed to reside. Natural philosophy is almost entirely employed in examining the nature of these various pressures or accelerative forces; and the general doctrines of dynamics, by ascertaining what is common to them all, enable us to mark with precision what is characteristic of each.

General corollaries.

53. We have now advanced very far in this investigation; for we have obtained the criterion by which we learn the direction and the magnitude of every changing force; and, on the other hand, we see how to state what will be the effect of the exertion of any force that is known or suspected to act. All this we learn by the composition of forces; and the greatest part of mechanical disquisition consists in the application of this doctrine. For such reasons it merits minute consideration; and therefore we must point out some general conclusions from the properties of figure, which will greatly facilitate the use of the parallelogram of forces.

54. *First,* The constituent and the resulting forces, or the simple and compound forces, act in the same plane; for the sides and diagonal of a parallelogram are in one plane.

Fig. 9.



55. *Second,* The simple and the compound forces are proportional to the sides of any triangle which are parallel to their directions. For if any three lines, *ab*, *bd*, *ad*, be drawn parallel to AB, AC, and AD (fig. 9), they will form a triangle similar to the triangle ABD. For the same reasons they are proportional to the sides of a triangle *a'b'd*, which are respectively perpendicular to their directions.

56. *Third,* Therefore each is proportional to the sine of the opposite angle of this triangle; for the sides of any triangle are proportional to the sines of the opposite angles.

57. *Fourth,* Each is proportional to the sine of the angle contained by the directions of the other two; for AD is to AB as the sine of the angle ABD to the sine of the angle ADB. Now the sine of ABD is the same with the sine of BAC contained between the directions AB and AC, and the sine of ADB is the same with the sine of CAD; also AB is to AC, or BD, as the sine of ADB (or CAD) to the sine of BAD.

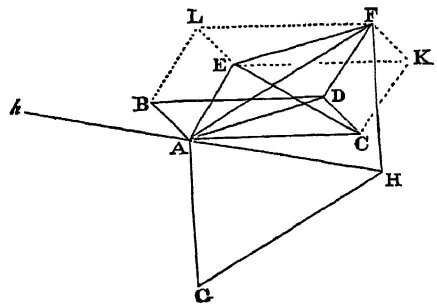
Some special uses of the parallelogram of forces.

58. We now proceed to the application of this fundamental proposition. And we observe, in the first place, that since AD may be the diagonal of an indefinite number of parallelograms, the motion or the pressure AD may result from the joint action of many pairs of forces. It may be produced by forces which would separately produce the motions AF and AG. This generally gives us the means of discovering the forces which concur in its production. If one of them, AB, is known in direction and intensity, the direction AC, parallel to BD, and the intensity, are discovered. Sometimes we know the directions of both. Then, by drawing the parallelogram or triangle, we learn their proportions. The force which deflects any motion AB into a motion AD, is had by simply drawing a line from the point B (to which the body would have moved from A in the time of really moving from A to D) to the point D. The deflecting force is such as would have caused the body move from B to D in the same time. And, in the same manner, we get the compound motion AD, which arises from any two simple motions AB and AC, by supposing both of the motions to be accomplished in succession. The final place of the body is the same, whether it moves along AD or along AB and BD in succession.

Equivalent of many forces.

59. This theorem is not limited to the composition of two motions or two forces only; for since the combined action of two forces puts the body into the same state as if their equivalent alone had acted on it, we may suppose this to have been the case, and then the action of a third force will produce a change on this equivalent motion. The resulting motion will be the same as if only this third force and the equivalent of the other two had acted on the body. Thus, in fig. 10, the three forces AB, AC, AE, may act at once on a particle of matter. Complete the parallelogram ABDC; the diagonal AD is the force which is generated by AB and AC. Complete the parallelogram AEFD; the diagonal AF is the force resulting from the combined action of the forces AB, AC, and AE. In like manner, completing the parallelogram AGHF, the diagonal AH is the force resulting from the combined action of AB, AC, AE, and AG, and so on of any number of forces.

Fig. 10.



This resulting force and the resulting motion may be much more expeditiously determined, in any degree of composition, by drawing lines in the proportion and direction of the forces in succession, each from the end of the preceding. Thus, draw AB, BD, DF, FH, and join AH; AH is the resulting force. The demonstration is evident.

60. It is to be noticed here, that in the composition of more than two forces, we are not limited to one plane. The force AD is in the same plane with AB and AC; but AE may be elevated above this plane, and AG may lie below it. AF is in the plane of AD and AE, and AH is in the plane of AF and AG.

Complete the parallelograms ABLE, ACKE, ELFK. It is evident that ABLFKCD is a parallelopiped, and that AF is one of its diagonals. Hence we derive a more general theorem of great use.

Three forces having the proportion and direction of the three sides of a parallelopiped, compose a force having the proportion and direction of the diagonal.

One force may balance many acting together.

61. Any number of forces acting together on one particle of matter are balanced by a force that is equal and opposite to their resulting force; for this force would balance their resulting force which is equivalent to them in action. When this is duly considered, we perceive that each force is then in equilibrio with the equivalent of all

Second Law of Motion.

the others; for a force can balance only what is equal and opposite to it. It appears very readily by the geometrical construction. If, instead of the circuit A, B, D, F, H, we take B, D, F, H, A, we have BA for the equivalent of the forces AC, AE, AG; but AB is equal and opposite to BA. Therefore the force AB is in equilibrio with the equivalent of all the others.

62. When any number of forces act on one particle of matter, and are in equilibrio, if they be considered as acting in parcels, the equivalents of these parcels are in equilibrio; for let the forces AB, AC, AE, AG, A*h*, be in equilibrio, and let them be considered in the two parcels AB, AC, and AE, AG, A*h*, then AD is the equivalent of AB, BD (or AC), and DA is the equivalent of DF, FH, HA (or A*h*): now AD and DA balance each other. This corollary enables us to simplify many intricate complications of force; it also enables us to draw accurate conclusions from very imperfect observations. In most of our practical discussions we know, or at least we attend to, a part only of the forces which are acting on a material particle; and in such cases we reason as if we saw the whole: yet is our mathematical reasoning good with respect to the equivalent of all the parcels which we are contemplating, and the equivalents of the smaller parcels of which it consists; and the neglected force, or parcel of forces, induces no error on our conclusions.

Expeditious methods for obtaining the resulting motion in complicated cases.

63. In the spontaneous phenomena of nature, the investigation and discovery of our ultimate object of search is frequently very difficult, on account of the multiplicity of directions and intensities of the operating forces or motions. We may generally facilitate the process, by substituting equivalent forces or motions acting in convenient directions. It is in this way that the navigator computes the ship's place with very little trouble, by substituting equivalent motions in the meridional and equatorial directions for the real oblique courses of the ship. Instead of setting down ten miles on a course, S. 36° 52′ W. he supposes that the ship has sailed eight miles due south, and six miles due west, which brings her near to the same place. Then, instead of fourteen miles south-west, he sets down ten miles south and ten miles west; and he proceeds in the same way for every other course and distance. He does this expeditiously by means of a traverse table, in which are ready calculated the meridional and equatorial sides of right-angled triangles, corresponding to every course and distance. Having done this for the course of a whole day, he adds all the southings into one sum, and all the westings into another; he considers these as forming the sides of a right-angled triangle; he looks for them, paired together, in his traverse table, and then notices what angle and what distance corresponds to this pair. This gives him the position and magnitude of the straight line joining the beginning and end of his day's work.

The miner proceeds in the same way when he takes the plan of subterraneous workings, measuring, as he goes along, and noticing the bearing of each line by the compass, and setting down, from his traverse table, the northing or southing, and the easting or westing, for each oblique line: but there is another circumstance which he must attend to, namely, the slope of the various drifts, galleries, and other workings. This he does by noting the rise or the dip of each sloping line. He adds all these into two sums, and taking the risings from the dips, he obtains the whole dip. Thus he learns how far the workings proceed to the north, how far to the east, and how far to the dip.

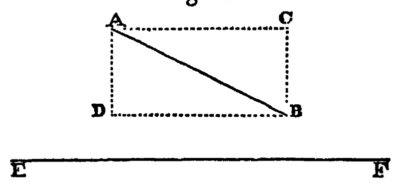
The reflecting reader will perceive that the line joining the two extremities of this progression will form the diagonal of a rectangular parallelopiped; one of whose sides lies north and south, the other lies east and west, and the third is right up and down.

The mechanician proceeds in the very same way in the investigation of the very complicated phenomena which frequently engage his attention. He considers every motion as compounded of three motions in some convenient directions, at right angles to each other. He also considers every force as resulting from the joint action of three forces, at right angles to each other, and takes the sum or difference of these in the same or opposite directions. From this process he obtains the three sides of a parallelopiped, and from these computes the position and magnitude of the diagonal. This is the motion or force resulting from the composition of all the partial ones.

Forces may be estimated by, or reduced to

This procedure is called the *estimation* or *reduction* of motions and forces.

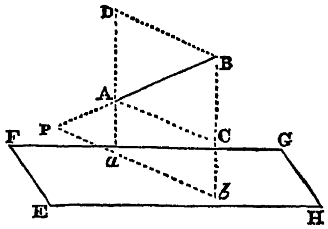
Fig. 11.



a given direction,

64. A motion or force AB (fig. 11) is said to be *estimated* in the direction EF, or to be *reduced* to this direction when it is conceived as compounded of the motions or forces AC, AD, one of which, AC, is parallel to EF, and the other, AD, is perpendicular to it. This expression is abundantly significant; for it is plain that the motion AD neither promotes nor hinders the progress along EF, and that AC expresses the whole progress in this direction.

Fig. 12.



or a given plane.

65. In like manner, a force AB (fig. 12) is said to be *estimated in*, or *reduced to*, a given plane EFGH, when it is conceived as resulting from the joint action of two forces AC, AD, one of which is parallel to a line *ab* drawn in that plane, and the other AD is perpendicular to it. The position of the line *ab* is determined by letting fall B*b* perpendicular to the plane, and drawing *b*P to the point P, in which BA meets the plane; then A*a* being drawn parallel to B*b*, will cut off *ba*, which is the reduction of the motion AB to the plane. Drawing AC parallel to *ab*, and completing the parallelogram ACBD, it is evident that the motion AB is equivalent to AD and AC, which is parallel to *ab*, and the three forces AB, AC, AD, are, as they should be, in one plane perpendicular to the plane EG.

Equilibrium of forces so estimated or reduced

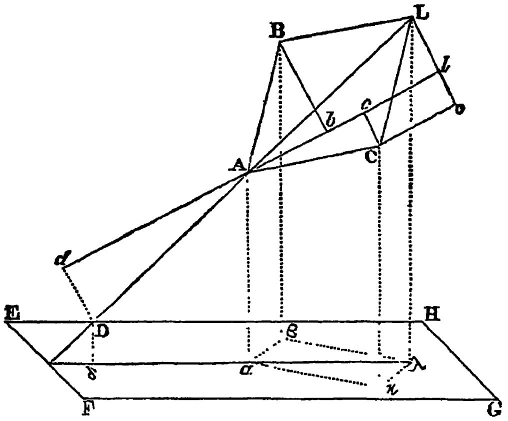
66. If three forces AB, AC, AD (fig. 13) are in equilibrio, and are reduced to any one direction *d*A*l*, or to one plane EFGH, the reduced forces are also in equilibrio.

First, let them be reduced to one direction *dl* by drawing the perpendiculars B*b*, C*c*, D*d*; make AL equal to AD, and join BL, CL, and draw the perpendiculars L*l*, C*c*; then, because the forces AB, AC, AD, are in equilibrio, ABLC must be a parallelogram, and AL is the force equivalent to AB and AC combined; then, because the lines D*d*, B*b*, C*c*, L*l*, are parallel, *d*A is equal to A*l*, and A*b* to C*o*, or to *cl*; therefore A*l* is equal to the sum of A*b* and A*c*, which are the reductions of AB and AC;

Second Law of Motion.

therefore dA is equal to the same sum, and in equilibrio with them.

Fig. 13.



Secondly, Let them be reduced to one plane, EFGH, and let $\alpha\beta$, αx, $\alpha\delta$, be the reduced forces. The lines $D\delta$, $A\alpha$, $B\beta$, Cx, $L\lambda$, are all parallel, being perpendicular to the plane; therefore the planes AB, $\beta\alpha$, and CL, λx, are parallel, and $\alpha\beta$, $x\lambda$, are parallel. For similar reasons, $\beta\lambda$, αx, are parallel; therefore $\alpha\beta\lambda x$ is a parallelogram. Also, because the lines $D\delta$, $A\alpha$, $L\lambda$, are parallel, and DA is equal to AL; therefore $\delta\alpha$ is equal to $\alpha\lambda$. But because $\alpha\beta\lambda x$ is a parallelogram, the forces $\alpha\beta$, αx, are equivalent to $\alpha\lambda$; and $\alpha\delta$ is equal and opposite to $\alpha\lambda$, and will balance it; and therefore will balance $\alpha\beta$ and αx, which are the reductions of AB and AC to the plane EFGH, while $\alpha\delta$ is the reduction of AD; therefore the proposition is demonstrated.

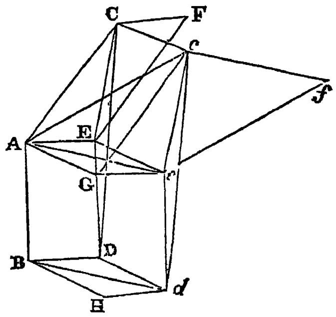
The most useful mode of reduction is to their co-ordinates.

The most usual and the most useful mode of reduction is to estimate all forces in the directions of three lines drawn from one point, at right angles to each other, like the three plane angles of a rectangular chest, forming the length, the breadth, and the depth of the chest. These are commonly called the three co-ordinates. The resulting force will be the diagonal of this parallelopiped. This process occurs in all disquisitions in which the mutual action of solids and fluids is considered, and when the oscillation or rotation of detached free bodies is the subject of discussion.

Relative motions of bodies not affected by any extraneous equal and parallel force.

67. The only other general theorem that remains to be deduced from this law of motion is, that if a number of bodies are moving in any manner whatever, and an equal force act on every particle of matter in the same or parallel directions, their relative motions will suffer no change;

Fig. 14.



for the motion of any body A (fig. 14), relative to another body B, which is also in motion, is compounded of the real motion of A, and the opposite to the real motion of B; for let A move uniformly from A to C, while B describes BD uniformly; draw AB, also draw AE equal and parallel to BD; join EC, DC, ED. The motion of A, relative to B, consists in its change of position and distance. Had A described AE, while B described BD, there would have been no change of relative place or distance; but A is now at C, and DC is its new direction and distance. The relative or apparent motion of A therefore is EC. Complete the parallelogram ACFE; it is plain that the motion EC is compounded of EF, which is equal and parallel to AC, the real motion of A, and of EA, the equal and opposite to BD, the real motion of B.

Now let the motions of A and B sustain the same change; let the equal and parallel motions AG, BH, be compounded with the motions AC and BD; or let forces act at once on A and B, in the parallel directions AG, BH, and with equal intensities; in either supposition, the resulting motions will be Ac, Bd, the diagonals of the parallelograms AGcC and BHdD. Construct the figure as before, and we see that the relative motion is now ec, and that it is the same with EC both in respect of magnitude and position.

Here we still see the constant analogy between the composition of motions and the composition of forces. In the first case, the relative motions of things are not changed, whatever common motion be compounded with them all; or, as it is usually but inaccurately expressed, although the space in which they move be carried along with any motion whatever. In the second case, the relative motions and actions are not changed by any external force, however great, when equally exerted on every particle in parallel directions.

Thus it is that the evolutions of a fleet in a uniform current are the same, and produced by the same means, as in still water. Thus it is that we walk about on the surface of this globe in the same manner as if it neither revolved round the sun, nor turned round its axis. Thus it is that the same strength of a bow will communicate a certain velocity to an arrow, whether it is shot east, or west, or north, or south. Thus it is that the mutual actions of sublunary bodies are the same, in whatever directions they are exerted, and notwithstanding the very great changes in their velocities by reason of the earth's rotation and orbital revolution. The real velocity of a body on the earth's equator is about 3000 feet per second greater at midnight than at mid-day. For at midnight the motion of rotation nearly conspires with the orbital motion, and at mid-day it nearly opposes it. The difference between the velocities at the beginning of January and the beginning of July is vastly greater. And at other times of the day, and other seasons of the year, both motions of the earth are transversely compounded with the easterly or westerly motion of an arrow or cannon bullet; yet we can observe no change in the effects of the mutual actions of bodies.

This affords a demonstration of the proportionality of moving forces to the motions produced by them.

68. This is an important observation, because it proves that forces are to be measured by no other scale than by the motions which they produce. We have had repeated occasions to mention the very different estimation of moving forces by Mr Leibnitz; and have shown how, by a very partial consideration of the action of those natural powers called *pressures*, he has attempted to prove that moving forces are proportional to the squares of the velocities; and we showed briefly in what manner a right consideration of what passes when motion is produced by measurable pressures, proves that the forces really exerted are as the velocities produced. But the most copious proof is had from the present observation, that, in fact, the mutual actions of bodies depend on their relative motions alone.

69. The Leibnitzian measure of moving force is altogether incompatible with the universal fact now mentioned,

Second Law of Motion.

and is incompatible with their proportionality to the squares of those motions.

viz. that the relative motions of bodies, resulting from their mutual actions, are not affected by any common motion, or the action of any equal and parallel force on both bodies; for this universal fact imports, that when two bodies are moving with equal velocities in the same direction, a force applied to one of them, so as to increase its velocity, gives it the same motion relative to the other, as if both bodies had been at rest. Here it is plain that the space described by the body in consequence of the primitive force, and of the force now added, is the sum of the spaces which each of them would generate in a body at rest. Therefore the forces are proportional to the velocities or changes of motion which they produce, and not to the squares of those velocities. This measure of forces, or the position that a force makes the same change on any velocity whatever, and the independence of the relative motions on any motion that is the same on all the bodies of a system, are counterparts of each other. Since this independence is a matter of observation in all terrestrial bodies, we are entitled to say that the powers which the Author of nature has imparted to natural bodies are no way different from what are competent to matter once called into existence. And it also follows from this, that we must always remain ignorant of the absolute motions of bodies. The fact that it has required the unremitted study of ages to discover even the relative motions of our solar system, is an argument to prove that the influence of this mechanical principle extends far beyond the limits of this sublunary world; nor has any phenomenon yet been exhibited which should lead us to imagine that it is not universal.

So Bernoulli's defence of this last opinion is without force.

When we have made use of these arguments with some zealous partizans of Mr Leibnitz's doctrine, they have answered, that if indeed this independence of the relative motions of terrestrial bodies were observed to obtain exactly, it would be a conclusive argument. But the motion with which all is carried along is so great in comparison with the motions which we can produce in our experiments, that the small additions or diminutions that we can make to the velocity of this common motion must observe very nearly the proportions of the additions or diminutions of their squares. The differences of the squares of 2, 3, and 4, are very unequal; but the differences of the squares of 9, 10, 11, are much nearer to the ratio of equality; and the differences of the squares of 1000001, 1000002, 1000003, do not sensibly deviate from this ratio. But it is not fact that we cannot produce motions which have a very sensible proportion to the common motion. The motion of a cannon ball discharged with one third of its weight of powder, is nearly equal to that of the rotation of the earth's equator. When, therefore, we discharge the ball eastward, we double its motion; when to the westward, we destroy it. Therefore, according to Leibnitz, the action in the first case is three times the action in the second. In the first case it changes the square of the velocity (which we may call 1) from 1 to 4; and, in the second, it changes it from 1 to 0. But, say the Leibnitzians, the velocity of rotation is but $\frac{1}{63}$ of the orbital velocity of the earth, and our observations of the velocities of cannon bullets are not sufficiently exact to ensure us against an error of $\frac{1}{31\frac{1}{2}}$. But the latter observations on the peculiar motions of the fixed stars concur in showing, that the sun, with his attending planets, are carried along with a very great motion, which, in all probability, has a sensible ratio to the orbital motion of the earth. This must make a prodigious change on the earth's absolute motion, according as her orbital motion conspires with, opposes, or crosses, this other motion; the earth may even be at absolute rest in some points of its orbit. Thus will the composition with the motions produced in our experiments be so varied that cases *must* occur when the difference of the results of the two measures of force will be very sensible.

But, further, they have not attended to the agreement of our experiments when the discharges of cannon are made in a direction transverse to that of the common motion. Here the immensity of the common motion, and the minuteness of our experimental velocities, can have no effect in diminishing the difference of the results of the two doctrines. This will appear distinctly to every reader who is much conversant in disquisitions of this kind; and it is in these more moderate motions that the complete independence of the relative motions on the common motions most accurately appears. Pendulum clocks and watches have been often executed which do not deviate from perfect equability of motion one part in 86,400. This could not be obtained in all directions of the oscillations, if the forces deviated from the ratio of the velocities one part in 86,400.

Perfect agreement of the abstract notion of force with all our accurate observations of the exertions of natural powers.

On the whole, we may consider it as established on the surest foundation, that the action of those powers of natural bodies which we call *pressures*, such as the force of springs, the exertions of animals, the cohesion of bodies, as well as the action of those other incitements to motion which we call *attractions* and *repulsions*, such as gravitation, magnetism, and electricity, is proportional to the change of velocity produced by it. And we must observe here, that this is not a mere mode of conception, the result of the laws of human thought, which cannot conceive a natural power as the cause of motion otherwise than by its producing motion, and which cannot conceive any degree of *moving* power different from the degree of the motion. This is the abstract doctrine, and is true whether the pressures are proportional to the velocities or to the squares of the velocities.

But we see further, that whatever is the pressure of a spring (for example) on a quiescent body, yet the pressure actually exerted in producing a double velocity is only double, and not quadruple, as our first imperfect observations make us imagine.

Newton's third law of motion is founded on experience alone, and is not a necessary truth.

70. Sir Isaac Newton has added another proposition to the number of laws of motion; namely, that *every action is accompanied by an equal and contrary re-action.* But in affirming this to be a law of nature, he only means that it is a universal fact: and he makes this affirmation on the authority of what he conceives to be a law of human thought; namely, that those qualities which we find in all bodies on which we can make experiments and observations, are to be considered as universal qualities of body. But we have limited the term *law of motion* to those consequences that necessarily flow from our notions of motion, of the causes of its production and changes. Now this third Newtonian proposition is not such a result. A magnet is said to act on a piece of iron, when, and only when, the vicinity of the magnet is observed to be accompanied by certain motions of the iron. But it by no means follows from this observation, that the presence of the iron shall be accompanied by any motion, or any change of state whatever of the magnet, or any appearance that can suggest the notion that the iron acts on the magnet. When this was observed, it was accounted a discovery. Newton *discovered* that the sun acts on the planets, and that the earth acts on the moon; and Kepler *discovered* that the moon re-acts on the earth. Newton had observed that the iron re-acts on the magnet; that the actions of electrified bodies were mutual; and that every action of sublunary bodies was, in fact, accompanied by an equal and contrary re-action. On the authority of his rule of philosophizing, he affirmed that the planets re-act on the sun, and that the sun is not at rest, but is continually agi-

Second Law of Motion.

tated by a small motion round the general centre of gravitation. He pointed out several consequences of this re-action. Astronomers examined the celestial motions more narrowly, and found that those consequences do really obtain, and disturb all the planetary motions. It is now found that this reciprocity of action obtains throughout the solar system with the utmost precision, and that the third Newtonian proposition is really a law of nature, although it is not a law of human thought. It is a discovery. The contrary involves no absurdity or contradiction. It would indeed be contrary to experience; but things might have been otherwise. It is conceivable and possible that a ball A shall strike another equal ball B, and carry it along with it, without any diminution of its velocity. The fact that the velocity of A is reduced to one half, is the indication of a force residing in B, which force changes the motion of A; and the intensity of this force is learned from the change which it produces. This is found to be equal to the change produced by A on B. And thus the re-action of B is *discovered* to be equal to the action of A.

It is highly probable that this universality and equality of re-action to action is the consequence of some general principle, which we may in time discover; meanwhile we are entitled to suppose it universal, and to reason from this topic in our disquisitions about the actions of bodies on each other.

Maupertuis, Leibnitz, and other philosophers, have entertained very inadequate opinions concerning the foundation of the laws of motion.

Although the celebrated philosophers of Europe have at last agreed in the reception of the two propositions so largely discussed by us as the laws of motion, they have differed exceedingly in their opinion about their origin and validity. Some asserted that they are entirely matters of experience, while others affirmed them to be necessary truths. The Royal Academy of Berlin made this question the subject of their prize dissertation in the year 1744. Mr Maupertuis, president of the academy, published a dissertation, in which he endeavoured to prove that they are necessary truths, only because *they are such as make the quantity of action the least possible*, an economy which is worthy of infinite wisdom, and therefore certainly directs the choice of the Author of nature. On this account alone are they necessary truths.

But this is not the way to consider a question of this kind. We know too little about infinite wisdom to be able to say, with Messrs Leibnitz and Maupertuis, that the Deity should or should not impress on bodies laws different from those which are essential to matter; and we are not to inquire whether God could or could not do this. We know from our own experience, that matter, when subjected to the action of intelligence, may be moved in a way extremely different from what it would follow if left to itself, and that its motions may either be regulated by fixed but contingent law, or may be without any constancy whatever, and vary in every instance. When we suppose the existence of matter and motion, a variety of truths are involved in the supposition, in the same manner as all the theorems in the third book of Euclid's *Elements* are involved in the conception of a circle and a straight line. Our first employment should be to evolve those truths. We can do this in no way but by first noticing the relations of the ideas that we have of the different objects of contemplation, and then following the laws of human thought in our judgments concerning those relations. This process of the mind is expressed in the train of a geometrical demonstration. The different parts or argumentations of this train are not the causes of our conclusions, but the means by which we form our judgment; not the reasons of the truth of our ultimate conclusion, but the steps by which we arrive at the knowledge of it. The young geometer generally thinks otherwise. But that this is the matter of fact, is plain from this, that more than one demonstration, and often very different, can be given of the same theorem. We must proceed in the same manner in the present question; and the first general truths which we find involved in the notions of matter, motion, and force, must be received as *necessary* truths. The steps by which we arrive at the discovery are the laws of human thought; and the expression of the discovery, involving both the truth itself, and the manner of conceiving it, is a necessary law of motion. There may be other facts, perhaps as general as any of those necessary laws, but which do not necessarily result from the relations of our notions of motion and of force. These are discovered by observation only, and they serve to characterize the forces which nature presents to our view. These facts are *contingent* laws of motion.

We apprehend that this method has been followed in treating this article. The first proposition, termed *a law of motion*, is only a more convenient way of expressing our contemplation of a motion in body as an effect of the general cause which we term *force*. The second proposition does nothing but express more distinctly the relation between this cause and its effect; it expresses what we mean by the magnitude and the kind of the cause. The proposition, stating the composition of forces, is but another form of the same law, better suited to the ordinary procedure in geometrical disquisitions.

These propositions might have completed the doctrines of dynamics; but it appears that, in order to the production of a material universe which should accomplish the purposes of the Creator, it was necessary that there be certain characteristic differences between the forces inherent in the various collections of matter which compose this universe. The facts or physical laws (for the above-mentioned laws are metaphysical) of motion may be different from those which would have been observed had matter been left entirely to itself. This difference may have introduced other laws of motion as necessarily resulting from the nature of the forces. We have occasionally mentioned some instances where this appears to obtain, but gave good reasons for affirming that a due examination of all circumstances which may be observed in the production or variation of motion by those forces, has demonstrated, that there are no such deviations from the two laws of motion already determined, but that all the mechanical powers of bodies, when considered merely as causes of motion, act agreeably to the same laws. Careful examination was, however, said to be necessary.

This examination must consist in distinctly noticing the circumstances that occur in the production of motion by any force whatever. It is by no means enough to state simply the intensity of the force and the direction of its exertion. If a force continue to act, it continues to vary the motion already produced. Should the force change its intensity or direction while it is acting, these circumstances must induce still farther changes in the motion; and it is not till all action has ceased that the motion is brought to its ostensible state, in which it is the object of our attention and our future discussions. Instances of the effects of such continued and such varied actions are to be seen in most of the phenomena of nature or art. The communication of motion by impulse is perhaps the only instance (very frequent indeed) that can be produced where this is not necessary; nay, we shall perhaps find reason to conclude that this instance is not an exception, and that even the communication of motion from one billiard ball to another is brought about by an action continued for some time, and greatly varied during that time. Much preparation is therefore necessary before we can apply the

Of Accelerated and Retarded Motions.

general laws of motion to the solution of most of the questions which come before us in the course even of our elementary disquisitions. We must lay down some general propositions which determine the results of the continued, and perhaps varied, actions of moving forces; and we must mark the different effects of the simple continuation of action, and also those of the variations in this continued action, both in respect of intensity and direction. The effect of a mere continuance of action must be an acceleration of the motion, or a retardation of it if the force continue to act in the opposite direction. The effect of the continued action of a transverse force must be a continual deflection, that is, a curvilineal motion. These must therefore now occupy our attention in their order.

OF ACCELERATED AND RETARDED MOTIONS.

Circumstantial exposition of our conception of the condition of a body in respect to motion.

71. All men can perceive that a stone dropped from the hand, or sliding down an uniform slope, has its motion continually accelerated, and that the motion of an arrow rising perpendicularly through the air is continually retarded; and they feel no difficulty in conceiving these changes of motion as the effects of the continual operation of their weight or heaviness. The falling stone is in a different condition in respect of motion in the beginning and end of its fall. In what respect do these states of the body differ? Only in respect to what we call its *velocity*. This is an affection of motion; it is an expression of the relation between the two notions or ideas which concur to form the idea of motion, namely, the space and the time. These are all the circumstances that we observe in a motion. Time elapses, and during its currency a space is described. The term *velocity* expresses the magnitude of the space, which corresponds to some unit of time. Thus the rate of a ship's motion is determined when we say that it is nine miles in an hour, or nine miles per hour. We sometimes say (but awkwardly) "the motion is at the rate or with the velocity of a mile in three days." It is most conveniently expressed by a number of some given units of length, which completely make up the line described during this unit of time. But the mechanicians express it in a way more general by a fraction, of which the numerator is a number of inches, feet, yards, fathoms, or miles, and the denominator is the number of seconds, minutes, or hours employed in moving along this line. This is a very proper expression; for when we speak of any velocity, and continue to reason from it, we conceive ourselves to speak of something that remains the same, in the different occasions of using the term. Now if the velocity be constant, it is indifferent how long the line may be, because the time of its description will be lengthened in the same proportion. Thus if 48 feet be described in 12 seconds, 36 feet will be described in 9 seconds, 16 feet will be described in 4 seconds, &c. Now $\frac{48}{12}$, $\frac{36}{9}$, and $\frac{16}{4}$, are fractions of equal value, being equal to $\frac{4}{1}$, or 4, that is, to the velocity of 4 feet per second. The value of this fraction, or the quotient of the number of the units of length, divided by the number of units of time, is the number of those units of length described uniformly in one unit of time.

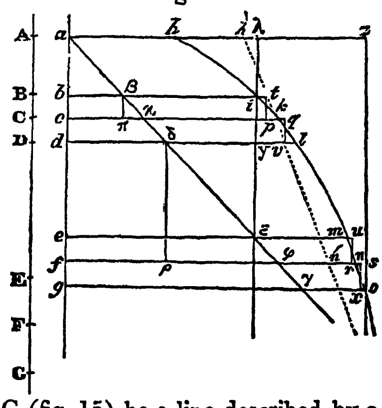
Magnitude of a velocity of which we

But how shall we determine the velocity in any instant or in any point of a motion that is continually changing? Suppose that a body has fallen 144 feet, and that we would ascertain its velocity in that point of its fall, or the velocity which it has in passing through that point. In the next second the body falls 112 feet farther. This cannot be the measure of the velocity at the beginning of the fourth or the end of the third second. It is too great. The fall during the preceding second was 80 feet. This is too small. The mean of these two, or $\frac{80+112}{2}, = \frac{192}{2} = 96$, is probably more exact. Due attention to the nature of this motion shows us that 96 is the proper measure, or that the motion at that instant is at the rate of 96 feet per second. But it is peculiar to this kind of motion that the half sum of the spaces described in two succeeding equal moments is the measure of the velocity in the middle instant. Therefore this method will not generally give an accurate measure. Yet it is indispensably necessary to obtain some accurate measure; for it is in this particular alone that the state of the body differs from its similar state in another instant. The difference of place makes no distinction; for if a body continue its motion unchanged, its condition in every different instant of time, or point of space, is unchanged, or the same. The change of place is not a change of motion, but is involved in the very conception of the continuation of the motion. The change of condition consists, therefore, in the change of velocity: therefore the change of velocity is the only indication and the only measure of the action (perhaps accumulated) of the changing force. It is therefore the chief object of our search; and accurate measures of velocity are absolutely necessary.

72. When the velocity changes continually, there can be no *actual* measure of it. In what then does the magnitude of a velocity consist, when there is no actual measure of it? It is a certain undescribable *determination*, by which, if not changed, a certain space *would* be uniformly described in a given unit of time. Thus we know, that if, when a stone has fallen sixteen feet, its motion be directed along a horizontal plane, without diminution, it will move on for ever at the rate of thirty-two feet per second. The space which would be thus described is not the velocity, but the measure of the velocity. But the proportions of those spaces, being the proportions of those measures, are the proportions of the velocities themselves. We may discover these proportions in the following manner.

Momentary proportion of velocities that are continually changing.

Fig. 15.



Fundamental requisite in all mechanical disquisitions.

Let ACG (fig. 15) be a line described by a body with a motion any how continually but gradually varied; and let it be required to determine the proportion of the velocity in any point C to the velocity in any other point F.

Axiom.—If A be to B in a ratio that is greater than any ratio less than that of C to D, but less than any ratio greater than that of C to D, then A is to B as C to D.

Take the straight line *acg* to represent the time of the body's motion along ACG, so that the points *a*, *c*, *f*, *g*, may represent the instants of time in which the body passes through the points A, C, F, G; and the portions *ac*, *cf*, *fg*, of the line *ag*, may represent the times employed in describing the portions AC, CF, FG; and therefore *ac* is to *af* as the time of describing AC to the time of describing AF.

Of Accelerated and Retarded Motions.

Moreover, let *hkno* be a line so related to the straight line *acfg*, by the perpendicular ordinates *ah*, *ck*, *fn*, *go*, that the areas *ackh*, *afnh*, *agoh*, may be proportional to the portions AC, AF, AG, of the line described by the moving body; and let this relation be true with respect to every point B, D, E, &c. and the corresponding points *b*, *d*, *e*, &c.

Then it is affirmed that *the velocity in the point* C *is to the velocity in the point* F *as ck is to fn.*

Let the equal lines *bc*, *cd*, *ef*, *fg*, represent equal moments of time, and let B, D, E, G, be the points through which the body is passing at the instants *b*, *d*, *e*, *g*. Then the areas *bikc*, *ckld*, *emnf*, *fnog*, will represent, and be proportional to, the spaces BC, CD, EF, FG, which are described during the moments *bc*, *cd*, *ef*, *fg*.

Draw *tp* parallel to *ag*, so as to make the rectangle *btpc* equal to the trapezium *bikc;* and draw the lines *qv*, *ur*, *sx*, in the same manner, so that each rectangle may be equal to its corresponding trapezium.

If the motions had been uniform during the moments *bc* and *fg*, that is, if the spaces BC and FG had been uniformly described, then the velocity in the point C would have been to the velocity in the point F as *cp* to *fs;* for since the rectangles *btpc* and *fsxg* are respectively equal to the trapeziums *bikc* and *fnog*, and since *bikc* is to *fnog* as BC is to FG, the rectangle *btpc* is to the rectangle *fsxg* as BC to FG. But because these two rectangles have equal altitudes *bc* and *fg*, they are to each other in the proportion of their bases *cp* and *gx*, or *cp* and *fs*. Therefore BC is to FG as *cp* to *fs*. But if BC and FG are uniformly described in equal times, they are proportional to the velocities of those uniform motions. Therefore *cp* is to *fs* as the velocity with which BC is uniformly described to the velocity with which FG is uniformly described in an equal time.

But the motion expressed by the figure is not uniform, because the line *hlo* recedes from the axis *ag*, and the areas, cut off by the parallel ordinates, increase in a greater proportion than the corresponding parts of the axis; that is, the spaces increase faster than the times; for the moments *bc*, *cd*, *ef*, *fg*, being all equal, it is evident that the corresponding slips of the area continually augment. The motion is swifter at the instant *c* than at the instant *b*, and the velocity at the instant *c* is *greater* than that with which the space BC would be uniformly described in the same time. For the same reason, the velocity at the instant *f* is *less* than that with which the space FG would be uniformly described in the same time. Therefore the velocity at the instant *c* is to the velocity at the instant *f* in a greater ratio than that of *cp* to *fs*. In the very same manner, it will appear, by comparing the motion during the moment *cd* with the motion during the moment *ef*, that the velocity at the instant *c* is to the velocity at the instant *f* in a less ratio than that of *cq* to *fr*.

Therefore the velocity in the point C is to the velocity in the point F in a greater ratio than that of *cp* to *fs*, but in a less ratio than that of *cq* to *fr*.

But by continually diminishing the equal moments *bc*, *cd*, *ef*, *fg*, it is evident that *cp* and *cq* continually approach to equality with *ck*, and *fr* and *fs* continually approach to equality with *fn;* that when *cp* is less than *ck*, *fs* is greater than *fn*, and when *cq* is greater than *ck*, *fr* is less than *fn*.

Therefore the velocity in the point C is to the velocity in the point F in a ratio that is greater than the ratio of *any* line less than *ck* to *any* line greater than *fn*, but which is less than the ratio of any line greater than *ck* to any line less than *fn*. Therefore the ratio of the velocity in C to the velocity in F is greater than any ratio that is less than that of *ck* to *fn;* but it is less than any ratio that is greater than that of *ck* to *fn*. Therefore the velocity in the point C is to the velocity in the point F as *ck* to *fn*.

This important theorem may be expressed in more general terms as follows:

If the abscissa ag of a line hko represent the time of any motion, and if the areas bounded by parallel ordinates be proportional to the spaces described, the ordinates are proportional to the velocities.

Remark.—The propriety or aptitude of expressing the time by the portions of the axis *acg* will perhaps appear more clearly in the following manner:

Let *acg* be any straight line, and let *h'kv* be another line straight or curved. Let the straight line *ahz*, perpendicular to *ag*, be carried uniformly down along this line, keeping always perpendicular to it, and therefore always parallel to its first position *ahz*. In its various situations *ckz*, *emz*, &c. it will cut off areas *ackh*, *aemh*, &c. bounded by the axis, by the ordinates *ah* and *ck*, or by the ordinates *ah* and *em*, &c. and by the line *hkg*. By this motion the moveable ordinate is said, in the language of modern geometry, to *generate* the areas *ackh*, *aemh*, &c. At the same time, let a point A move along the line ACG, setting out from A at the instant when the line *az* sets out from *a;* and let the motion of the point A be so regulated that the spaces AB, AC, AD, &c. generated by this motion may increase at the same rate with the areas *abih*, *ackh*, *adlh*, &c. or such that we shall have AB to AC as *abih* to *ackh*, &c. It is plain that the motion along AG is the same with that described in the enunciation of the proposition; for because the motion of the ordinate *az* along the axis *ag* is supposed to be uniform, the spaces *ab*, *ac*, *ad*, &c. are proportional to the times in which they are described, and may therefore be taken to measure or to represent those times.

73. Cor. 1. *In a motion continually varied, the velocities in the different points of the path are to each other in the limiting or ultimate ratio of the spaces described in equal times,* those times being supposed to diminish continually; for it is evident that if the equal moments *bc*, *cd*, *ef*, *fg*, are supposed to diminish continually till the instants *b* and *d* coalesce with *c*, and the instants *e* and *g* coalesce with *f*, then the ratio of *ck* to *fn* is the limit of the continually increasing ratio of *cp* to *fs*, or of the continually diminishing ratio of *cq* to *fr*. Sir Isaac Newton calls this the ultimate ratio of *cp* to *fs*, or of *cq* to *fr*. Now the ratio of *cp* to *fs* is, by construction, the same with the ratio of the rectangle *btpc* to the rectangle *fsxg*, and the ratio of *cq* to *fr* is the same with the ratio of the rectangle *cqvd* to the rectangle *eurf*. But the ratio of the rectangle *btpc* to the rectangle *fsxg* is the same with the ratio of the space *bikc* to the space *fnog;* that is (by hypothesis) the same with the ratio of the space BC to the space FG; and the ratio of the rectangles *cqvd* and *eurf* is the same with that of the spaces CD and EF. Therefore the ratio of the velocity at C to the velocity at F is the same with the ultimate ratio of the small increments BC, FG, or CD, EF of the spaces generated in very small and equal times.

It is also evident, that because the ratio of *ck* to *fn* is the limit both of the ratio of *cp* to *fs* and of the ratio of *cq* to *fr*, these ultimate ratios are the same, and that we may say that the velocity in C is to the velocity in F in the ultimate ratio of BC to EF, or in the ultimate ratio of CD to FG.

We also can easily perceive that the ratio of the area *bikc* to the area *emnf* approaches more near to the ratio of *ck* to *fn* as we take the moments *bc* and *ef* smaller. Therefore, in many cases of practice, where it may be easy to measure the spaces described in the different small moments of the motion, but difficult to ascertain their ultimate ratio, so as to obtain accurate measures of

Of Accelerated and Retarded Motions.

the proportions of the velocities, we may reduce the errors of measurement to something very insignificant, by taking these moments extremely small; and we shall diminish the error still more by taking the proportion of the half sum of BC and CD to the half sum of EF and FG for the proportion of the velocities in C and F.

It often happens that we have it not in our power to compare the spaces described in small moments which are precisely equal. Still we can find the exact proportion of the velocities, if we can ascertain the ultimate ratio of the increments of the spaces, and the ultimate ratio of the moments of time in which these increments are described; for it is plain, by considering the gradual approach of the points p and r to the points k and n, that the ratio of ck to fn is still the ultimate ratio of the bases of rectangles equal to the mixtilineal areas, whether the altitudes (representing the moments) are equal or not. Now the bases of two rectangles are in the proportion of the rectangles directly, and of their altitudes inversely. But the ultimate ratio of the altitudes is the ultimate ratio of the moments, and the ultimate ratio of the rectangles is the ultimate ratio of the spaces described in those unequal moments. Therefore, in such cases, we have,

74. Cor. 2. *The velocities are in the ratio compounded of the direct ultimate ratio of the momentary increments of the spaces, and the inverse ultimate ratio of the increments (or moments) of the times in which these increments of the spaces are made.*

If s, v, and t, are taken to represent the magnitudes of the spaces, velocities, and times, and if ds, dt, and dv, are taken always in the limiting or ultimate ratio of their momentary increments,[1] we shall have v always in the proportion of ds directly, and of dt inversely. We express this by the proportional equation $v \doteqdot \frac{ds}{dt}$, which is equivalent to the analogy $V : v = \frac{dS}{dT} : \frac{ds}{dt}$, or $V : v = dSdt : dsdT$.

75. N. B. Here observe that this is not the only way of stating the relation of space and time—the abscissa may be made the time, and the ordinate the space: then the velocity $= \frac{dy}{dx}$.

The converse of this proposition may be thus expressed.

Converse theorem.

76. *If the axis ag of the line hko represent the time of a varied motion along the line* AG, *and if the ordinates ah, bi, ck, &c. be as the velocities in the instants a, b, c, or in the points* A, B, C; *then the areas abih, ackh, adlh, &c. are proportional to the spaces* AB, AC, AD, &c.

This may be demonstrated in the same way with the former; but the indirect demonstration is more brief, and equally strict.

If the spaces AC, AF, &c. are not proportional to the areas *ackh*, *afnh*, &c. they are proportional to some other areas *ackh'*, *afn'h'*, &c. which are bounded by the same ordinates, and by another line *h'kn'*. But because the areas *ackh'*, *afn'h'*, &c. are always proportional to the spaces AC, AF, &c. described on the line AG, the velocity in the point C is to the velocity in the point F as the ordinate *ck* is to the ordinate *fn'*; but, by hypothesis, the velocity in C is to the velocity in F as *ck* to *fn*, and *fn'* is equal to *fn*, which is absurd. Therefore the spaces AC, AF, are not proportional to any other areas, &c.

77. Cor. *The ultimate ratio of the momentary increments of the spaces is compounded of the ratio of the velocities, and the ultimate ratio of the increments of the times:* for when the moments *bc*, *ef*, are equal, it is evident that the ultimate ratio of the rectangles *bcpt*, *efru* is the same with the ultimate ratio of the increments of the spaces. But the ultimate ratio of these rectangles is the same with that of their bases *cp* and *fr*; that is, the ratio of *ck* to *fn*, that is, the ratio of the velocities. And when the moments are unequal, the ratio of the rectangles is compounded of the ratio of their bases and the ratio of their altitudes; that is, compounded of the ratio of the velocities and the ultimate ratios of the moments of time.

We have therefore $dS : ds = VdT : vdt$ and $ds \doteqdot vdt$.

It most commonly happens that we can only observe the accumulated results of varied motions, and in them we only observe a space passed over, and a certain portion of time that has elapsed during the motion; but being able to distinguish the portions of the whole space which are described in known portions of the whole time, and having made such observations in several parts of the motion, we discover the general law that the motion affects, and we affirm this law to hold universally, even though we have not observed it in *every* point. We do this with a degree of probability and confidence proportioned to the frequency of our observation. It is not till we have done this that we can make use of the first of these two propositions, which enables us to ascertain the velocity of the motion in its different moments. Thus, if we observe that a stone in falling descends one foot in the quarter of a second, 16 feet in a second, 64 feet in two seconds, and 144 feet in three seconds, the general law immediately observed is, "that the spaces described are as the squares of the times;" for 1 is to 16 as the square of $\frac{1}{4}$ to the square of 1. Again, 16 is to 64 as 1^2 to 2^2, and 16 is to 144 as 1^2 to 3^2. Hence we infer, with great probability, that the stone would fall 36 feet in a second and a half; for 16 is to 36 as 1^2 to $1\frac{1}{2}^2$; and we conclude in the same way for all other parts of the motion.

A good example of geometrical method.

78. This immediate observation of the analogy between the spaces and the squares of the times suggests an easy determination of the velocity in this particular kind of motion, and it merits particular notice, being very often referred to. We can take *ag* to represent the time, and then, because the areas which are to represent the spaces described must be proportioned to the squares of the portions of *ag*, we perceive that the line which comes in place of *hko* must be a straight line drawn from *a*; for example, the straight line $a\delta\gamma$; for this is the only boundary which will give areas $ab\beta$, $ac\varkappa$, $ad\delta$, &c. proportional to ab^2, ac^2, ad^2, &c. And we perceive that *any* straight line drawn from *a* will have this property.

Having thus got our representations of the times and the spaces, we say, on the authority of our theorem, that the velocity at the instant *b* is to the velocity at the instant *d* as $b\beta$ to $d\delta$, &c. And now we begin to make inferences purely geometrical, and express our discovery of the velocities in a very general and simple manner. We remark, that $b\beta$ is to $d\delta$ as *ab* is to *ad*; and we make the same affirmation concerning the magnitudes represented by these lines. We say that the velocity at the instant *b* is to the velocity at the instant *d* as the time *ab* is to the time *ad*. We say, in terms still more general, that the velocities are proportional to the times from the beginning of the motion. We moreover perceive, that the spaces are

[1] In this article, as originally printed, the symbols $\dot{s}$, $\dot{t}$, and $\dot{v}$ were employed to represent the things here denoted by ds, dt, and dv: a like change in the notation of the fluxions of the quantities will be made throughout the article

Of Accelerating and Retarding Forces.

also proportional to the squares of the acquired velocities; or the velocities are as the square roots of the spaces.

We can further infer, from the properties of the triangle, that the momentary increments of the spaces are proportional to the momentary increments of the squares of the times, or of the squares of the velocities.

We also observe, that not only the whole acquired velocities are proportional to the whole elapsed times, but that the increments of the velocities are proportional to the times in which they are acquired; for $\pi\kappa$ is to $\rho\phi$ as bc to df, &c. Equal increments of velocity are therefore acquired in equal times. Therefore such a motion may, in great propriety of language, be denominated a *uniformly accelerated motion;* that is, *a motion in which we observe the spaces proportioned to the squares of the times, is a motion uniformly accelerated;* and spaces in the duplicate ratio of the times form the ostensible characteristic of an uniformly accelerated motion.

79. Lastly, if we draw $\iota\lambda$ parallel to the axis ab, we perceive that the rectangle $ae\iota\lambda$ is double of the triangle $ae\iota$. Now, because ae represents the time of the motion, and $e\iota$ represents the acquired velocity, the rectangle $ae\iota\lambda$ will represent the space which would be uniformly described with the velocity $e\iota$ during the time ae. But the triangle $ae\iota$ represents the space really described with the uniformly accelerated motion during the same time. Hence we infer, that the space that is described in any time, with a motion increasing uniformly from nothing, is one half of the space which would be uniformly described during the same time with the final velocity.

These are but a part of the inferences which we may draw from the geometrical properties of those representations which we had selected of the different measureable affections of motion. We may affirm, with respect to the motions themselves, all the inferences which relate to magnitude and proportion, and thus improve our knowledge of the motions.

We took the opportunity of this very simple and perspicuous example, to give our readers a just conception of the *mathematical method* of prosecuting mechanical knowledge, and to make them sensible of the unquestionable authority for every theorem deduced in this manner.

One of the most important is, to discover the accumulated result of a motion of which we only observe the momentary increments. This is to be done by finding the area, or portions of the area, of the mixtilineal space *agoh;* and it is evidently analogous to the inverse method of fluxions, or the integral calculus.

In most cases, we must avail ourselves of the corollary $ds \doteq vdt$, and we obtain the solution of our question only in the cases where our knowledge of the quantities ds, dt, and v (considered as geometrical magnitudes, that is, as lines and surfaces), enables us to discover s and t.

OF ACCELERATING AND RETARDING FORCES.

80. Having thus discovered the proportions of the velocities in motions varying in any manner whatever, we can observe the variations which happen in them. These variations are the effects, and the only marks and measures, of the changing forces. They are the characteristics of their kinds (considered merely as moving forces); that is, the indications of the directions in which they act; for this is the only difference *in kind* of which they are susceptible in this general point of view. If they increase the velocity, their direction must be conceived as the same with that of the previous motion; because the result of the action of a force is equivalent to the composition of the motion which that force would produce in a quiescent body with the motion already existing; and an increase of velocity is equivalent to the composition of a motion in the same direction.

Of Accelerating and Retarding Forces.

Having no other mark of the force but the acceleration, we have no other name for it in the abstract doctrines of dynamics, and we call it an *accelerating force.* Had it retarded the motion, we should have called it a *retarding force.*

In like manner we have no measure of the *magnitude* or *intensity* of an accelerating force, but the acceleration which it produces. In order therefore to investigate the powers which produce all the changes of motion, we must endeavour to obtain measures of the acceleration.

A continual increase of velocity is the effect of the continued action of accelerating forces. If equal increments of velocity are produced in every succeeding equal moment of time, we cannot conceive that there is any change in the accelerating force. Therefore a uniformly accelerated motion is the mark of the unvaried action of an accelerating force, that is, of the continued action of a constant force; of a force whose intensity is always the same. When therefore we observe a body describe spaces proportional to the squares of the times, we must infer that it is urged forward by a force whose intensity does not change; and, on the other hand, a constant force must produce a uniformly accelerated motion by its continued action. And if any previous circumstances assure us of this continued action of an invaried force, we may make all the inferences which were mentioned under the article of uniformly accelerated motion.

Measure of an accelerating force.

81. That force must surely be accounted double which produces a double increment of velocity in the same time by its uniform action; we can form no other estimation of its magnitude. And in general, *accelerating forces must be accounted proportional to the increments of velocity which they produce, by acting uniformly during the same or equal times.*

Supposing them to act on a body at rest. Then the velocity produced is itself the increment; and we must say that accelerating forces are proportional to the velocities which they generate in a body in equal times. And because we found (No. 79), that the space described with a uniformly accelerated motion is half the space which would be uniformly described in the same time with the final velocity, which space is the direct measure of this velocity, and because halves have the same proportion with the wholes—we may say that *accelerating forces are proportional to the spaces through which they impel a body from rest in equal times by their uniform action.*

Another measure.

This is an important remark; because it gives us an easy measure of the force, without the trouble of first computing the velocities. It also gives us the only distinct notion that we have of the measurement of forces by the motions which they produce. When speaking of the composition of forces, we distinguished or denominated them by the sides and diagonal of a parallelogram. These lines must be conceived as proportional to the spaces through which the forces urge the body *uniformly* during the small and insensible time of their action, which time is supposed to be the same for both forces; for the sides of the parallelogram are supposed to be separately described in equal times, and therefore to be proportional to the velocities generated by the constituent forces. If indeed the forces do not act uniformly, nor similarly, nor during equal times, we cannot say (without farther investigation) what is the proportion of the intensity of the forces, nor can we infer the composition of their action. We must at least suppose, that in every instant of this very small time of their joint action, their direction remains unchanged, and that their intensities are in the

same ratio. We shall see by and by, that with these conditions the sides of the parallelogram are still proportional to the velocities generated. In the mean time we may take the spaces through which a body is uniformly impelled from rest (that is, with a uniformly accelerated motion) as the measures of the forces; yet these spaces are but the halves of the measures of the velocities. Then, if a body be moving with the velocity of thirty-two feet per second, and an accelerating force acts on it during a second, and if this force be such that it would impel the body (from a state of rest) sixteen feet, it will add to the body a velocity of thirty-two feet per second. Accordingly, this is the effect of gravity—the weight of a pound of lead may be considered as a force which does not vary in its intensity. We know that it will cause the lead to fall sixteen feet in a second; but if the body has already fallen sixteen feet, we know that it is then moving with the velocity of thirty-two feet per second. And the fact is, that it will fall forty-eight feet farther in the next second, and will have acquired the velocity of sixty-four feet per second. It has therefore received an augmentation of thirty-two feet of velocity by the action of gravity during the second second; and gravity is in fact a constant force, causing equal increments of velocity in equal times, however great the velocities may be. It does not act like a stream of fluid, whose impulse or action diminishes as the solid body withdraws from it by yielding.

But supposing that we have not compared the increments of velocity uniformly acquired during equal times, in what manner shall we measure the accelerating forces? In such a case that force must be accounted double which generates the same velocity, by acting uniformly during half the time; for when the force is supposed invariable, the changes of velocity which it produces are proportional to the times of its action; therefore if it produces an equal velocity in half the time, it will produce a double velocity in an equal time, and is therefore a double force. The same may be said of every proportion of time in which an equal change of velocity is produced by the uniform action of an accelerating force. The force must be accounted greater in the same proportion that the time required for the production of a given velocity in a body is less. Hence we infer that *accelerating forces are inversely proportional to the times in which a given change of velocity is produced by their uniform action.*

82. By combining these two propositions, we establish this general theorem:

Measure of accelerating force.

Accelerating forces are proportional to the changes of velocity which they produce in a body by their uniform action directly, and to the times in which these changes are produced inversely.

If, therefore, A and a are the forces, V′ and v' the changes of velocity, and T′ and t' the portions of time in which they are uniformly produced, we have

$$\mathrm{A} : a = \mathrm{V}'t' : v'\mathrm{T}', = \frac{\mathrm{V}'}{\mathrm{T}'} : \frac{v'}{t'}$$

$$\text{and } a \doteqdot \frac{v'}{t'}.$$

The formula $a \doteqdot \dfrac{v'}{t'}$ is not restricted to any particular magnitude of v' and t'. It is true, therefore, when the portion of time is diminished without end; for since the action is supposed uniform, the increment of velocity is lessened in the same proportion, and the value of the fraction $\dfrac{v'}{t'}$ remains the same. The characters or symbols v' and t' are commonly used to express *finite* portions of v and t. The symbols $\dot{v}$ and $\dot{t}$ are used by Newton to express the same things taken in the ultimate or limiting ratio. (These have been changed to dv and dt throughout this article.) They are usually considered as *indefinitely small* portions of v and t. We shall abide by the formula $a \doteqdot \dfrac{dv}{dt}$.

83. It must always be kept in mind, that v and t are abstract numbers; and that v refers to some unit of space, such as a foot, an inch, a yard; and that t refers to some unit of time, such as an hour, a minute, a second; and especially that a is the number of the same units of space, which will be uniformly described in *one* unit of the time with the velocity generated, by the force acting uniformly during *that* unit. It is twice the space actually described by the body during that unit when impelled from rest by the accelerating force. It is necessary to keep hold of these clear ideas of the quantities expressed by the symbols.

Is an abstract number.

On the other hand, when the measure of the accelerating force is previously known, we employ the theorem $at = v'$; that is, the addition made to the velocity during the whole or any part of the time of the action of the force is obtained by multiplying the acceleration of one unit of time by the number of such units contained in t'.

Measure of a change of velocity.

These are evidently leading theorems in dynamics, because all the mechanical powers of nature come under the predicament of accelerating or retarding forces. It is the collection of these in any subject, and the manner in which they accompany or are inherent in it, which determine the mechanical character of that subject; and therefore the phenomena by which they are brought into view are the characteristic phenomena. Nay, it may even be questioned whether the phenomena bring any thing more into view. This force, of which we speak so familiarly, is no object of distinct contemplation; it is merely a something that is proportional to $\dfrac{dv}{dt}$. And when we observe that the $\dfrac{d\mathrm{V}}{d\mathrm{T}}$, found in the motions that result from the vicinity of a body A, is double of the $\dfrac{dv}{dt}$ which results from the vicinity of another body B, we say that a force resides in A, and that it is double of the force residing in B. The accelerations are the things immediately and truly expressed by these symbols. And the whole science of dynamics may be completely taught without once employing the word *force*, or the conception which we imagine that we form of it. It is of no use till we come to study the mechanical history of bodies. Then, indeed, we must have some way of expressing the fact, that an acceleration $= \dfrac{32 \text{ feet}}{1''}$ is observed in every thing on the surface of this globe; and that an acceleration $= \dfrac{418 \text{ feet}}{1''}$ is observed over all the surface of the sun. These facts are characteristic of this earth and of the sun; and we express them shortly by saying that such and such forces reside in the earth and in the sun. It will preserve us from many mistakes and puzzling doubts, if we resolutely adhere to this meaning of the term *force;* and this will carry mathematical evidence through the whole of our investigations.

These measures express the greatest part of our knowledge of mechanical nature.

84. As velocity is not an immediate object of contemplation, and all that we observe of motion is a space and a time, it may be proper to give an expression of this measure of accelerating force which involves no other idea. Supposing the body to have been previously at rest, we

Another measure of accelerating force.

Of Accelerating and Retarding Forces.

have $a \doteqdot \frac{v}{t}$. Multiply both parts of the fraction by t which does not change its value, and we have $a \doteqdot \frac{vt}{t^2}$.

But $vt = s$; and therefore $a \doteqdot \frac{s}{t^2}$.

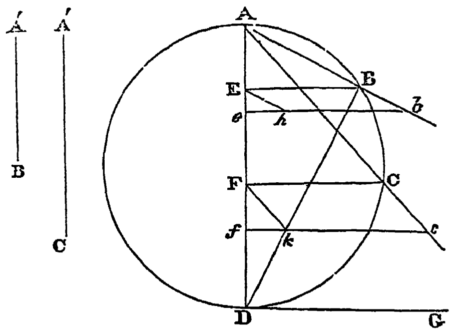
The formula $a = \frac{s}{t^2}$ is equivalent to the proportion $t^2 : 1 = s : a$; and a would then be the space through which the accelerating force would impel the body in one unit of the time t. But this is only half of the measure of the velocity which the accelerating force generates during that unit of time. For this reason we did not express the accelerating force by an ordinary equation, but used the symbol $\doteqdot$. In this case, therefore, of uniform action, we may express the accelerating force by $a = \frac{2s}{t^2}$.

85. The following theorem is of still more extensive use in all dynamical disquisitions.

Most general measure of accelerating force.

Accelerating forces are proportional to the momentary increments of the squares of the velocities directly, and as the spaces along which they are uniformly acquired inversely.

Fig. 16.



Let A′B, A′C, and AD (fig. 16) be three lines, described in the same or equal times by the uniform action of accelerating forces; the motions along these lines will be uniformly accelerated, and the lines themselves will be proportional to the forces, and may be employed as their measures. On the greatest of them, AD, describe the semicircle ABCD, and apply the other two lines A′B, A′C as chords AB, AC. Draw EB, FC perpendicular to AD. Take any small portions Bb, Cc of AB and AC, and draw be, cf perpendicular to AD, and Eh and Fk parallel to AB and AC.

Then, because the triangles DAB and BAE are similar, we have $AD : AE = AD^2 : AB^2$. And because AD is to AB as the velocity generated at D is to the velocity generated at B (the times being equal), we have AD to AE as the square of the velocity at D to the square of the velocity at B; which we may express thus:

$$AD : AE = V^2, D : V^2, B.$$

For the same reasons we have also

$$AD : AF = V^2, D : V^2, C. \quad \text{Therefore}$$
$$AE : AF = V^2, B : V^2, C.$$

But because in any uniformly accelerated motion, the spaces are as the squares of the acquired velocities, we have also

$$AE : Ae = V^2, B : V^2 b, \text{ and}$$
$$AF : Af = V^2, C : V^2 c.$$

Therefore Ee is to Ff as the increment of the square of the velocity acquired in the motion along Bb to the increment of the square of the velocity acquired along Cc.

But by similarity of the triangles ABD and Eeh, we have

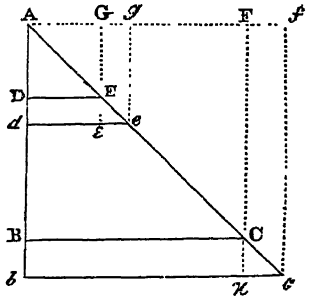
$$AB : AD = Ee : Eh; \text{ and in like manner,}$$
$$AD : AC = Fk : Ff. \quad \text{Therefore}$$
$$AB : AC = Ee \times Fk : Ff \times Eh.$$

Now AB and AC are proportional to the forces which accelerate the body along the lines A′B and A′C; Ee and Ff are proportional to the increments of the squares of the velocities acquired in the motions along the portions Bb and Cc; and Eh and Fk are equal to those portions respectively. The ratio of AB to AC is compounded of the direct ratio of Ee to Ff, and the inverse ratio of Eh to Fk. The proposition is therefore demonstrated.

The proportion may be expressed thus:

$AB : AC = \frac{Ee}{Eh} : \frac{Ff}{Fk}$, and may be expressed by the proportional equation $AB \doteqdot \frac{Ee}{Eh}$, or symbolically, $a \doteqdot \frac{d(v^2)}{ds}$.

Fig. 17.



vdv is but one half of the increment of v^2

REMARK.—Because the motion along any of these three lines is uniformly accelerated, the relation between spaces, times, and velocities, may be represented by means of the triangle ABC (fig. 17); where AB represents the time, BC the velocity, and ABC the space. If BC be taken equal to AB, the triangle is half of the square ABCF of the velocity BC; and the triangle ADE is half of the square ADEG of the velocity DE. Let Dd and Bb be two moments of time, equal or unequal. Then DdeE and BbcC are half the increments of the squares of the velocities DE and BC, acquired during the moments Dd and Bb. It was demonstrated that the ratio of the area DdeE to the area BbcC is compounded of the ratio of DE to BC, and the ultimate ratio of Dd to Bb. But Dd and Bb are respectively equal to εe and $\varkappa c$. Therefore DdeE is to BbcC, in the ratio compounded of the ratio of DE to BC, and the ultimate ratio of εe to $\varkappa c$. If we represent DE and BC by V and v, then εe and $\varkappa c$ must be represented by V′ and v', the increments of V and v; and then the compound ratio will be the ratio of VV′ to vv'; and if we take the ultimate ratio of the moments, and consequently the ultimate ratio of the increments of the velocities, we have the ratio of VdV to vdv. If therefore V^2 and v^2 represent the squares of the velocities, VdV and vdv will represent, not the increments of those squares, but half the increments of them.

We may now represent this proposition concerning accelerating forces by the proportional equation $a \doteqdot \frac{vdv}{ds}$;

and we must consider this as equivalent with $a = \frac{V^2 - v^2}{2(S - s)}$;

keeping always in mind that a, V, and v, relate to the same units of time and space, and that a is that number of units of the scale on which S and s are measured, which is run over in *one* unit of time.

Of Accelerating and Retarding Forces.

This will be more clearly conceived by taking an example. Let us ascertain the accelerative power of gravity, supposing it to act uniformly on a body. Let the spaces be measured in feet and the time in seconds. It is

Measure of gravity considered as an accelerating force.

a matter of observation, that when a body has fallen 64 feet, it has acquired a velocity of 64 feet per second; and that when it has fallen 144 feet, it has acquired the velocity of 96 feet per second. We want to determine what velocity gravity communicated to it by acting on it during one second. We have $V^2 = 9216$, and $v^2 = 4096$; and therefore $V^2 - v^2 = 5120$. $S = 144$, and $s = 64$, and $S - s = 80$, and $2(S - s) = 160$. Now $a = \frac{5120}{160}, = 32$. Therefore gravity has generated the velocity 32 feet per second by acting uniformly during one second.

86. *The augmentation of the square of the velocity is proportional to the force and to the space jointly.* For, because $a = \frac{vdv}{ds}$, we have $ads = vdv$.

Thus we learn, that a given force, acting uniformly on a body along a given space, produces the same increment of the square of the velocity, whatever the previous velocity may have been. Also, in the same manner as we formerly found that the augmentation of the velocity was proportioned to the time during which the force has acted, so the augmentation of the square of the velocity is proportional to the space along which it has acted.

Theorems respecting retarding forces.

It is pretty plain, that all that we have said of the uniform action of an *accelerating* force may be affirmed of a *retarding* force, taking a diminution or decrement of velocity in place of an increment. A uniformly retarded motion is that in which the decrements of velocity in equal terms are equal, and the whole decrements are proportional to the whole times of action. Such a motion is the indication of a constant or invariable force acting in a direction opposite to that of the motion. We conceive this to be the case, when an arrow is shot perpendicularly upwards; its weight is conceived as a force continually pressing it perpendicularly downwards.

In such motions, however great the initial velocity may be, the body will come to rest; because a certain determined velocity will be taken from the body in each equal successive moment, and some multiple of this will exceed the initial velocity. Therefore the velocity will be extinguished before the end of a time that is the same multiple of the time in which the velocity was diminished by the quantity above mentioned. It is no less evident that the time in which any velocity will be extinguished by an opposing or retarding force, is equal to the time in which the same force would generate this velocity in the body previously at rest. Therefore,

87. (1.) The times in which different initial velocities will be extinguished by the same opposing force are proportional to the initial velocities.

88. (2.) The distances to which the body will go till the extinction of its velocity, are as the squares of the initial velocities.

(3.) They are also as the squares of the times elapsed.

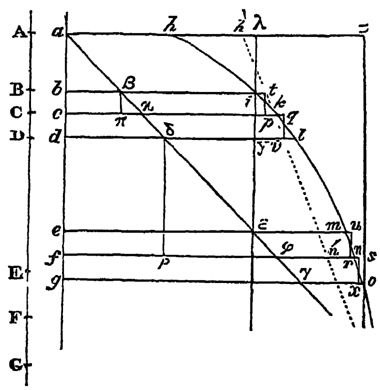
89. (4.) The distance to which a body, projected with any velocity, will go till its motion be extinguished by the uniform action of a retarding force, is one half of the space which it would describe uniformly during the same time with the initial velocity.

Forces generally variable in their intensity.

It very rarely happens that the force which accelerates the body acts uniformly, or with an unvaried intensity. The attraction of a magnet, for example, increases as the iron approaches it. The pressure of a spring diminishes as it unbends. The impulse of a stream of water or wind diminishes as the impelled surface retires from it by yielding. Therefore the effects of accelerating forces are very imperfectly explained, till we have shown what motions result from any given variation of force, and how to discover the variation of force from the observed motion. This last question is perhaps the most important in the study of mechanical nature. It is only thus that we learn what is usually called *the nature of a mechanical force.* This chiefly consists in the relation subsisting between the intensity of the force and the distance of the substance in which it resides. Thus the nature of that power which produces all the planetary motions, is considered as ascertained, when we have demonstrated that its pressure or intensity is inversely as the square of the distance from the body in which it is supposed to reside.

Acceleration expresses some relation of the velocity and time. This relation may be geometrically expressed in a variety of ways. In fig. 18 the uniform acceleration, or the unvaried relation between the velocity and the time, is very aptly expressed by the constant ratio of the ordinates and abscisses of the triangle *agv*. The ratio of $d\delta$ to *ad* is the same with that of $e\varepsilon$ to *ae*, or that of $f\varphi$ to *af*, &c.; or the ratio of the increment of velocity $\pi\varkappa$ to the increment of the time $\beta\pi$ or *bc*, or that of $\iota\varphi$ to $\varepsilon\iota$, &c. This ratio $\pi\varkappa : \beta\pi$ is equivalent to the symbol $\frac{dv}{dt}$.

Fig. 18.



But when the spaces described in a varied motion are represented by the areas bounded by a curve line *hko*, we no longer have that constant ratio of the increments of the ordinates and abscisses.

Their measures in such cases how obtained. Theorems of most extensive use.

90. Therefore, in order to obtain measures of the accelerating forces, or at least of their proportions, let the abscissa *aeg* (fig. 18) of the line *hko* again represent the time of a motion. But let the areas bounded by parallel ordinates now represent the velocities; that is, let the whole area increase during the time *ag* at the same rate with the velocities of the motion along the line AG. In this case the ordinates *bi*, *ck*, *dl*, &c. will be as the accelerations at the instants *b*, *c*, *d*, &c. or in the points B, C, D, &c.

This is demonstrated in the same way as the former proposition (No. 72). If the accelerating force be supposed constant during any two equal moments *bc* and *fg*, the rectangles *bcpt* and *fgxs* would express the increments of velocity uniformly acquired in equal times, and their bases *cp* and *fs* would have the ratio of the accelerations, or of the accelerating forces. But as the velocities expressed by the figure increase faster than the times during every moment, the force at the instant *c* is to the force at the instant *f* in a greater ratio than that of *cp* to *fs*; but, for similar reasons, it is in a less ratio than that of *cq* to *fr*; and therefore (as in the other proposition) the force at the instant *c* is to the force at the instant *f* as *ck* to *fn*.

91. *Cor.* Because *cp* is to *fs* in the ratio compounded of

Of Accelerating and Retarding Forces.

the direct ratio of the rectangle *cptb* to the rectangle *fsxg*, and the inverse ratio of the altitude *bc* to the altitude *fg*; and because these rectangles are proportional to the increments of velocity, and the ultimate ratio of the altitudes is the ultimate ratio of the moments or increments of the time, we must say that *the accelerating forces (that is, their intensities or pressures producing acceleration) are directly as the increments of velocity, and inversely as the increments of the times;* which proposition may be expressed in regard to two accelerations A and a, by this analogy:—

$$A : a = \frac{dV}{dT} : \frac{dv}{dt}.$$

Or by the proportional equation $a \doteq \frac{dv}{dt}$. Also $adt \doteq dv$, and $\int adt = v'$. And thus do these theorems extend even to the cases where there cannot be observed an immediate measure either of velocity or of acceleration, because neither the space nor the velocity increases uniformly.

The theorem $a \doteq \frac{dv}{dt}$ is employed when we would discover the variation in the intensity of some natural power.[1] We observe the motion, and represent it by a figure analogous to fig. 18, where the abscissa represents the times, and the area is made to increase at the same rate with the spaces described. Then the ordinates will represent the velocities, or have the proportion of the velocities. Then we may draw a second curve on the other side of the same abscissa, such that the areas of this last curve shall be proportional to the ordinates of the first. The ordinates of this last curve are proportional to the accelerating forces.

92. On the other hand, when we know from other circumstances that a force, varying according to some known law, acts on a body, we can determine its motion. The intensity of the force in every instant being known, we can draw a line so related to another line representing the time, that the ordinates shall be proportional to the forces. The areas will be proportional to the velocities. We can draw another curve to the same absciss, such that the ordinates of this shall be proportional to the areas of the other, that is, to the velocities of the motion. The areas of this second curve will be proportional to the spaces described.

All these theorems relate to *changes* of velocity; by which means they indicate *immediately* the operation of natural powers.

93. We must now observe, that all that has been said concerning the effects of accelerating forces continually varying, relates to *changes* of motion, independent of what the absolute motions may be. The areas of the line whose ordinates represent the velocities do not necessarily represent the spaces described, but the change made on the spaces described in the same time; not the motions, but the changes of motion. If, indeed, the body be supposed to be at rest when the forces begin to act, these areas represent the very spaces that are passed over, and the ordinates are the very velocities. In every case, however, the accelerations are the real increments of the velocities.

This circumstance gives a great extension to our theorems, and enables us to ascertain the disturbances of any species of regular motion, apart from the motions themselves, and thus avoid a complication which would frequently be inextricable in any other way. And this process, which is merely mathematical, is perfectly conformable to mechanical principles. It is in fact an application of the doctrine of the composition of motion; a doctrine rigidly demonstrated when we measure a mechanical force by the *change* of motion which it produces. Acceleration is the continual composition of a new motion with the motion already produced.

No finite change of velocity can be produced in an instant by any accelerating force.

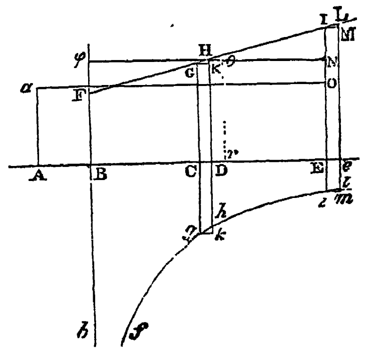
We may learn from this investigation of the value of an accelerating force, that no finite change of velocity is effected in an instant by the action of an accelerating force. When the fig. 18 is used for the scale of accelerations, and they are represented by the ordinates of the line *hko*, the increment of velocity is represented by an area, that is, by a slip of the whole area; which slip must have some altitude, or must occupy some portion of the abscissa which represents time. Some portion of time, however small it may be, must elapse before any measurable addition can be made to the velocity. The velocity must change *continually*. As no motion can be conceived as instantaneous, because this would be to conceive that in one instant the moving particle is in every point of its momentary path,—so no velocity can change, by a finite quantity, in one instant, because this would be to conceive that in that instant the particle had all the intervening velocities. The instant of change is at once the last instant of the preceding velocity, and the first of the succeeding, and therefore must belong to both. This cannot be conceived, or is absurd. As a body, in passing from one part of space to another, must pass in succession through all the intermediate places; so, in passing from one velocity to another, it must in succession have all the intermediate velocities. It must be *continually* accelerated—we must not say *gradually*—however small the steps.

But to return from this digression:

More convenient manner of considering the action of forces, and more frequently coming into view.

94. The most frequent cases which come under examination do not show us the relation between the forces and times, but the relation between the forces and spaces. Thus, when a piece of iron is in the neighbourhood of a magnet, or a planet is considered in the neighbourhood of the sun, a force is acting on it in every point of its path, and we have discovered that the intensity of this force varies in a certain proportion. Thus, a spring varies in its pressure as it unbends; gunpowder presses less violently as it expands, &c. &c.

Fig. 19.



Our knowledge is generally confined to some such effect as this. We know, that while a body is moving along a line, ADE (fig 19), it is urged forward by a force, of which the intensity varies in the proportion of the ordinates BF, CG, DH, EI, &c. of the line FGHI.

To investigate the motion or change of motion produced by the action of this force, let CD be supposed a very small portion of the space s, which we may express by s'. Draw GK perpendicular to DH. Then, if we suppose that the

[1] See Barrow's *Lect. Geometr.* passim.

Of Accelerating and Retarding Forces.

force acts with the unvaried intensity CG through the whole space CD, the rectangle CDKG will express half of the increment of the square of the velocity (No. 85). We may suppose that the force acts uniformly along the adjoining small space Dr with the intensity DH. The rectangle DHor will in like manner express another half increment of the square of the velocity. And in like manner we may obtain a succession of such increments. The aggregate or sum of them all will be half the difference between the square of the velocity at B and the square of the velocity at E.

If we employ f to express the indetermined or variable intensity of the accelerating force, and v to express the variable velocity, and v' its increment *uniformly* acquired, then the rectangle CDKG will be expressed by fs'. We have seen that this is equal to vv'. Therefore, in every case where we can tell the aggregate of all the quantities fs, it is plain that we will obtain half the difference between the squares of the velocities in B and E, on the supposition that the intensity of the force was constant along each little space, and varied by starts. Then, by increasing the number and diminishing the magnitude of those little portions of the space without end, it is evident that we terminate in the expression of the real state of the case, *i. e.* of a force varying continually; and that in this case the aggregate of these rectangles occupies the whole area AEIF, and is equivalent to the fluent of fds, or to the symbol $\int fds$, used to express this fluent, which is conceived an aggregate of small rectangles fs'. And we see that this area expresses half of the augmentation of the square of the velocity. Therefore,

Most important theorem.

95. *If the abscissa* AE (fig. 19) *of a line* FGI *is the path along which a body is urged by an accelerating force, and if the ordinates* BF, CG, DH, *&c. are proportional to the forces acting in the points* B, C, D, *&c. the intercepted areas* BCGF, BEIF, *&c. are proportional to the augmentations of the square of the velocity.*[1]

Observe that the areas BCGF and DEIH are also proportional to the augmentations made on the squares of the velocities in B and in D.

Observe also, that it is indifferent what may have been the original velocity. The action of the forces represented by the ordinates make always the same addition to its square; and this addition is half the square of the velocity which those forces would generate in the body by impelling it from rest in the point A.

96. Lastly, on this head, observe, that we can state what constant or variable force will make the same augmentation of the square of the velocity by impelling the body uniformly along the same space BE, or along what space a given force must impel the body in order to produce the same increase of the square of its velocity. In the first case, we have only to make a rectangle BENφ, equal to the area BEIF, and then Bφ is the intensity of the constant force wanted. In the second case, in which the force EO is given, we must make the rectangle AαOE equal to the area BEIF, and AE is the space required.

97. The converse of this proposition, viz. *if the areas are as the increments of the square of the velocity, the ordinates are as the forces,* is easily demonstrated in the same way; for if the elementary areas CDKG and EIMe represent increments of the squares of the velocity, the accelerating forces are in the ratio compounded of the direct ratio of these rectangles and the inverse ratio of their altitudes, because these altitudes are the increments of the space (No. 85). Now the base CG of the rectangle CDKG is to the base EI of the rectangle EIMe in the same compounded ratio; therefore the force in C is to the force in E as CG to EI.

Scales of force, velocity, acceleration, time, &c.

98. The line hko (fig. 18) was called by Dr Barrow (who first introduced this extensive employment of motion into geometry) the SCALE *of velocities;* and the line FHL (fig. 19) was named by him the *scale of accelerations.* Hermann, in his *Phoronomia,* calls it the *scale of forces.* We shall retain this name, and we may call hko of fig. 18 the *scale* of accelerations, when the areas represent the velocities. Sir Isaac Newton added another scale of very great use, viz. a scale of times. It is constructed as follows.

99. Let ABE (fig. 19) be the line along which a body is accelerated, and let FHI be the scale of forces, that is, having its ordinates FB, HD, IE, &c. proportional to the forces acting at B, D, E, F, &c.; let fhi be another line so related to ABE, that Cg is to Ei in the inverse subduplicate ratio of the area BFGC to the area BFIE; or, to express it more generally, let the squares of the ordinates to the line fgi be inversely as the areas of the line FHI intercepted between these ordinates and the first ordinate drawn through B; then the times of the bodies moving from a state of rest in B are as the intercepted areas of the curve fgi.

For let CD and Ee be two very small portions of the space described in equal times. They will be ultimately as the velocities in C and E. The area FBCG is to the area FBEI as the square of Ei to the square of Cg (by construction); but the area FBCG is to FBEI as the square of the velocity at C to the square of the velocity at E (by the proposition); therefore the square of the velocity at C is to the square of the velocity at E as the square of Ei to the square of Cg; therefore Ei is to Cg as the velocity at C to the velocity at E, that is, as CD to Ee: but since Ei : Cg = CD : Ee, we have Ei × Ee = Cg × CD, and the elementary rectangles CgkD and Eime are equal, and may represent the equal moments of time in which CD and Ee were described. Thus the areas of the line fgl will represent or express the times of describing the corresponding portions of the abscissa.

We may express the nature of this scale more briefly thus. Let BE be the space described with any varied motion, and fgl a curve, such that its ordinates are inversely as the velocities in the different points of the abscissa, then the area will be as the times of describing the corresponding portions of the abscissa.

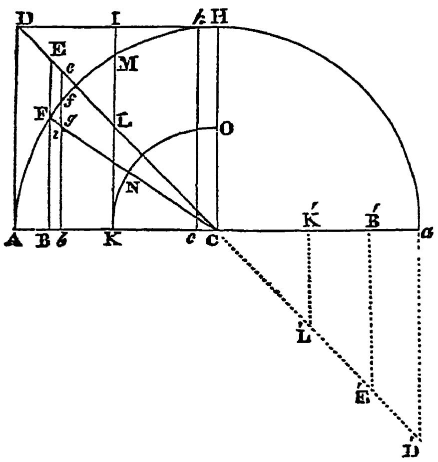
Example of the application of No 95.

100. In all the cases where our mathematical knowledge enables us to assign the values of the ordinates of the figure 19, we can obtain the law of action of the forces, or the nature of the force; and where we can assign the value of the areas from our knowledge of the proportions of the ordinates or forces, we can ascertain the velocities of the motion. We shall give an example or two, which will show the way in which we avail ourselves of the geometrical properties of figure in order to ascertain the effects of mechanical forces.

(1.) In fig. 19, let the accelerating force which impels the body along the line AB be constant, and let the body be previously at rest in B; the line which bounds the ordinates that represent the forces must be some line φHN parallel to AB. The area BDHφ is to the area BENφ as the square of the velocity at D to the square of the velocity at E. These areas, having equal bases DH and EN, are as their altitudes BD and BE; that is, the spaces described are as the squares of the acquired velocities. And we see that this characteristic mark of uniformly accelerated motion is included in this general proposition.

[1] Newton's *Principia*, i. 39.

Fig. 20.



101. (2.) Let us suppose that the body is impelled from A (fig. 20), towards the point C, by a force proportional to its distance from that point. This force may be represented by the ordinates DA, EB, *eb*, &c. to the straight line DC. We may take any magnitude of these ordinates; that is, the line DC may make any angle with AC. It will simplify the investigation if we make the first force AD = AC. About C describe the circle AH*a*, cutting the ordinate EB in F; let *eb* be another ordinate, cutting the circle in *f* very near to F; draw CH perpendicular to AC, and make the arch H*h* = *f*F, and draw *hc* parallel to HC; join FC and DH, and draw F*g* perpendicular to *fb*. Let IML be another ordinate.

The area DABE is to the area DAKL as the square of the velocity at B to the square of the velocity at K. But DABE is the excess of the triangle ADC above the triangle EBC, or it is half of the excess of the square of CA or CF above the square of CB, that is, half the square of BF. In like manner, the area DAKL is equal to half the square of KM; but halves have the same ratio as the integers; therefore the square of BF is to the square of KM as the square of the velocity at B to the square of the velocity at K; therefore the velocity at B is to the velocity at K as BF is to KM. The velocities are proportional to the sines of the arches of the quadrant AFH described on AC.

Cor. 1. The final velocity with which the body arrives at C is to the velocity in any other point B as radius to the sine of the arch AF.

Cor. 2. The final velocity is to the velocity which the body would acquire by the uniform action of the initial force at A as 1 to $\sqrt{2}$; for the rectangle DACH expresses the square of the velocity acquired by the uniform action of the force DA; and this is double of the triangle DAC; therefore the squares of these velocities are as 1 and 2, and the velocities are as $\sqrt{1}$, and $\sqrt{2}$, or as 1 to $\sqrt{2}$.

102. *Cor.* 3. The time of describing AB is to the time of describing AC as the arch AF to the quadrant AFH.

For when the arch F*f* is diminished continually, it is plain that the triangle *fi*F is ultimately similar to CFB, by reason of the equal angles C*ib* (or CFB) and *fi*F, and the right angles CBF and *f*F*i*; therefore the triangles *fg*F and CBF are also similar. Moreover, B*b* is equal to F*g*, F*f* is equal to *h*H, which is ultimately equal to *c*C; therefore, since the triangles *fg*F and CFB are similar, we have F*g* : F*f* = FB : CF = FB : HC; therefore B*b* is to *c*C as FB to HC, that is, as the velocity at B to the velocity at C; therefore B*b* and *c*C are described in equal moments when indefinitely small; therefore equal portions F*f*, *h*H, of the quadrant correspond to equal moments of the accelerated motion along the radius AC; and the arches AF, FM, MH, &c. are proportional to the times of describing AB, BK, KH, &c.

Cor. 4. The time of describing AC with the unequally accelerated motion, is to the time of describing it uniformly with the final velocity as the quadrantal arch is to the radius of a circle; for if a point move in the quadrantal arch so as to be in F, *f*, M, H, &c. when the body is in B, *b*, K, C, it will be moving uniformly, because the arches are proportional to the times of describing those portions of AC; and it will be moving with the velocity with which the body arrives at C, because the arch *h*H is ultimately = C*c*. Now if two bodies move uniformly with this velocity, one in the arch AFH, and the other in the radius AC, the times will be proportional to the spaces uniformly described; but the time of describing AFH is equal to the time of the accelerated motion along AC, therefore the proposition is manifest.

103. *Cor.* 5. If the body proceed in the line C*a*, and be retarded in the same manner that it was accelerated along AC, the time of describing AC uniformly with the velocity which it acquires in C is to the time of describing AC*a* with the varied motion, as the diameter of a circle to the circumference; for because the momentary retardations at K′, B′, &c. are equal to the accelerations at K and B, &c. the time of describing AC*a* is the same with that of describing AH*a* uniformly with the greatest velocity; that is, to the time of describing AC uniformly as AH*a* to AC, or as the circumference of a circle to the diameter; therefore, &c. N. B. In this case of retarding forces it is convenient to represent them by ordinates K′L, B′E, *a*D′, lying on the other side of the axis AC*a*; and to consider the areas bounded by these ordinates as subtractive from the others. Thus the square of the velocity at K′ is expressed by the whole area DACK′L′C, the part C′K′L′ being negative in respect of the point DAC. This observation is general.

Cor. 6. The time of moving along KC, the half of AC, by the uniform action of the force at A, is to that of describing AC*a* by the varied action of the force directed to C, and proportional to the distance from it, as the diameter of a circle to the circumference; for when the body is uniformly impelled along KC by the constant force IK, the square of the velocity acquired at C is represented by half the rectangle IKCH, and therefore it is equal to the velocity which the variable force generates by impelling it along AC (by the way, an important observation). The body will describe AC uniformly with this velocity in the same time that it is uniformly accelerated along KC. Therefore by *Cor.* 5 the proposition is manifest.

Cor. 7. If two bodies describe AC and KC by the action of forces which are everywhere proportional to the distances from C, their final velocities will be proportional to the distances run over, and the times will be equal.

For the squares of the final velocities are proportional to the triangle ADC, LKC, that is, to AC^2, KC^2, and therefore the velocities are as AC, KC. The times of describing AC and KC uniformly, with velocities proportional to AC and KC, must be equal; and these times are in the same ratio (viz. that of radius to $\frac{1}{4}$ of the circumference) to the times of describing AC and KC with the accelerated motion. Therefore, &c.

Thus, by availing ourselves of the properties of the circle, we have discovered all the properties or characters of a motion produced by a force always directed to a fixed point, and proportional to the distance from it. Some of these are remarkable, such as the last corollary; and they are all important, for there are innumerable cases where this law of action obtains in nature It is nearly the law

of action of a bowstring, and of all elastic bodies, when their change of figure during their mutual action is moderate; and it has been by the help of this proposition first demonstrated in a particular case by Lord Brouncker and Mr Huygens, that we have been able to obtain precise measures of time, and consequently of actual motions, and consequently of any of the mechanical powers of nature. It is for this reason, as well as for the easy and perspicuous employment of the mathematical method of proceeding, that we have selected it.

Instead of giving any more particular cases, we may observe in general, that if the intensity of the force be proportional to any power whose index is $n-1$ of the distance, and if a be the distance from the fixed point at which the body begins to be accelerated, and x its distance from the point in any part of the motion, the velocity will be $\doteqdot \sqrt{\overline{a^n - x^n}}$. This is very plain, because the increment CGHD of the area of fig. 19, which is also the increment of the square of the velocity, is $\doteqdot x^{n-1}dx$, and the area is $\doteqdot x^n$; and the whole area, corresponding to the distance a, is a^n. Therefore the portion of the area lying beyond the distance x is $a^n - x^n$. This is as the square of the velocity, and therefore the velocity is as the square root $\sqrt{\overline{a^n - x^n}}$ of this quantity.

This proposition, $fds \doteqdot vdv$, or $f \doteqdot \frac{vdv}{ds}$, is the 39th of the first book of Newton's *Principia*, and is perhaps the most important in the whole doctrine of dynamics, whether employed for the investigation of forces or for the explanation of motions. It furnishes the most immediate data for both purposes, but more especially for the last. By its help Sir Isaac Newton was able to point out the numerous disturbances of the planetary motions, and to separate them from each other; thus unravelling, as it were, that most intricate motion in which all are blended together. He has given a most wonderful specimen of its application in his Lunar Theory.

We now are able to explain all the puzzling facts which were adduced by Leibnitz and his partisans in support of their measure of the forces of bodies in motion. We see why four springs, equally bent, communicate but a double velocity, and nine springs but a triple velocity; why a bullet moving twice as fast will penetrate an earthen rampart to a quadruple depth, &c. &c.

Conservatio virium vivarum.

This theorem also gives a most perspicuous explanation of the famous doctrine called *conservatio virium vivarum.* When perfectly elastic bodies act on each other, it is found that the sum of the masses multiplied by the squares of the velocities is always the same. This has been substituted, with great encomiums, by the German philosophers, in place of Descartes's principle, that the quantity of motion in the universe, estimated in one direction, remains always the same. They are obliged, however, to acknowledge, that in the actions of perfectly hard bodies, there is always a loss of *vis viva,* and therefore have denied the existence of such bodies. But there is the same loss in the mutual actions of all soft or ductile, or even imperfectly elastic, bodies; and they are miserably puzzled how to explain the fact; but both the *conservatio* and the *amissio* are necessary consequences of this theorem.

In the collision of elastic bodies, the whole change of motion is produced during the short time that the bodies are compressed, and while they regain their figure. When this is completed, the bodies are at the same distance from each other as when the mutual action began. Therefore the preceding body has been accelerated, and the following body has been retarded along equal spaces; and in every point of this space the accelerating and the retarding force has been equal. Consequently the same area of fig. 20 expresses the change made on the square of the velocity of both bodies. Therefore, if V and U are the velocities before collision, and v and u the velocities after collision, of the two bodies A and B, we must have $A \times \overline{V^2 - v^2} = B \times \overline{u^2 - U^2}$, and therefore $A \times V^2 + B \times U^2 = A \times v^2 + B \times u^2$.

But in the other class of bodies, which do not completely regain their figure, but remain compressed, they are nearer to each other when their mutual action is ended than when it began. The foremost body has been accelerated along a shorter space than that along which the other has been retarded. The mutual forces have in every instant been equal and opposite. Therefore the area which expresses the diminution of the square of the velocity must exceed the area expressing the augmentation by a quantity that is always the same when the permanent compression is the same; that is, when the relative motion is the same. $A \times \overline{V^2 - v^2}$ must exceed $B \times \overline{u^2 - U^2}$, and $A \times V^2 + B \times U^2$ must exceed $A \times v^2 + B \times u^2$.

This same theorem is of the most extensive use in all practical questions in mechanic arts; and without it mechanics can go no farther than the mere statement of equilibrium.

History of No. 95 is curious.

Hermann, professor of mathematics at Pavia, one of the ornaments of the mathematical class of philosophers, has given a pretty demonstration of this valuable proposition, in the *Acta Eruditorum Lipsiæ* for 1709; and says, that having searched the writings of the mathematicians with great care, he found himself warranted to say, that Newton was the undoubted author, and boasts of his own as the first synthetical demonstration. The purpose of this assertion was not very apparent at the time; but long after, in 1746, when Hermann's papers, preserved in the town-house of Pavia, were examined, in order to determine a dispute between Maupertuis and Koenig about the claim to the discovery of *the principle of least action,* letters of Leibnitz's were found, requesting Hermann to search for any traces of this proposition in the writings of the mathematicians of Europe. Leibnitz was by this time the envious detractor from Newton's reputation, and could not but perceive that all his contorted arguments for his doctrine received a clear explanation by means of this proposition, in perfect conformity to the usual measure of moving forces. Newton had discovered this theorem long before the publication of the *Principia,* and even before the discovery of the chief proposition of that book in 1666; for in his Optical Lectures, the materials of which were in his possession in 1664, he makes frequent use of a proposition founded on this. (See No. 42.) We may here remark, that Hermann's demonstration is in every step the same with Dr Barrow's demonstration of it as a theorem merely geometrical, without speaking of moving forces (see *Lect. Geometr.* xi. p. 85, edit. 16), but giving it as an instance of the transformation of curves, which he calls *scales* of velocity, of time, of acceleration, &c. It is very true that Barrow in these mathematical lectures approached very near to both of Newton's discoveries, the fluxionary geometry, and the principles of dynamics; and the junto on the Continent, who were his continual detractors, charge him with impudent plagiarism from Dr Barrow, and even say that he has added nothing to the discoveries of his teacher. But surely Dr Barrow was the best judge of this matter; and, so far from resenting the use which Newton has made of what he had taught him, he was charmed with the genius of the *juvenis spectatissimus* his scholar, and of his own accord gave him his professorial chair, and ever after lived in the utmost harmony and friendship with him. Nay, it would even appear

from some expressions in those very lectures, that Dr Barrow owed to young Newton the first thought of making such extensive use of motion in geometry. We recommend this work of Barrow's to the serious perusal of our readers, who wish to acquire clear notions of the science of motion, and an elegant taste in their mechanical disquisitions. After all the cultivation of this science by the commentators and followers of Newton, after the *Phoronomia* of Hermann, the *Mechanica* of Euler, the *Dynamique* of D'Alembert, and the *Mechanique Analytique* of De la Grange, which are undoubtedly works of transcendent merit and utility, the *Principia* of Newton will still remain the most pleasing, perspicuous, and elegant specimen of the application of mathematics to the science of *universal mechanics*, or what we call DYNAMICS.

The two fundamental theorems $fdt = dv$, and $fds = vdv$, enable us to solve every question of motion accelerated or retarded by the action of the mechanical powers of nature. But the employment of them may be greatly expedited and simplified by noticing two or three general cases which occur very frequently.

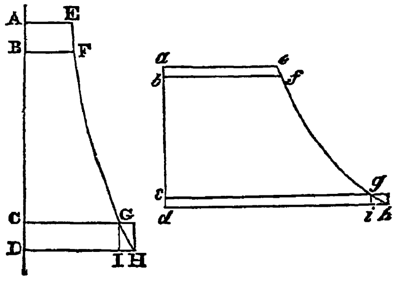
Similar instants and points, what.

104. *These may be called similar instants of time, and similar points of space which divide given portions of time, and of space in the same ratio.* Thus the middle is a similar instant of an hour or of a day, and is the similarly situated point of a foot or of a yard. The beginning of the 21st minute, and of the 9th hour, are similar instants of an hour and of a day. The beginning of the fifth inch, and of the second foot, are similar points of a foot and of a yard.

Similar actions, what.

105. *Forces may be said to act similarly when their intensities in similar instants of time, or in similar points of space, are in a constant ratio.* Thus in fig. 20, when one body is impelled towards C from A, and another from K, each with a force proportional to the distance of every point of its motion from C, these forces may be said to act similarly along the spaces AC and KC, or during the times represented by the quadrantal arches AFH, KNO. The following propositions on similar actions will be found very useful on many occasions; but we must premise a geometrical lemma.

Fig. 21.

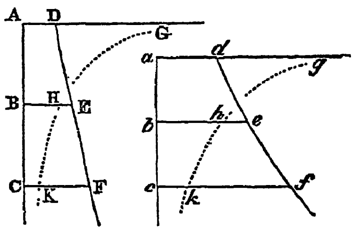


106. If there be two lines EFGH (fig. 21), *efgh*, so related to their abscisses AD, *ad*, that the ordinates BF, *bf*, drawn from similar points B and *b* of the abscisses, are in the constant ratio of AE to *ae*; then the area ADHE is to the area *adhe* as the rectangle of AD × AE to the rectangle *ad* × *ae*.

For, let each abscissa be divided into the same number of equal and very small parts, of which let CD and *cd* be one in each. Inscribe the rectangles CGID, *cgid*. Then because the number of parts in each axis is the same, the lengths of the portions CD and *cd* will be proportional to the whole abscisses AD and *ad*. And because C and *c* are similar points, CG is to *cg* as AE is to *ae*. Therefore CD × CG : *cd* × *cg* = AD × AE : *ad* × *ae*. This is true of each pair of corresponding rectangles, and therefore it is true of their sums. But when the number of these rectangles is increased, and their breadth diminished without end, it is evident that the ultimate ratio of the sum of all the rectangles, such as CDHG, to the sum of all the rectangles *cdhg*, is the same with that of the area ADHE to the area *adhe*, and the proposition is manifest.

107. *If two particles of matter are similarly impelled during given times, the changes of velocity are as the times and as the forces jointly.*

Fig. 22.



Let the times be represented by the straight lines ABC (fig. 22), and *abc*, and the forces by the ordinates AD, BE, CF, and *ad*, *be*, *cf*. Then if B and *b* are similar instants (suppose the middles) of the whole times, we have BE : *be* = AD : *ad*. Therefore, by the lemma, the area ACFD is to *acfd* as AC × AD to *ac* × *ad*. But these areas are proportional to the velocities (No. 72), and the proposition is demonstrated. For the same reason, the change of velocity during the time AB is to the change during *ab* as AB × AD to *ab* × *ad*.

Cor. 1. If the times and forces are reciprocally proportional, the changes of velocity are equal; and if the forces are inversely as the times, the changes of velocity are equal.

108. *If two particles be similarly urged along given spaces, the changes made on the squares of the velocities are as the forces and spaces jointly.*

For if AC (fig. 22) and *ac* are the spaces along which the particles are impelled, and the forces are as the ordinates AD and *ad*, the areas ACFD and *acfd* are as the changes on the squares of the velocities. But these areas are as AC × AD, and *ac* × *ad*. Therefore, &c.

Cor. 2. If the spaces are inversely as the forces, the changes of the squares of the velocities are equal; and if these are equal, the spaces are inversely as the forces.

Cor. 3. If the spaces along which the particles have been impelled from a previous state of rest, are directly as the forces, the velocities are also as the forces. For, because the changes of the squares of the velocities are as the spaces and forces jointly, they are in this case as the squares of the forces or of the spaces; but the changes of the squares of the velocities are in this case the whole squares of the velocities; therefore the squares of the velocities are as the squares of the forces, and the velocities are as the forces. N. B. This includes the motions represented in fig. 20.

109. *If two particles be similarly impelled along given spaces, from a state of rest, the squares of the times are proportional to the spaces directly, and to the forces inversely.*

Let ABC (fig. 22), *abc*, be the spaces described, and AD, *ad*, the accelerating forces at A and *a*. Let V, B express the velocity at B, and *v*, *b* the velocity at *b*.

Let GHK and *ghk* be curves whose ordinates are inversely as the velocities at the corresponding points of the abscissa. These curves are therefore exponents of the times (No. 99). Then, because the forces act similarly, we have, by the last theorem, $AC \times AD : ac \times ad = V^2, B : v^2, b, = hb^2 : HB^2$. Therefore $HB : hb = \sqrt{ac \times ad} : \sqrt{AC \times AD}$, and therefore in a con-

Of Accelerating and Retarding Forces.

stant ratio. Call this the ratio of m to n. But since the ordinates of the lines GHK, ghk, are inversely as the velocities, the areas are as the times (No. 99); and since these ordinates are in the constant ratio of m to n, the areas are in the ratio of AC $\times$ m to $ac \times n$. Therefore (calling the times of the motions T and t), we have

$\mathrm{T} : t = m \times \mathrm{AC} : n \times ac$; and therefore
$\mathrm{T}^2 : t^2 = m^2 \times \mathrm{AC}^2 : n^2 \times ac^2$. But
$m^2 : n^2 = ac \times ad : \mathrm{AC} \times \mathrm{AD}$. Therefore
$\mathrm{T}^2 : t^2 = ac \times ad \times \mathrm{AC}^2 : \mathrm{AC} \times \mathrm{AD} \times ac^2$,
or $\mathrm{T}^2 : t^2 = ad \times \mathrm{AC} : \mathrm{AD} \times ac$.

$$\text{Or } \mathrm{T}^2 : t^2 = \frac{\mathrm{AC}}{\mathrm{AD}} : \frac{ac}{ad}.$$

The attentive reader will observe that these three propositions give a great extension to the theorems which were formerly deduced from the nature of uniformly accelerated motion, or of uniform action of the forces, and were afterwards demonstrated to obtain in the momentary action of forces any how variable.

The first of the three propositions, $\mathrm{V} : v = \mathrm{F} \times \mathrm{T} : f \times t$, is the extension of the theorem $fdt = dv$. The second, $\mathrm{V}^2 : v^2 = \mathrm{F} \times \mathrm{S} : f \times s$, is the extension of the theorem $fds = vdv$. And the third, $\mathrm{T}^2 : t^2 = \frac{\mathrm{S}}{\mathrm{F}} : \frac{s}{f}$, is the extension of $f = \frac{ds}{d(t^2)}$, or of $fd\ (t^2) = ds$. These theorems hold true of all *similar* actions; and, only for this reason, are true of uniformly accelerated motions, or uniform actions.

Aggregate of many equal accelerating forces.

There remains one thing more to be said concerning the action of accelerating forces. Their magnitude is ascertained by their effect. Therefore that is to be considered as a double force which produces a double quantity of motion. Therefore when a body A contains twice the number of equal atoms of matter, and acquires the same velocity from the action of the force F, that another body a, containing half the number of atoms, acquires from the action of a force f, we conceive F to be double of f. That this is a legitimate inference appears clearly from this, that we conceive the sensible weight of a body, or that pressure which it exerts on its supports, as the aggregate of the equal pressure of every atom accumulated perhaps on one point; as when the body hangs by a thread, and, by its intervention, pulls at some machine. Without inquiring in what manner or by what intervention this accumulation of pressure is brought about, we see clearly that it results from the equal accelerating force of gravity acting immediately on each atom. When this weight is thus employed to move another body by the intervention of the thread, which is attached to one point perhaps of that body, it puts the whole into motion, generating a certain velocity v in every atom, by acting uniformly during the time t. We conceive each atom to have sustained the action of an equal accelerating force whose measure is $\frac{v}{t}$. Without considering how this force is exerted on each atom, or by what it is immediately exerted, or how it is diffused through the body from the point to which the weight of the other body is applied by means of the thread; we still consider it as the aggregate of the action of gravity on each atom of that other body. Moreover, attending only to the motion produced by it, and perhaps not knowing the weight of the impelling body, we measure it, as a moving force, by considering it as the aggregate of the forces propagated to each atom of he impelled body, and measured by $\frac{v}{t}$. If we know that the impelled body contains the number m of atoms, the aggregate of forces is $m\frac{v}{t}$, or $\frac{mv}{t}$.

Of Deflecting Forces.

But since we measure forces by the quantity of motion which they produce, we must conceive, that when the same force is applied to a body which consists of n particles, and produces the velocity u, by acting uniformly during the same time t, the force $n\frac{u}{t}$ is equal to the force $m\frac{v}{t}$.

Moving force, motive force, vis motrix, as distinguished from accelerating force.

110. Sir Isaac Newton found it absolutely necessary, in the disquisitions of natural philosophy, to keep this circumstance of acceleration clear of all notions of quantity of matter, or other considerations, and to contemplate the affections of motion only. He therefore considered $\frac{v}{t}$ as the true original measure of accelerating force, and $m\frac{v}{t}$ as an aggregate. He therefore calls the aggregate a *vis motrix*, a *moving force*, measured by the *quantity of motion* that it generates. And he confines the term *accelerating force* to the quantity $\frac{v}{t}$ measured by the *acceleration* or *velocity* only. It would be convenient, therefore, also to confine the symbol f to $m\frac{v}{t}$, and to retain the symbol a for expressing the accelerating force $\frac{v}{t}$.

This appellation of *motive force* is perfectly just and simple; for we may conceive it as the same with the accelerating force which produces the velocity m times v in one particle, by acting on it uniformly during the time t. This motion of one particle having the velocity mv, is the same with that of m particles having each the velocity v.

If therefore a motive force f act on a body consisting of m particles, the accelerating force a is $= \frac{f}{m}\frac{v}{t}$.

Therefore the three last propositions concerning the similar, the uniform, or the momentary actions of *moving* forces, when expressed in the most general terms, are,

$$v' \doteq \frac{f}{mt'},$$
$$v^{2\prime} \doteq \frac{fs'}{m}, \text{ or } vdv = \frac{fds}{m},$$
$$t^2 \doteq \frac{ms'}{f}.$$

OF DEFLECTING FORCES.

Deflecting forces.

111. When we observe the direction of a body to change, we unavoidably infer the agency of a force which acts in a direction that does not coincide with that of the body's motion; and we may distinguish this circumstance by calling it a *deflecting force*. We have already shown how to estimate and measure this deflecting force, by considering it as competent to the production of that motion which, when compounded with the former motion, will produce the new motion (No. 44). Now, as all changes of motion are really compositions of motions or forces, it

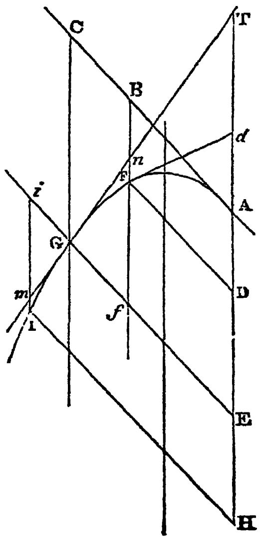
Of Deflecting Forces.

is evident that we shall explain the action of deflecting forces when we show this composition.

Alteration of deflections are continual, and produce curvilineal motions.

We may almost venture to say *a priori*, that all deflections must be continual, or exhibit curvilineal motions: for as no finite velocity, or change of velocity, can be produced in an instant by the action of an accelerating force, no polygonal or angular deflection can be produced; because this is the composition of a finite velocity produced in an instant. Deflective motions are all produced by the composition of the former motion, having a finite velocity, with a transverse motion continually accelerated from a state of rest. Of this we can form a very distinct notion, by taking the simplest case of such accelerated motion, namely, a uniformly accelerated motion.

Fig. 23.



Example. Determination of the path,

112. Let a body be moving in the direction AC (fig. 23) with any constant velocity, and when it comes to A, let it be exposed to the action of an accelerating force, acting uniformly in any other direction AE. This alone would cause the body to describe AE with a uniformly accelerated motion, so that the spaces AD, AE, would be as the squares of the times in which they are described. Therefore, if AB be the space which it would have described uniformly in the time that it describes AD by the action of the accelerating force, and AC the space which it would have described uniformly while it describes AE by the action of the accelerating force, nothing more is wanted for ascertaining the real motion of the body but to compound the uniform motion in the direction AC with the uniformly accelerated motion in the direction AE. AD is to AE as the square of the time of describing AD to the square of the time of describing AE; that is, as the square of the time of describing AB to the square of the time of describing AC; that is, as AB^2 to AC^2 (by reason of the uniform motion in AC). This composition is performed by taking the simultaneous points B, D, and the simultaneous points C, E, and completing the parallelograms ABFD, ACGE. The body will be found in the points F and G in the instants in which it would have been found at B and C by the uniform motion, or in D and E by the accelerated motion. In the same manner may be found as many points of the real path as we please. It is plain that these points will be in a line AFG, so related to AE that $AD : AE = DF^2 : EG^2$; or so related to the original motion AC, that $AB^2 : AC^2 = BF : CG$, &c. This line is therefore a parabola, of which AE is a diameter, DF and EG are ordinates, and which touches AC in A.

and of the motion in this path.

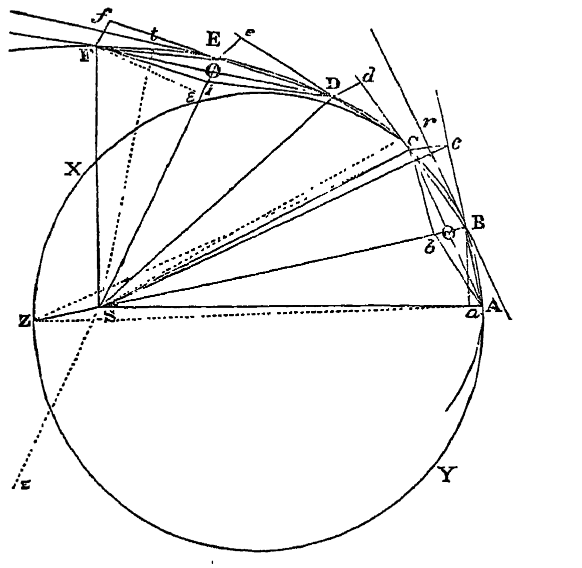
Having thus ascertained the path of the body, we can also ascertain the motion in that path; that is, the velocity in any point of it. We know that the velocity in the point G is to the velocity of the uniform motion in the direction AC as the tangent TG is to the ordinate EG; because this is the ultimate ratio of the momentary increment of the arch AFG to the momentary increment of the ordinate EG. Thus is the velocity in every point of the curve determined. We have taken it for granted that the line of projection touches the path, and that the direction in every point is that of the tangent. To suppose that the curve, in any portion of it, coincides with the tangent, is to suppose that the body is not deflected, that is, is not acted on by a transverse accelerating force; and to suppose that the tangent makes a finite angle with any part of the path, is to suppose that the deflection is not continual, but by starts, both of which are contrary to the conditions of the case. No straight line can be drawn between the direction of the body and the succeeding portion of the path, otherwise we must again suppose that the deflection is subsultory, and the motion angular.

113. But while the investigation is so easy when the direction and intensity of the deflecting force in every point of the curve are known, the investigation of the deflecting force from the observed motion is by no means easy. The observed curvilineal motion always arises from a composition of a uniform motion in the tangent with some transverse motion; but the same curvilineal motion may be produced by compounding the uniform motion in the tangent with an infinity of transverse motions, and the law of action will be different in these transverse motions according as their directions differ. We must learn not only the intensity of the deflecting force, and the law of its variation, but also its direction in every point of the curve. It is not easy to find general rules for discovering the direction of the transverse force; most commonly this is indicated by extrinsic circumstances. The deflecting force is frequently observed to reside in or to accompany some other body. It may be presumed, therefore, that it acts in the direction of the line drawn to or from that body; yet even this is uncertain. The most general rule for this investigation is to observe the place of the body at several intervals of time before and after its passing through the point of the curve, where we are interested to find its precise direction. We then draw lines joining those places of the tangent where the body would have been by the uniform motion only. We shall perhaps observe these lines of junction keep in parallel positions: we may be assured that the direction of the transverse force is the same with that of any of these lines. This is the case in the example just now given of a parabolic motion; but when these lines change position they will change it gradually, and their position in the point of contact is that to which their positions on both sides of it gradually approximate.

But all this is destitute of the precision requisite in philosophical discussion. We are indebted to Sir Isaac Newton for a theorem which ascertains the direction of the transverse force with all exactness, in the cases in which we most of all wish to attain mathematical accuracy, and which not only opened the access to those discoveries which have immortalized his name, but also pointed out to him the path he was to follow, and even marked his first steps. It therefore merits a very particular treatment.

Of Deflecting Forces.

Fig. 24.



Newton's fundamental theorem for the direction of a deflecting force.

114. If a body describes a curve line ABCDEF (fig. 24) lying in one plane, and if there be a point S so situated in this plane that the line joining it with the body describes areas ASB, ASC, ASD, &c. proportional to the times in which the body describes the arches AB, AC, AD, &c. the force which deflects the body from rectilineal motion is continually directed to the fixed point S.

Let us first suppose that the body describes the polygon ABCDEF, &c. formed of the chords AB, BC, CD, DE, EF, &c. of this curve, and, for greater simplicity of argument, let us consider areas described in equal successive times; that is, let us suppose that the triangles ASB, BSC, CSD, &c. are equal, and described in equal times. Make $Bc = AB$, and draw cS.

Areas = to the times indicate central forces.

Had the motion AB suffered no change in the point B, the body would have described Bc in the equal moment succeeding the first; but it describes BC. The body has therefore been deflected by an external force, and BC is the diagonal of a parallelogram (No. 45, 46), of which Bc is one side, and cC is another. The deflecting force will be discovered, both in respect of direction and intensity, by completing the parallelogram BcCb. Bb is the space which the deflecting force would have caused the body to describe in the time that it describes Bc or BC. Because Bc is equal to BA, the triangles BSc, BSA are equal. But, by the nature of the motion, BSA is equal to BSC; therefore the triangles BSC and BSc are equal. They are also on the same base BS; therefore they lie between the same parallels, and Cc is parallel to SB. But cC is parallel to Bb; therefore Bb coincides with BS, and the deflecting force at B is directed toward S. By the same argument, the deflecting force at the angles D, E, F, &c. is directed to S.

Now, let the sides of the polygon be diminished, and their number increased without end. The demonstration remains the same, and continues, when the polygon finally coalesces with the curve, and the deflection is continual.

When areas are described proportional to the times, equal areas are described in equal times; and therefore the deflection is always directed to S. Q. E. D.

Centre of deflection. Centre of forces. Central forces.

The point S may, with equal propriety of language, be called the *centre of deflection*, or *the centre of forces;* and forces which are thus continually directed to one fixed point may be distinguished from other deflecting forces by the name *central forces*.

Radius vector.

The line joining the centre of forces with the body, and which may be conceived as a stiff line carrying the body round, is usually named the *radius vector*.

Central forces produce areas proportional to the times.

115. The converse of this proposition, viz. that if the deflecting forces be always directed to S, the motion is performed in one plane, in which S is situated, and areas are described proportional to the times, is easily demonstrated by reversing the steps of this demonstration. The motion will be in the plane of the lines SB and Bc, because the diagonal BC of the parallelogram of forces is in the plane of the sides. Areas are described proportional to the times; for Cc being parallel to SB, the triangles SCB and ScB are equal; and therefore SCB and SAB are equal, &c. &c.

Velocity is inversely as the perpendicular from the centre.

116. *Cor.* 1. When a body describes areas round S proportional to the times, or when it is continually deflected toward S, or acted on by a transverse force directed to S, the velocities in the different points A and E of the curve are inversely proportional to the perpendiculars Sr and St, drawn from the centre of forces to the tangents in those points; that is, to the perpendiculars from the centre on the momentary directions of the motion: for since the triangles ASB, ESF are equal, their bases AB, EF are inversely as their altitudes Sr, St; but these bases being described in equal times, are as the velocities, and they ultimately coincide with the tangents at A and E.

117. *Cor.* 2. If $B\alpha$ and $F\varepsilon$ be drawn perpendicular to SA and SE, we have $SA \times B\alpha = SE \times F\varepsilon$, and $SA : SE = F\varepsilon : B\alpha$. For $SA \times B\alpha$ is double of the triangle BSA, and $SE \times F\varepsilon$ is double of the equal triangle SFE.

Angular velocity is inversely as the square of the distance from the centre of forces.

118. *Cor.* 3. The angular velocity round S, that is, the magnitude of the angle described in equal times by the radius vector, is inversely proportional to the square of the distance from S. For when the arches AB, EF are diminished continually, the perpendiculars $B\alpha$ and $F\varepsilon$ will ultimately coincide with arches described round S with the radii SB and SF. Now the magnitude of an angle is proportional to the length of the arch which measures it directly, and to the radius of the arch inversely. In any circle, an arch of two inches long measures twice as many degrees as an arch one inch long; and an arch one inch long contains twice as many degrees of a circle whose radius is twice as short. Therefore, ultimately, the angle ASB is to the angle ESF as $B\alpha$ to $F\varepsilon$, and as SF to SB jointly; that is, as $B\alpha \times SF$ to $F\varepsilon \times SB$. But $B\alpha : F\varepsilon = SE : SA$ (Cor. 2); therefore $ASB : ESF = SE \times SF : SB \times SA$, $=$ ultimately $SE^2 : SB^2$.

This corollary gives us an ostensible mark, in many very important cases, of the action of a deflecting force being always directed to a fixed point. We are often able to measure the angular motion when we cannot measure the real velocities.

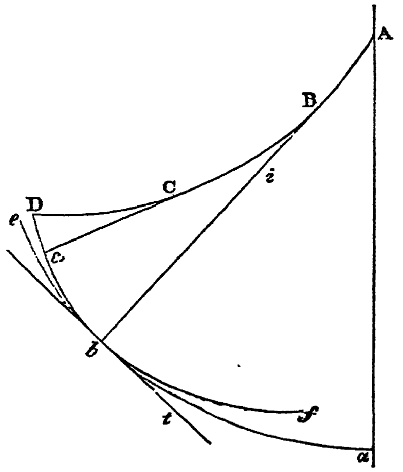
Intimate connection of dynamics and the higher geometry.

Having thus discovered the chief circumstances which enable us to ascertain the direction of the deflecting force, we proceed to investigate the quantity of this deflective determination in the different points of a curvilineal motion. This is a more difficult task. The momentary effect of the deflecting force is a small deviation from the tangent; and this deviation is made with an accelerated motion. The law of this acceleration regulates the curvature of the path, and is to be determined by it. We may be allowed to observe by the way, that it appears clearly, from the form in which Newton has presented all his dynamical theorems, that we are indebted to these problems for the immense improvement which he has made in geometry by his invention of fluxions. The purposes he had in view suggested to his penetrating mind the means for attaining them; and the connection between dynamics and geometry is so intimate, that the same theorems are in a manner common to both. This is

particularly the case in all that relates to curvature. Or shall we say that the geometry of Dr Barrow suggested the dynamical theorems to Newton? We have seen how the curvature of a parabola is produced by a force acting uniformly. The *momentary* action of all finite forces may be considered as uniform, and therefore the curvature will be that of some portion of some parabola; but it will be difficult to determine the precise degree without some farther help. We are best acquainted with the properties of the circle, and will have the clearest notions of the curvature of other curves by comparing them with circles.

Measure of curvature. The curvature of a circular arch of given length is so much greater as its radius is shorter, for it will contain so many more degrees in the same length; and therefore the change of direction of its extremities is so much greater. Curvatures may always be measured by the length of the arch directly, and the radius inversely.

Fig. 25.



Evolution and involution of curves. 119. Suppose a thread made fast at one end of a material curve ABCD (fig. 25), and applied to it in its whole length. Taking hold of its extremity D, unfold it gradually from the curve DCBA; the extremity D will describe another curved D*cba*. This geometrical operation is called the *evolution* of curves, and D*cba* is called the *evolute* of DCBA, which is called the *involute* of D*cba*. Perhaps this denomination has been given from the genesis of the area or surface contained by the two lines, which is folded up and unfolded somewhat like a fan. When the describing point is in *b*, the thread *b*B is undoubtedly the momentary radius of a circle *ebf*, whose centre is B, the point of the involute which it is just going to quit. The momentary motion of *b* is the same, whether it is describing an arch of the evolute passing through *b*, or an arch of a circle round the centre B. The same line *bt*, perpendicular to the thread *b*B, touches the circle *ebf* and the curve D*ba* in the point *b*. This circle *ebf* must lie within the curve D*ba* on the side of *b*B toward *a*, because on this side the momentary radius is continually increasing. For similar reasons, the circle *ebf* lies without the curve on the other side of *b*B. Therefore the circle *ebf* both touches and cuts the curve D*ba* in the point *b*. Moreover, because every portion of the curve between *b* and D is described with radii that are shorter than *b*B, it must be more incurvated than any portion of the circle *ebf*. For similar reasons, every portion of the curve between *b* and *a* must be less incurvated than this circle; therefore the circle has that precise degree of curvature that belongs to the curve in the point *b*; it is therefore called the *equicurve circle*, or the *circle of curvature*, and B is called the centre, and B*b* the *radius of curvature*. It is easy to perceive that no circle can be described which shall touch the curve in *b*, and come between it and the circle *ebf*; for its centre must be in some point *i* of the radius *b*B. If *ib* be less than B*b*, it must fall within the curve on both sides of *b*, and if *ib* is greater than B*b*, the circle must fall without the curve on both sides of B*b*. The circle *ebf* lies closer to the curve, has closer contact with it than any other, and has therefore got the whimsical name of *osculating circle;* and this sort of contact was called *osculation*.

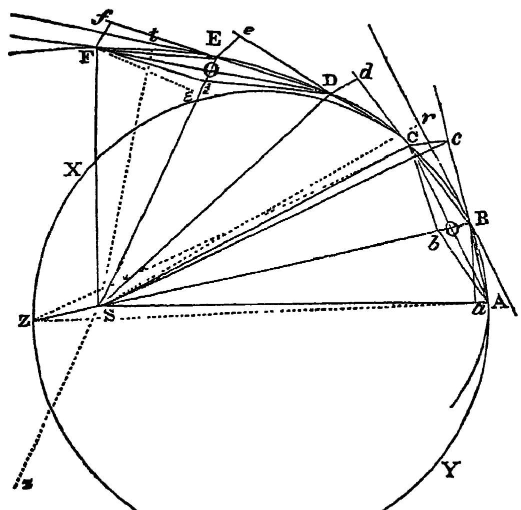
Circle of curvature. Equicurve circle.

This view of the genesis of curve lines is of particular use in dynamical discussions. It exhibits to the eye the perfect sameness of the momentary motion, and therefore of the momentary deflection, in the curve and in the equicurve circle, and leaves the mind without a doubt but that the forces which produce the one will produce the other. A great variety of curves may be described in this way. If perpendiculars be drawn to the curve D*ba* in every point, they will intersect each other, each its immediate neighbour, in the circumference of the curve DBA; and geometry teaches us how to find the curve DBA which shall produce the curve D*ba* by evolution. (See Fluxions.)

It is a matter worthy of remark, that the path of a body that is deflected from rectilineal motion by a *finite* force, varying according to any law whatever, may always be described by evolution. This includes almost every case of the action of deflecting forces; none being excepted but when, by the opposite action of different forces, the body is in equilibrio in one single point of its path.

Our task is now brought within a very narrow compass, namely, to measure the deflection in the arch of a circle.

Fig. 26.



Had the motion represented in fig. 26 been polygonal, it is plain that the deflecting force in the point B is to that in the point E as the diagonal B*b* of the parallelogram ABC*b* to the diagonal E*i* of the parallelogram DEF*i;* therefore let ABCZY be a circle passing through the points A, B, and C, and let the radius vector BS cut the circumference in Z; draw AZ, CZ, and the diagonal AC, which necessarily bisects and is bisected by the diagonal B*b*. The triangles *b*BC and CBZ are similar; for the angle C*b*B is equal to the alternate angle AB*b* or ABZ, which is equal to the angle ACZ, standing on the same chord AZ. And the angle CB*b*, or CBZ, is equal to CAZ, standing on the same chord CZ; therefore the remaining angle *b*CB is equal to the remaining angle

AZC; therefore ZA is to AC as BC to B*b*, and B*b* $= \frac{AC \times BC}{AZ}$. In like manner E*i* $= \frac{DF \times EF}{Dz}$.

Measure of deflecting forces. Now let the points A and C continually approach, and ultimately coalesce with B; it is evident that the circle ABCZY is ultimately the equicurve or coinciding circle at the point B, and that AS ultimately coalesces with and is equal to BS, and that AC×BC is ultimately $2BC^2$; therefore ultimately $Bb : Ei = \frac{2BC^2}{BZ} : \frac{2EF^2}{Ez}$, or $= \frac{BC^2}{\frac{1}{2}BZ} : \frac{EF^2}{\frac{1}{2}Ez}$.

Now BC and EF being described in equal times, are as the velocities: B*b* and E*i* are the measures of the velocities which the deflective forces at B and E would generate in the time that the body describes BC or EF, and are therefore the measures of those forces. *They are as the squares of the velocities directly, and inversely as those chords of the equicurve circles which have the directions of the deflection.*

Observe that B*b* or E*i* is the third proportional to half of the chord and the arch described; for $Bb : BC = BC : \frac{BZ}{2}$.

It is evident, that as the arches AB, BC, continually diminish, AC is ultimately parallel to the tangent B*r*, and BO is equal to the actual deflection from the tangent. The triangles BOC and AOZ are similar, and $BO = \frac{OC^2}{OZ}$, or ultimately $= \frac{BC^2}{BZ}$. We may measure the forces by the actual deflections, because they are the halves of the measures of the generated velocities; and we may say that

Measure of deflection. 120. *The actual momentary deflection from the tangent is a third proportional to the deflective chord of the equicurve circle and the arch described during the moment.*

Caution. Either of these measures may be taken, but we must take care not to confound them. The first is the most proper, because the change produced on the body (which is the *immediate* effect and measure of the force) is the determination left inherent in it to move with a certain velocity. This is the measure also which we obtain by means of the differential or fluxionary calculus; but the other measure must be obtained when our immediate object is to mark the actual path of the body. The steps of this demonstration, which is Newton's, naturally terminate in the equicurve circle, and give at once the immediate measure of the deflecting force. At the same time the reader must perceive that this measure does not depend on the force being always directed to one centre; it is enough that the two sides of the polygon, in immediate succession, are described in equal times. This is necessary in order that ABC*b* may be a parallelogram, and that the diagonals AC and B*b* may mutually bisect each other.

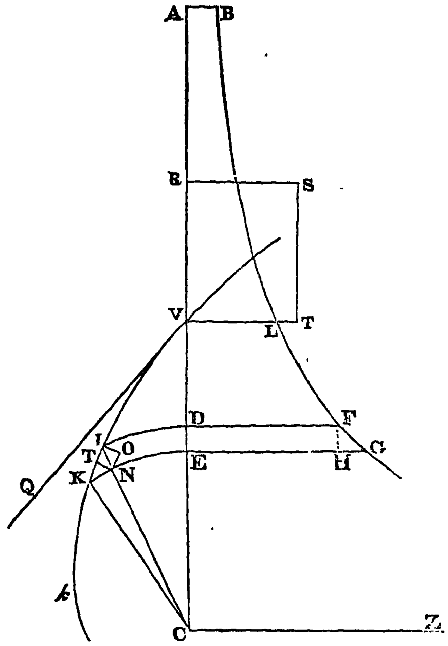
Thus have we obtained a measure of deflecting force, and, in the most important cases, a method of discovering its direction. It only remains to point out the relation between the intensity of the force, the curvature of the path, and the velocity of the motion. These three circumstances have a necessary connection; for we see that the intensity is expressed by certain values of the other two in the formula $f \doteqdot \frac{\text{Arch}^2}{\frac{1}{2}\text{Chord}}$, or $f = \frac{2\,BC^2}{BZ}$. The deflective velocity B*b* is acquired in the time that the body describes BC; therefore the deflective velocity is to the velocity in the curve as B*b* to BC. The velocity B*b* is acquired by an accelerated motion along BO; for while, by progressive motion, the body describes BC, it deflects from the tangent through a space equal to the half of B*b*, because the momentary action of the deflecting force may be considered as uniform. The progressive velocity BC may be generated by the same force uniformly acting through a space greater than BC; call this space *x*. The spaces along which a body must be uniformly impelled in order to acquire different velocities are as the squares of those velocities; therefore $Bb^2 : BC^2 = Bo : x$; but $Bb : BC = BC : \frac{1}{2}BZ$; therefore $Bb^2 : BC^2 = Bb : \frac{1}{2}BZ$, and $Bb : \frac{1}{2}BZ = Bo : x$, and $Bb : Bo = \frac{1}{2}BZ : x$; but B*o* is $\frac{1}{2}$ of B*b*, therefore *x* is $\frac{1}{4}$ of BZ; that is,

121. *The velocity in any point of a curvilineal path is that which the deflecting forces in that point would generate in the body by impelling it uniformly along one fourth part of the deflective chord of the equicurve circle.* If the velocity increase, the chord of the equicurve circle must increase; that is, the path becomes less incurvated. If the force be increased, the curvature will also increase, for the chord of curvature will be less.

There is another general observation to be made on the velocity of a curvilineal motion, which greatly assists us in our investigation.

122. *If a body describes a curve by the action of a force always directed to a fixed point, and varying according to any proportion whatever of the distances from that point, and if another body, acted on by the same centripetal force, move toward the centre in a straight line, and if in any one case of equal distances from the centre of force the two bodies have equal velocities, they will have equal velocities in every other case of equal distances from the centre.* **Comparison of orbital motion with direct approach to the centre.**

Fig. 27.



Let one body be impelled from A (fig. 27) toward C along the straight line AVDEC, and let another be deflected along the curve line VIK*k*. About the centre C describe concentric arches ID, KE, very near to each other, and cutting the curve in I and K, and the line AC in D and E; draw IC, cutting KE in N, and draw NT perpendicular to the arch IK of the curve, and complete the parallelogram ITNO. Let the bodies be supposed to have equal velocities at I and at D.

Then, because the centripetal forces are supposed to be the same for both bodies when they are at equal distances, the accelerating forces at D and I may be represent-

Of Deflecting Forces.

ed by the equal lines DE and IN; but the force IN is not wholly employed in accelerating the body along the arch IK, but, acting transversely, it is partly employed in incurvating the path. It is equivalent to the two forces IO and IT, of which only IT accelerates the body. Now IKN is a right-angled triangle, as is also the triangle INT; and they are similar; therefore IN : IT = IK : IN, or DE : IT = IK : DE; that is, the force which accelerates the body along DE is to the force which accelerates the body along IK as the space IK is to the space DE; therefore (No. 86) the increment of the square of the velocity acquired along DE is equal to the increment of the square of the velocity acquired along IK. But the velocities at D and I were equal, and consequently their squares were equal; and these having received equal increments, therefore the squares of the velocities at E and K are equal, and the velocities themselves are equal. And since this is the case in all the corresponding points of the line AC and the curve VIK, the velocities at all equal distances from C will be equal.

It is evident that the conclusion will be the same, if the bodies, instead of being accelerated by approaching the centre in the straight line AC, and in the curve VIK, are moving in the opposite directions from E to A, or from I to V, and are therefore retarded by the centripetal force.

Retarded curvilineal motion always accompanied by recess from the centre.

123. *Cor.* Hence it follows, that if a body be projected from any point, such as V, of the curve, in a line tending straight from the centre, with the velocity which it had in that point of the curve, it would go to a distance VA, such, that if it were impelled along AV by the centripetal force, it would acquire its former velocity in the point V; also in any point between V and A it will have the same velocity in its recess from the centre that it has there in its approach to the centre.

The line BLFG, whose ordinates are as the intensities of the centripetal force in A, V, D, E, or in A, V, I, K, may be called the *scale* or *exponent* of force; the areas bounded by the ordinates AB, VL, DF, EG, &c. drawn from any two points of the axis, are as the squares of the velocity acquired by acceleration along the intercepted part of the axis, or in any curvilineal path, while the body approaches the centre, or which are lost while the body retires from it. When we can compute these areas we obtain the velocities (see No. 102).

We are now in a condition to solve the chief problem in the science of dynamics, to which the whole of it is in a great measure subservient. The problem is this:

Inverse problem of centripetal forces.

124. Let a body be projected with a known velocity from a given point and in a given direction, and let it be under the influence of a mechanical force, whose direction, intensity, and variation, are all known; it is required to determine its path, and its motion in this path, for any given time.

This problem is susceptible of three distinct classes of conditions, which require different investigation.

1. The force may act in one constant direction; that is, in parallel lines.
2. The force may be always directed to a fixed point.
3. It may be directed to a point which is continually changing its place.

1. When the force acts in parallel lines, the problem is solved by compounding the rectilineal accelerated motion which the force would produce in its own direction with the uniform motion which the projection alone would have produced. The motion must be curvilineal when the accelerating force is transverse, in any degree whatever, to the projectile motion; and the curvilineal path must be concave on that side to which the deflecting force tends, for the force is supposed to act incessantly. The place of the body will be had for any time, by finding where the body would have been at the end of that time by each force acting alone, and by completing the parallelogram. Thus, suppose a body projected along AB (fig. 23), while it is continually acted on by a force whose direction is AD. Let D and B be the places where the body would be at the end of a given time. Then the body will, at the end of that time, be in F, the opposite angle of the parallelogram ABFD. But it has not described the diagonal AF, because its motion has been curvilineal, as we shall find by determining its place at other instants of this time.

The velocity in any point F is found by first determining the velocity at D, and making D*d* to DF as the velocity at D to the velocity at B (that is, the velocity of projection, because the motion along AB is uniform). Then draw *d*F. Then AB is to *d*F as the constant velocity of projection to the velocity at F. We have seen already (No. 112–119) that *d*F is a tangent to the curve in F. Hence we may determine the velocity at F in another way. Having determined the form of the path in the way already described, by finding its different points, draw the tangent F*d*, cutting the line DA in *d*. Then the velocity at A is to that at F as AB to *d*F. Hence also we see that the velocities in every point of the curve are proportional to the portion of the tangents at those points which are intercepted between *any* two lines parallel to AD.

Either of these methods for ascertaining the velocity, in this case of parallel deflections, will in general be easier than the general method in No. 121, by the equicurve circle.

It was thus that Galileo discovered the parabolic motion of heavy bodies.

Inverse problem of centripetal forces.

2. We must consider the motions of bodies affected by centripetal or centrifugal forces, always tending to one fixed point. This is the celebrated *inverse problem of centripetal forces*, and is the forty-second proposition of the first book of Newton's *Principia*. We shall give the solution after the manner of its illustrious author, because it is elementary in the purest sense of the word, keeping in view the two leading circumstances, and these only, namely, the motion of approach and recess from the centre, and the motion of revolution. By this judicious process, it becomes a pattern by which more refined, and, in some respects, better solutions should be modelled. At the same time we shall supply some steps of the investigation which his elegant conciseness has made him omit.

125. Let a body which tends to C (fig. 28) with a force proportional to the ordinates of the exponent BLFG, having the axis CA, be projected from V in the direction VQ, with the velocity which the centripetal force would generate in it by accelerating it along AV. It is required to determine the path or orbit VIKI of the body, and its place I in this orbit, at the end of the assigned time T.

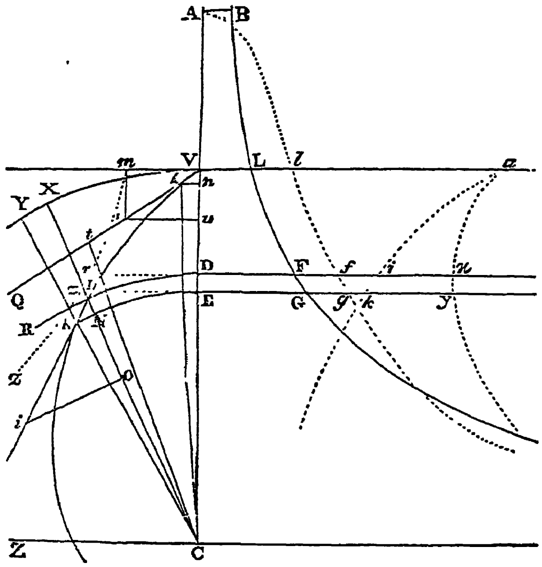
Suppose the thing done, and that I is the place of the body. About the centre C, with the distances CV and CI, describe the circles YV and ID. Draw CIX to the circumference, and draw the ordinate DF of the exponent of forces, producing it toward *x*, and produce the ordinate VL toward *a*. Let V*t* be the distance to which the body would go along the tangent VQ in the time T, and join *t*C. Let this be supposed done for every point of the curve. Let *aik* and *axy* be two curves so related to the curve VIK, that the ordinate DF cuts off an area V*ai*D equal to the orbital sector VCI, and an area V*ax*D equal to the circular sector VCX.

Then, because the velocity of projection is given, the

Of Deflecting Forces.

distance Vt is known, and the area of the triangle VCt. But this is equal to the area VCI, by the laws of central forces. (No. 115.) Therefore the area $VaiD$ is given. Also, because the area VCI increases in the proportion of the time, the area $VaiD$ increases at the same rate.

Fig 28.



Therefore, having these subsidiary curves aik, axy, the problem is solved as follows:

Draw an ordinate Di, cutting off an area $VaiD$ proportional to the time, and describe a circle DIR. Then draw a line CX, cutting off a sector VCX, equal to the area $VaxD$ cut off by the ordinate Dix. This line will cut the circle DR in the point I, which is the point of the orbit that was demanded.

But the chief difficulty of the problem consists in the description of the two subsidiary curves aik and axy, into which the lines VIK and VXY are transformed. We attain this construction by resolving the motion in the arch of the orbit into two motions, one of which is in the direction of the transverse force, or of the radius vector, and the other is in the direction of revolution, or perpendicular to the radius.

Let Vk and IK be two very small arches described in equal moments, and therefore ultimately in the ratio of the velocities in V and I (No. 73). Describe the circle KE, cutting IC in N. Draw KC and kC, and kn perpendicular to VC.

The element ICK of the orbit is $= \frac{IC \times KN}{2}$, or to $\frac{1}{2}$ IC $\times$ KN. This is equal to the element $DikE$ of the area $VaiD$, or to $Di \times DE$, or to $Di \times IN$. Therefore $IN : KN = \frac{1}{2} IC : Di$, or $2IN : KN = IC : Di$, and $Di = \frac{IC \times KN}{2IN}$.

Now let $Alfgh$ be the exponent of the velocities, that is (No. 86), let Vl^2 be to Df^2 as ABLV to ABFD, or $Vl : Df = \sqrt{ABLV} : \sqrt{ABFD}$. Make Vv and Ii in the tangents respectively equal to Vl and Df. Draw vu and iO perpendicular to VC and IC, and vm perpendicular to LV produced. Let mrz be an equilateral hyperbola, having VC, ZC, for its asymptotes, and cutting FD produced in r. Then the ordinates Vm, Dr, are inversely proportional to CV, CD, or $Vm : Dr = CD : CV$, $= CI : CV$. But because the momentary sectors VCk and ICK are equal, $kn : KN = CI : CV$. Therefore,

$$Vm : Dr = kn : KN;$$
$$\text{but } Vv : Vm = Vk : kn,$$
$$\text{and } Ii \text{ (or } Df) : Vv = IK : Vk,$$
$$\text{therefore } Ii : Dr = IK : KN;$$
$$\text{but } Ii : iO = IK : KN, \text{ by sim. triang.}$$
$$\text{therefore } Dr = iO, \text{ and } iO : Vm = VC : CI.$$

Also, by similarity of triangles, $IO : iO = IN : KN$, and $2IO : iO = 2IN : KN$.

Now it was shown, that in order that the space $DikE$ may be equal to the space ICK, we must have

$$2IN : KN = IC : Di,$$
$$\text{or } 2IO : iO = IC : Di;$$
$$\text{but } iO : Vm = VC : IC,$$
$$\text{therefore } 2IO : Vm = VC : Di,$$
$$\text{and } Di = \frac{VC \times Vm}{2IO}.$$

Having obtained Di, we easily get Dx; for the ultimate ratio of ICK to XCY is that of IC^2 to VC^2. Therefore make

$$IC^2 : VC^2 = Di : Dx.$$

Thus are the points of the two subsidiary curves aik, axy, determined.

The rectangle $VC \times Vm$ is a constant magnitude, and is given because VC is given, and Vm is the given velocity Vl, diminished in the ratio of radius to the sine of the given angle CVQ.

But the line 2IO is of variable magnitude; but it is also given by means of known quantities. IO^2 is $= Ii^2 - iO^2$, $= Df^2 - Dr^2$, and $IO = \sqrt{Df^2 - Dr^2}$. Moreover, $Df^2 = ABFD$, and $Dr^2 = \frac{VC^2 \times Vm^2}{IC^2}$. Therefore $2IO =$ $2\sqrt{ABFD - \frac{VC^2 \times Vm^2}{IC^2}}$, expressed in known quantities, because ABFD is known from the nature of the centripetal force.

Let the indeterminate distance CI or CD be $= x$, and let the ordinate DF, expressing the force, be y. Let VC be a, and Vm be c, and let ab be a rectangle equal to the whole area of the exponent of force lying between the ordinate AB and the ordinate CZ, so that $ba - \int y dx$ may represent the indeterminate area ABFD.

$$\text{We have } Di = \frac{ac}{2\sqrt{ab - \int y dx - \frac{a^2 c^2}{x^2}}}$$

$$\text{and } Dx = \frac{a^3 c}{2x^2 \sqrt{ab - \int y dx - \frac{a^2 c^2}{x^2}}}.$$

Remark.—We have hitherto supposed that the velocity of projection is acquired by acceleration along AV. But this was merely for greater simplicity of argument, and that the final values of Di and Dx might be easier conceived. In whatever way the velocity is acquired, it will still be true, that when in any point V we make Vl to Vm as the momentary increment Vk of the arch is to the perpendicular kn on the radius vector, we shall have in every other point, such as I, the line Df to the line Dr as the increment IK of the arch to KN. And in the final equation Df will still be expressed by $\sqrt{ab - \int y dx}$.

126. *Cor.* 1. The angle which the path of the projectile makes with the radius vector is determined by this solution; for Ii is to iO as radius to the sine of this angle; which sine is therefore $= \frac{ac}{x\sqrt{ab - \int y dx}}$.

127. *Cor.* 2. When the magnitude $\frac{ac}{x}$ is equal to $\sqrt{ab - \int y dx}$, the path is perpendicular to the radius vec- Apsides determined;

Of Deflecting Forces.

tor, and the body is at one of the apsides of its orbit, and begins to recede from the centre after having approached to it, or begins to approach after having receded.

and curvature.

128. *Cor.* 3. The curvature of the orbit VIK is also determined in every point; for the curvature of any line is inversely as the radius of the equicurve circle, and this is to the chord which passes through C as radius to the sine of the angle CI*i*. Because the velocity in any point I is $= \sqrt{\text{ABFD}}$, and is equal to what the centripetal force at I would produce, by impelling the body along one fourth of the deflective chord of the equicurve circle, we have this chord $= 4\frac{\text{ABFD}}{\text{DF}}$. Or we obtain it by taking a third proportional to the momentary deflection and the momentary arch of the curve, or by other processes of the higher geometry, all proceeding on the quantities furnished in this investigation.

Newton the inventor.

129. Such is the solution of this celebrated problem given by Sir Isaac Newton, who may justly be called the inventor of the science of which it is the chief result, as well as of the geometry by help of which it is prosecuted. For we cannot give this glory to Galileo; for his simple problem of the motion of bodies affected by uniform and parallel gravity, however just and elegant his solution may be, was peculiar; and the same must be said of Mr Huygens's doctrine of centrifugal forces. Besides, these theorems had been investigated by Newton several years before, *suâ mathesi facem preferente*, as corollaries which he could not pass unnoticed, from his general method. This is proved by letters from Huygens. Newton's investigation is extremely but elegantly concise, and is one of the best exertions of his sagacious mind.

History of this problem.

130. Whether we consider this problem as a piece of mere mathematical speculation, or attend to its consequences, which include the whole of the celestial motions in all their extent and complication, we must allow it to be highly interesting, and likely to have engaged much attention in the period of ardent inquiry which closed the last century. Accordingly, it was no sooner known, by the publication of the *Mathematical Principles of Natural Philosophy* in 1686, than it occupied the talents of the most eminent mathematicians; and many solutions were published, some of which differ considerably from Newton's, and some are more expeditious, and better fitted for computation. Of these, the most remarkable for originality and ingenuity are those of De Moivre, Hermann, Keill, and Stewart. The last differs most from the methods pursued by others. M'Laurin's propositions on this subject, and in that part of his fluxions which treats of curvature, are highly valuable, classing the chief affections of curvilineal motions geometrically, as they are suggested by the fluxionary method; and then showing, in a very instructive manner, the connection between these mathematical affections of motion and the powers of nature which produce them. This part of his excellent work is a fine example of the real nature of all inquiries in dynamics, showing that it differs from geometry little more than in the language, in which the word *force* is substituted for *acceleration*, *retardation*, or *deflection*. We recommend the careful perusal of these propositions to all who wish to have clear conceptions of the subject. Dr John Keill and Dr Horsley (bishop of Rochester) have given particular treatises on the motions of bodies deflected by centripetal forces inversely proportional to the cubes of the distances; induced by the singular motions which result from this law of action, and the multitude of beautiful propositions which they suggest to the mathematician. Newton, indeed, first perceived both of these peculiarities, and has begun this branch of the general problem. He first demonstrated the description of the logarithmic and hyperbolic spirals, and indicated a variety of curious recurring elliptical spirals, which would be described by means of this force, showing that they are all susceptible of accurate quadrature. Several of those authors affect to consider their solutions as more perfect than Newton's, and as more immediately indicating the remarkable properties of such motions; and also affect to have deduced them from different and original principles. But we cannot help saying that their claims to superiority are very ill founded; there is not a principle made use of in their solutions which was not pointed out by Newton, and employed by him. The appearance of originality arises from their having taken a more particular concern in some general property of curvilineal motions, such as the curvature, the centrifugal force, &c. and the making that the leading step of their process. But Newton's is still the best, because it is strictly elementary, aiming at the two leading circumstances, the motion to or from the centre, and the motion of revolution round that centre. To these two purposes he adapted his two subsidiary curves.

Singular boast of John Bernoulli.

131. Is it not surprising, that, twenty-five years after the publication of Newton's *Principia*, a mathematician on the Continent should publish a solution in the Memoirs of the French Academy, and boast that he had given the first demonstration of it? Yet John Bernoulli did this in 1710. Is it not more remarkable that this should be precisely the solution given by Newton, beginning from the same theorem, the 40th I. *Prin.* following Newton in every step, and using the same subsidiary lines? Yet so it is. Bernoulli actually reduces the whole to two functions, namely,

$$\frac{ac}{\sqrt{ab-\int\varphi dx-\frac{a^2c^2}{x^2}}} \text{ and } \frac{a^2c}{\sqrt{abx^4-x^4\int\varphi dx-a^2c^2x^2}};$$

which last is plainly the same with Newton's

$$\frac{\text{Q}\times\text{CX}^2}{\text{A}^2\sqrt{\text{ABDF}-\text{Z}^2}};$$

because Newton's $\frac{\text{Q}}{\text{A}}$ is the same with $\frac{ac}{x}$, and Newton's $\text{A}^2\sqrt{\text{ABFD}-\text{Z}^2}$ is the same with

$$x^2\sqrt{ab-\int\varphi dx-\frac{a^2c^2}{x^2}},$$

which Bernoulli has changed into

$$\sqrt{abx^4-x^4\int\varphi dx-a^2c^2x^2}.$$

Bernoulli's chief boast in this dissertation is, that *now* philosophers may be assured that the planets will always describe conic sections; a truth of which they had not as yet received any proof; because, says he, Newton's argument for it in the corollary of the 13th proposition is inconclusive, and because he had not been able to accommodate his demonstration of the 41st and 42d propositions to the particular case of the planetary gravitation. Newton's demonstration in the corollary of the 13th proposition is just founded on the principle on which the very demonstration of the 42d, adopted by Bernoulli, proceeds, and without which that demonstration is of no force; namely, that a body, in given circumstances of situation, velocity, direction, and centripetal force, can describe no other figure than what it really describes. Newton did not accommodate the demonstration of the 42d proposition to the planetary motions, because he had already demonstrated the nature of their orbits; but mentions the case of a force proportional to the reciprocal of the cubes of their distance, not as a deduction from the 42d, but because it *was not* a deduction from it, and admitted a very singular and beautiful investigation by methods totally and essentially different.

Conclusion.

132. It cannot be expected that, in the narrow limits prescribed to a work like ours, we can proceed to consider the various departments of this celebrated problem. We are only giving the outlines of the general doctrines of dynamics; and we have bestowed more time on those which are purely elementary than some readers may think they deserve. We were anxious to give just conceptions of the fundamental principles of dynamics; because we know that nothing else can entitle it to the name of a demonstrative science, and because we see much indistinctness and uncertainty, and a general vagueness or want of precision, in several elementary works which are put into the hands of persons entering on the study. This leads to errors of more consequence than a person is apt to think; because they affect our leading thoughts of mechanism itself, and our notions of the intimate nature of the visible universe.

Universal re-action is a law of the material world.

133. But we must conclude the article with this great problem. Many very general doctrines of dynamics remain untouched; all, namely, that relate to the rotative motion of rigid bodies, and all that relate to the mutual action of bodies on each other in the way of impulse.

Notwithstanding these great omissions, we must observe that no new principle remains to be considered. We have given all that are necessary; and there is no question that occurs in the cases omitted which cannot be completely answered by means of the propositions already established. We have taught how to discover the existence and agency of a mechanical force, to measure and characterize it, and then to state what will be its various effects, according to the circumstances of the case.

134. Proceeding by these principles, men have discovered an universal fact, that every *action* of one body on another is accompanied by an equal *re-action* of that other on the first in the opposite direction; that is, to express it in the language of dynamics, "all the phenomena which make us infer that the body A possesses a force by which it changes the motion of the body B, show, at the same time, that B possesses a force by which it makes an equal and opposite alteration in the motion of A." This, however, is not a doctrine of abstract dynamics; it does not flow from our idea of force; therefore it was not included in our list of the *laws of motion.* It is a part of the mechanical history of nature, just as the law of universal gravitation is; and it might be called the law of *universal re-action.* Sir Isaac Newton has, in our humble apprehension, deviated from his accustomed logical accuracy, when he admits, as a third *axiom* or law of motion, that re-action is always equal and contrary to action. It is a physical law, in as far as it is *observed* to obtain through the whole extent of the solar system. But Newton himself did not, in the subsequent part of his noble work, treat it as a logical axiom; that is, as a law of human thought with respect to motion; for he labours with much solicitude, and with equal sagacity, to prove, by *fact and observation,* that it really obtains through the whole extent of the solar system; and it is in this discovery that his chief claim to unequalled penetration and discernment appears.

Impulsion explained by it,

135. Availing ourselves of this fact, we, with very little trouble, state all the laws of impulsion. The body A, for example, moving to the westward at the rate of eight feet per minute, overtakes the double body B, moving at the rate of four feet per minute. What must be the consequence of their impenetrability, and of the equality and contrariety of action and re-action? Their motions must be such that both sustain equal and opposite changes. They must give, in some way or other, *this* indication of possessing equal and opposite forces. This will be the case if, when the changes are completed, A and B move on in contact at the rate of four feet per minute; for here A has produced in each half of B a change of motion two, and therefore a totality of change equal to four. This is the effect, the mark, the measure of the *impulsive* force of A; for it is the whole *impulsion.* B has produced in A a change of motion four, equal to the former, and in the opposite direction. This is the effect, mark, and measure of the *repulsive* force of A; for it is the whole *repulsion.* And this is all that we observe in the collision of two lumps of clay; and the observation is one of the facts on which the reality of the physical law of equal action and re-action is founded; and we can make no further inference from *this* fact.

But the event might have been very different. A and B may be two magnets floating on corks on water, with their north poles fronting each other. We know, by other means, that they really possess forces by which they equally repel each other. The dynamical principles already established tell us also what must happen in this case. That both conditions of equal re-action and sensible repulsion may be fulfilled, A must come to rest, and B must move forward at the rate of four feet per minute. The same thing must happen in the meeting of perfectly elastic bodies, such as billiard balls. If elasticities are known to be imperfect in any degree, our dynamical principles will still state the effect of their collision in conformity to the law of equal reaction.

and rotation.

136. In like manner, all the motions of rotation are explained or predicted by means of the same principles of dynamics applied to the force of cohesion. This is considered as a moving force, because, when the attraction of a magnet acts on a bit of iron attached to one end of a long lath floating on water, the whole lath is moved, although the magnet does not act on it at all; some other force acts on it; it is its cohesion, which is therefore a moving force, and the subject of dynamical discussion.

137. And thus it appears that these subjects do not come necessarily, nor perhaps with scientific propriety, under the category of dynamics, but are parts of the mechanical history of nature. Yet, did a work like ours give room in this place, the study of mechanical nature might be considerably improved, by giving a system of such *general* doctrines as involve no other notions but those of force and its measures, and the hypothesis of equal re-action. Some very general, nay universal, consequences of this combination might be established, which would greatly assist the mechanician in the solution of difficult and complicated problems. Such is the proposition, that *the mutual actions of bodies depend on their relative motions only, and require no knowledge of their real motions.* This principle simplifies in a wonderful manner the most difficult and the most frequent cases of action which nature presents to our view; but at the same time gives a severe blow to human vanity, by forcing us to acknowledge that we know nothing of the real motion of any thing in the universe, and never shall know any thing of it, till our intellectual constitution, or our opportunities of observation, are completely changed.

138. M. d'Alembert had made this principle still more serviceable for extricating ourselves from the immense complication of actions that occurs in all the spontaneous phenomena of nature, by presenting it to us in a different form, which more distinctly expresses what may be called the *elements* of the actions of bodies on each other. His proposition is as follows (see his *Dynamique,* page 73):

D'Alembert's general principle of dynamics.

"In whatever manner a number of bodies change their motions, if we suppose that the motion which each body would have in the following moment, if it were perfectly free, is decomposed into two others, one of which is the motion which it really takes in consequence of their mutual actions, the other will be such, that if each body were

impressed by this force alone (that is, by the force which would produce this motion), the whole system of bodies would be in equilibrio."

This is almost self-evident; for if these second constituent forces be not such as would put the system in equilibrio, the other constituent motions could not be those which the bodies really take by the mutual action, but would be changed by the first.

For example, let there be three bodies P, Q, R, and let the forces A, B, C, act on them, such as would give them the velocities p, q, r, in any directions whatever, producing the momenta, or quantities of motion, $P \times p$, $Q \times q$, $R \times r$, which we may call A, B, C, because they are the proper measures of the moving force. Let us moreover suppose, that, by striking each other, or by being any how connected with each other, they cannot take these motions, A, B, and C, but really take the motions a, b, and c. It is plain that we may conceive the motion A impressed on the body P, to be composed of the motion a, which it really takes, and of another motion α. In like manner, B may be resolved into b, which it takes, and another β; and C into c and $\varkappa$. The motions will be the same, whether we act on P with the force A, or with the two forces a and α; whether we act on Q with the force B, or with b and β; and on R with the force C, or with c and $\varkappa$. Now, by the supposition, the bodies actually take the motions a, b, and c; therefore the motions α, β, and $\varkappa$, must be such as will not derange the motions a, b, and c; that is to say, that if the bodies had only the motions α, β, and $\varkappa$, impressed on them, they would destroy each other, and the system would remain at rest.

M. d'Alembert has applied this proposition with great address and success to the very difficult questions that occur in the motions and actions of fluids, and many other most difficult problems, such as the precession of the equinoxes, &c. The cause of its utility is, that in most cases it is not difficult to find what forces will put a system in equilibrio; and, combining these with the known extraneous forces whose effects we are interested to discover, we obtain the motions which really follow the mutual action of the bodies.

This is not, properly speaking, a principle; it is a form in which a general fact may be conceived. In the same way the celebrated mathematician De la Grange observed, that a system of bodies, acting on each other in any way, is in equilibrio, if there be impressed on its parts forces in the inverse proportion of the velocities which each body takes in consequence of their action or connection; and he expresses this universal fact by a very simple formula; and, calling this also a principle, he solves every question with ease and neatness, by reducing it to the investigation of those velocities. In this way he has written a complete system of dynamics, to which he gives the title of *Méchanique Analytique*, full of the most ingenious and elegant solutions of very interesting and difficult problems; and all this without drawing a line or figure, but accomplishing the whole by algebraic operations.

But this is not teaching mechanical philosophy; it is merely employing the reader in algebraic operations, each of which he perfectly understands in its quality of an algebraic or arithmetical operation, and where he may have the fullest conviction of the justness of his procedure. But all this may be (and, in the hands of an expert algebraist, it generally is), without any notions, distinct or indistinct, of the things or the process of reasoning that are represented by the symbols made use of. (J. R.)

DYNAMOMETER, an instrument for ascertaining the relative strength of men and horses. An ingenious instrument of this kind was invented in London about the middle of the last century by the celebrated mechanician Graham, and improved by Desaguliers. It was constructed of woodwork however, and was soon found to be too complicated and cumbrous to be of any general utility. A simpler instrument was that invented by Leroy of the French Academy. It consisted of a metal tube ten or twelve inches in length, placed vertically on a foot like that of a candlestick, and containing in the inside a spiral spring, having above it a graduated shank terminating in a globe. This shank, together with the spring, sunk into the tube in proportion to the weight acting upon it, and thus pointed out, in degrees, the strength of the person who pressed on the ball with his hand. Simpler and more ingenious than either of these however is that of Régnier, of which a detailed description will be found in the *Journal de l'Ecole Polytéchnique*, tom. ii.

This dynamometer, in its form and size, has a near resemblance to a common graphometer. It consists of a spring twelve inches in length, bent into the form of an ellipsis; from the middle of which arises a semicircular piece of brass, having engraved upon it the different degrees that express a force of the power acting on the spring. The whole of this machine, which weighs only two pounds and a half, opposes, however, more resistance than may be necessary to determine the action of the strongest and most robust horse.

DYRRHACHIUM, in *Ancient Geography*. See EPIDAMNUS, and DURAZZO.

DYSÆ, in *Scandinavian Mythology*, inferior goddesses, whose province it was to convey the souls of such as died in battle to the abode of Odin, which was called *Valhalla* or the hall of slaughter, where they were to drink, with him and their other gods, in cups formed of the skulls of their enemies, a kind of malt liquor called *cerevisia*. The *Dysæ* conveyed those who died a natural death to *Hela*, the goddess of hell, where they were tormented with hunger, thirst, and every kind of evil.

DYSART, a royal burgh and seaport-town of Scotland, county of Fife, situated on the north coast of the Firth of Forth, 12 miles N. by E. of Edinburgh. It consists chiefly of three narrow streets, with a species of square in the centre. In the principal or High street are a number of antique houses, the fronts of which are generally decorated with inscriptions and dates. Dysart House, the residence of the Earl of Rosslyn, is on the west side of the town. Dysart is a place of great antiquity, being mentioned so early as 874, when the Danes invaded Fife. It was made a royal burgh in the reign of James V. The trade of Dysart was formerly very considerable, and acquired for it the name of "Little Holland;" but it is now unimportant, the chief exports being coal. The harbour of the town is tolerably good,—and has attached to it a wet-dock. The weaving of checks and ticks constitute the chief employment of the inhabitants. It unites with Kirkcaldy, Burntisland, and Kinghorn, in returning a member to parliament. Pop. (1851) of municipal burgh 1610; of parliamentary burgh 8041.

DYSCRASY, among physicians, denotes an ill habit or state of the humours, as in the scurvy, jaundice, &c.

DYSENTERY, a diarrhœa or flux, in which the stools are mixed with blood, and the bowels severely griped.

DYSOREXY, a want of appetite; or a bad and depraved appetite.

DYSPEPSIA, a difficulty of digestion.

DYSPNŒA, a difficulty of breathing.

DYVOUR (Fr. *devoir*), in *Scotch Law*, an insolvent debtor; a bankrupt who has made a *cessio bonorum* to his creditors.

E.

E, the second vowel, and fifth letter of the alphabet. This letter is most probably derived from the old character in the ancient Hebrew and Phœnician alphabets, reversed by the Greeks to this position, E, not from the Hebrew ה, as some have supposed. From the same origin is also derived the Saxon *e*, which is the first letter in their alphabet that differs from the Latin one. It is formed by a narrower opening of the larynx than the letter A; but the other parts of the mouth are used nearly in the same manner as in that letter. E has a long and short sound in most languages. The short sound is audible in *bed, fret, den*, and other words ending in consonants; the long sound is produced by a final *e*, or an *e* at the end of words, as in *glebe, here, hire, scene, sphere, interfere, revere, sincere*, and the like, in most of which it sounds like *ee*. In some other cases, this letter, by coming after *i*, is long, as in *believe, chief, grief, reprieve;* and sometimes the long sound is expressed by *ee* as in *bleed, beer, creed*, and so on. Sometimes the final *e* is silent, and only serves to lengthen the sound of the preceding vowel, as in *rag, rage, stag, stage, hug, huge*. The sound of *e*, however, is obscure in the following words: *oxen, heaven, bounden, fire, massacre, maugre*, and other words. The Greeks have their long and short *e*, which they call *epsilon* ε, and *éta* η. The French have several kinds of *e;* the Latins have likewise a long and short *e*. In some instances the latter also write *e* instead of *a*, as *dicem* for *dicam;* and this is no doubt the reason why *a* is so often changed into *e* in the preter-perfect tense, as *ago, egi; facio, feci*, and the like.

As a numeral, E stands for 250, according to the verse,

E, quoque ducentos et quinquaginta tenebit.

In the calendar it is the fifth of the dominical letters; and in sea charts it distinguishes all the easterly points. In ancient contractions and abbreviations E represents *Est, Ennius, Edilis;* EB, *Ejus Bona;* ED, *Ejus Domus;* EE, *Ejus Ætas;* EF, *Ejus Filius;* and so on.

EACHARD, John (1636–1697), an English divine, and the author of *The Grounds and Occasions of the Contempt of the Clergy and Religion inquired into*, 1670. In 1675 he succeeded Lightfoot as master of Catharine Hall. He also wrote against the philosophy of Hobbes. A collected edition of his works was published in 1774.

Eachard, *Laurence*, an English historian, and nearly related to the preceding, was born in 1721 at Suffolk, where his father was a clergyman. He was educated in the university of Cambridge; and after taking orders was presented to the living of Welton and Elkington in Lincolnshire. He was subsequently archdeacon of Lincoln, and prebendary of Stowe. He died in 1730. The work by which he is best known is his *History of England*, in two parts, from the time of the Roman Invasion to the Revolution. It has been attacked by Calamy and Oldmixon; but though it reached several editions, it is now almost entirely forgotten. He wrote also an *Ecclesiastical History from the Nativity of Christ to Constantine;* a *History of Rome till Augustus;* a *History of the Revolution*, and several other works.

EADMERUS, Eadmer, or Edmer, an English historian of the twelfth century. The place of his birth is unknown. His taste for history was developed at an early age; and when a monk in the cathedral of Canterbury he became the bosom friend of St Anselm and his successor Ralph. To the former of these he was appointed spiritual director by the pope. In 1120 he was sent for by Alexander I. of Scotland, to be raised to the primacy of that kingdom; and having obtained leave of Henry and the Archbishop of Canterbury, he departed for Scotland, where he was kindly received by the king, and on the third day after his arrival elected bishop of St Andrews. On the day after his election, however, a dispute arose in regard to the ceremony of consecration; Eadmer refusing to be consecrated by any but the Archbishop of Canterbury, whom he believed to be primate of all Britain; and Alexander with equal pertinacity maintaining that the see of Canterbury had no pre-eminency over that of St Andrews. This breach between the king and the bishop-elect became daily wider, until at length Eadmer, despairing of recovering the royal favour, sent his pastoral ring to the king, laid his pastoral staff upon the high altar, and abandoning his bishopric, returned to England. He was kindly received by the Archbishop and clergy of Canterbury, though they disapproved of his stiffness; and being deprived of their sympathy, Eadmer soon repented of his impetuosity, and endeavoured to retrace his steps. With this view he wrote a long submissive letter to the king of Scotland in 1122, entreating his permission to return to the bishopric, and promising compliance with his royal pleasure in everything respecting his consecration. These overtures, however, did not produce the desired effect. The fame of Eadmer accordingly rests solely on his historical works, particularly on his History of the Affairs of England in his own Time, from 1066 to 1122; a work in which he has inserted many original papers, and preserved many important facts which are nowhere else to be found. This production has been highly commended for its authenticity, as well as the regularity of its composition and purity of its style. It is indeed more free from legendary tales than any other work of this period; and it is impossible to peruse it with attention without conceiving a favourable opinion of the learning, good sense, sincerity, and candour of its author. Eadmer wrote also the Lives of St Anselm, St Wilfred, St Dunstan, and others. The best edition of his History is that by Selden in 1623.

EAGLE. See Ornithology.

Eagle, in *Heraldry*, is accounted one of the most noble bearings in armoury, and, according to the learned in this science, ought to be given to none but such as greatly excel in the virtues of generosity and courage, or have rendered singular service to their sovereigns; in which case they may be allowed a whole eagle, or an eagle naissant, or only the head or such other parts as may be judged most suitable to their exploits.

The eagle has been borne as an ensign or standard by several nations. The first who seem to have assumed the eagle were the Persians, according to the testimony of Xenophon; but subsequently it was adopted by the Romans, who, after a great variety of standards, at length fixed on the eagle, in the second year of the consulate of C. Marius, having till that period used indifferently wolves, leopards, and eagles. The Roman eagles were figures in relief formed of silver or gold, and borne on the tops of pikes; the wings being displayed, with frequently a thunderbolt in the talons. Under the eagle on the pike were piled bucklers, and sometimes crowns.

Constantine is said to have been the first who introduced the eagle with two heads, to intimate, that though the empire seemed divided, it had yet only one body. Others say that it was Charlemagne who resumed the eagle as the Roman ensign, and added to it a second head; but that opinion is destroyed by an eagle with two heads observed by Lipsius on the column of Antoninus, as also by the eagle's having only one head on the seal of the golden bull of the Emperor Charles IV. The conjecture, therefore, of Menestrier appears more probable; namely, that the emperors of the East, when there were two on the throne at the same

time, struck their coins with the impression of a cross with a double traverse, which each of them held in his hand, as being the symbols of the Christians; and that they did the like with the eagle in their ensigns, and, instead of doubling, joined them together, representing them with two heads; a practice in which they were followed by the emperors of the West. But this conjecture of Menestrier is not confirmed by ancient coins, without which Papebroche inclines to think the use of the eagle with two heads to have been merely arbitrary, though he admits it to be probable that it was first introduced on occasion of there being two emperors on the same throne.

The eagle on medals is, according to Spanheim, a symbol of divinity and providence, and, according to all other antiquaries, of empire. The princes on whose medals it is most usually found are the Ptolemies, and the Seleucidæ of Syria. An eagle with the word *consecratio* expresses the apotheosis of an emperor.

Eagle (*Aquila*), a constellation. See Astronomy.

White Eagle, a Polish order of knighthood, instituted in 1325 by Vladislaus V. on marrying his son Casimir to a daughter of the grand duke of Lithuania. The badge was a gold chain to which was suspended a silver eagle crowned.

Black Eagle, an order of knighthood, instituted in 1701 by the elector of Brandenburg, on his being crowned king of Prussia. The badge was an orange-coloured ribbon sustaining a black eagle.

Eagle, in *Numismatics*, a sort of base money which was current in Ireland in the early part of the reign of Edward I., that is, about the year 1272. There were also lionines, rosades, and many other coins of the same sort, named according to the figures with which they were impressed. The current coin of the kingdom at that time was a composition of copper and silver, in determinate proportions; but these were so much inferior to the standard of that time, that they were not intrinsically worth half so much as the others. They were imported from France and other foreign countries. When Edward had been a few years established on the throne, he set up mints in Ireland for coining good money, and then prohibited the use of eagles, and other kinds of base coin; making it death, with confiscation of effects, to import any more of them into the kingdom. Eagle is the designation of the principal gold coin of the American United States.

Eagle-Stone. See Ætites.

EALDERMAN, or Ealdorman, among the Saxons, was of the same import with *Earl* among the Danes. The word was also used for an elder, senator, or statesman; and hence, at this day, those functionaries are called *aldermen* who are associates to the chief officer in the common council of a city or corporate town.

EAR. See Anatomy.

Ear is used technically in music to denote susceptibility of the auditory organ, as well as of the mind, to all musical impressions; or the faculty of perceiving them correctly, and the power of transmitting them unchanged to the sensorium. When speaking figuratively of *an ear, a good ear, a fine ear* for music, we mean an ear very sensitive to music—able to distinguish true intonation from false—to perceive accuracy of time and justness of harmony—to feel the beauties of a musical composition and discover its faults, &c. To have *no ear* for music implies the absence of all these powers. An ear for the measure and cadence of poetical versification and for rhyme, by no means necessarily implies an ear for music, although both may and often do co-exist. Some distinguished poets have been utterly destitute of musical ear; while others, such as Milton, possessed great musical susceptibility. The want of an ear for music is a defect as inscrutable as that peculiarity of eye in some persons which hinders them from distinguishing colours. See Music, § *The sense of hearing*. (G. F. G.)

EARING, in nautical language, a rope attached to the cringle of a sail, by means of which it is bent or reefed.

EARL, a British title of nobility, next below a marquis, and above a viscount. The title is one of great antiquity, and the word is evidently a corruption of the Norwegian *jarl*. A certain order of the Saxon nobility was called *ealdormen*, elder men, a word of the same signification with *senior* or *senator* among the Romans; and also *schiremen*, because they had each of them the civil government of a civil division or shire. On the irruption of the Danes they changed the names to *eorels*, which, according to Camden, had the same signification in their language. In Latin they are called *comites*, (a title first used in the empire), from being the king's attendants; *a societate nomen sumpserunt, reges enim tales sibi associant*. After the Norman Conquest they were for some time called *counts*, from the French; but they did not long retain that name themselves, though their shires are thence denominated *counties* to this day. It is now become a mere title, the holders of which have nothing to do with the government of the county, that being now entirely devolved on the sheriff, the earls-deputy or *vicecomes*. In writs, commissions, and other formal instruments, the sovereign, when mentioning any peer of the degree of an earl, usually styles him trusty and well-beloved cousin; an appellation as ancient as the reign of Henry IV., who being, either by his wife, his mother, or his sisters, actually related or allied to every earl in the kingdom, artfully and constantly acknowledged that connection in all his letters and other public acts; whence the usage descended to his successors, though the reason has long ago failed.

Earl-*Marshal*. See Marshal.

EARNEST (Arrhæ), something given to bind a bargain; generally a small sum of money. By the civil law, he who recedes from his bargain loses his earnest; and if the person who received the earnest resiles, he must return the earnest double. But with us, the person who gives it is in strictness obliged to abide by his bargain; and in case he decline it, he is not discharged upon forfeiting his earnest, but may be sued for the whole money stipulated.

EAR-RING, an ornament worn at the ear; a pendant or jewel suspended by means of a ring or a hook passing through the pendulous lobe of the ear. The use of this kind of ornament dates from the remotest antiquity, since the first mention of ear-rings occurs in the book of Genesis. Ear-rings of certain kinds were anciently, and still are, in the East, instruments or appendages of idolatry and superstition—being regarded as talismans and amulets. Such, probably, were the ear-rings of Jacob's family, which he buried with the strange gods at Bethel. This somewhat barbarous species of adornment was used (as it still is in some countries) by both sexes among many Oriental nations; especially by the Lydians, Persians, Babylonians, Libyans, and Carthaginians, as may be gathered from various ancient authors.

Among the Hebrews and the Egyptians their use appears to have been confined to women: but that they were extensively used by the men of various other nations is sufficiently proved by the Egyptian monuments.

Among the Greeks and Romans ear-rings were worn only by females, and were sometimes of enormous value. It is a curious fact that the ears of the Venus de' Medici, and of some other female statues, are pierced, as if for the purpose of bearing these appendages.

EARTH (Sax. *eard, eorth, yrth*), among ancient philosophers, one of the four elements of which the whole system of nature was believed to be composed. In *Astronomy* and *Geography*, it denotes one of the primary planets, being the terraqueous globe we inhabit. See Astronomy; Figure of the Earth; Geology; Physical Geography.

EARTHENWARE. See Pottery.

EARTHQUAKE. The proximate cause of earthquakes, though by no means accurately defined, seems referable to the action of internal heat or fire. That the earth was once subject to the action of a vast internal power springing probably from the development of subterranean or central heat, the elevations and depressions, and the generally scarred and torn character of its exterior, make sufficiently evident. A power similar in kind, but more restricted in degree, is still at work in the bowels of the earth, and occasionally breaks down all barriers and devastates certain parts of the world. There is good reason for holding that earthquakes are closely connected with volcanic agency. Both probably spring from the same cause; and may be regarded as one mighty influence operating to somewhat dissimilar results. Volcanic agency, therefore, is an indication of earthquakes, and traces of the first may be taken as indications of the existence (either present or past, actual or possible) of the latter.

The manifestation of these awful phenomena is restricted in its range. Accordingly, geologists have laid down certain volcanic regions or bands within which this manifestation takes place. Over these regions various traces of volcanic agency are found, such as either gaseous vapours or hot springs, or bituminous substances, and in some instances (occasionally) active volcanoes. See PHYSICAL GEOGRAPHY, sec. v.; ÆTNA; ANTIOCH; LISBON; &c.

EARTHS, in *Chemistry*. See CHEMISTRY.

EASDALE, a small island of Argyleshire, 10 miles S.S.W. of Oban; noted for its slate-quarries, which have been wrought for 150 years.

EASE, in seamen's language, is to slacken a rope. To *ease a ship* is to put the helm a-lee when she is sailing close-hauled.

EASEL, the portable frame on which painters place their canvas. Hence, *easel-pieces* are the smaller pictures which are painted on the easel, as distinguished from those which are drawn on walls, ceilings, &c.

EASINGWOLD, a market-town in the north riding of Yorkshire, 13 miles N.N.W. of York. A large market is held here every Friday, chiefly for butter, bacon, and agricultural produce from the vicinity. Pop. (1851) 2240.

EAST, one of the four cardinal points of the world, being that point of the horizon where the sun is seen to rise when in the equinoctial. The word *east* is Saxon. In Italy, and throughout the Mediterranean, the east wind is called the *levante;* in Greek, ἀνατολή and ἀπηλιώτης, because it comes from the side of the rising sun, ἀπ' ἡλίου; in Latin, *Eurus*.

EAST INDIA COMPANY. See INDIA.

EASTBOURNE, a village and watering-place on the coast of Sussex, 65 miles from London by the Brighton and South Coast railway. It is situated in a chasm between two cliffs; one of which, Beachy Head, is the loftiest headland on the English Channel. It is divided into three distinct parts, and is much resorted to for sea-bathing. Pop. of parish (1851) 3133.

EASTER, a festival of the Christian church, observed in memory of our Saviour's resurrection. The Greeks call it *pasga*, the Latins *pascha*, from a Hebrew word signifying *passage*, applied to the Jewish feast of the Passover. It is called *Easter* in English, from the goddess Eostre, who was worshipped by the Saxons with peculiar ceremonies in the month of April. The Asiatic churches kept their Easter upon the very same day on which the Jews observed their Passover, and others on the first Sunday after the first full moon in the new year. This controversy was determined in the council of Nice, when it was ordained that Easter should be kept upon one and the same day, which should always be a Sunday, in all Christian churches in the world. See CALENDAR, vol. vi., p. 86.

EASTON, the capital of the county of Northampton, state of Pennsylvania, N. America, is situated on the W. side of the Delaware river, which here receives the Lehigh 93 miles E.N.E. of Harrisburg. This is one of the most prosperous commercial towns in Pennsylvania, being the entrepôt of an extensive trade between the coal and iron fields of that state, and the terminus of several lines of railway and of canals. It has numerous churches and educational institutions; among the latter—Lafayette College, which in 1850 had a president, 7 professors, and 82 students. Pop. (1850) 7250. There are several other places of this name in the United States.

EASTPORT, the capital of Washington county, state of Maine, North America, is built on the Moose and several smaller islands in Passamaquaddy Bay, 183 miles W.N.W. of Augusta. Pop. (1850) 4125. It is a garrison town, and has a fine harbour and an extensive trade.

EAU DE COLOGNE, a well-known perfume, prepared in many different ways. The recipe of Jean Maria Farina may be found in Ure's *Dictionary of Arts*, but it appears to be needlessly complicated. A good imitation of the genuine Eau de Cologne may be thus prepared: To one pint of very pure alcohol add the following ingredients; oils of bergamot, rosemary, and orange-peel, of each 1 drachm; cardamom seeds, 1 drachm; orange-flower water, 1 pint; and distil off one pint from a water bath.

EAU *de Luce*, a compound formed of the distilled oil of amber and a strong solution of ammonia, to which some mastic and scent are usually added. The vaunted efficacy of this compound as a remedy for the bites of venomous reptiles, appears to reside solely in the ammonia it contains.

EAVES (Sax. *efese;* Fr. *eaux*), the lower edges of the inclined sides of a roof, which project beyond the face of the walls, so as to throw off rain from the foundations.

EAVES-*Dropper*, one who stands under the eaves, or near the wall or window of a house, for the purpose of hearing what passes within. Eaves-droppers are called by the *Stat. of West.* i. c. 33, "*evil members of the commonwealth.*" In England they are punishable by a fine.

EBDOMARIUS, or HEBDOMARIUS, is used in old ecclesiastical writings to denote an officer who was appointed weekly to superintend the performance of divine service in cathedrals, and prescribe the duties of each person officiating in the choir.

EBDOME, in *Antiquity*, a festival observed by the Spartans on the seventh day of every lunar month, in honour of Apollo, to whom all seventh days were sacred, because he was born on the seventh day of the month; and hence he was sometimes called *Ebdomagetes*.

EBERHARD, JOHANN AUGUSTUS, an eminent German theologian and philosopher, was born at Halberstadt, in Lower Saxony, Aug. 31, 1739. His father was the singing-master at the church of St Martin's in that town, and also teacher of the school of the same name; a man, it is said, of a lively disposition, and considerable literary attainments. Young Eberhard was educated partly at home and partly in the school above mentioned. In the seventh year of his age he repaired to the University of Halle, with the view of prosecuting his theological studies. Towards the end of 1759 he returned to his native town, and became tutor to the eldest son of the Baron Von der Horst, to whose family he attached himself for a number of years. In 1763 he was appointed con-rector of the school of St Martin's, and second preacher in the Hospital Church of the Holy Ghost; but he soon afterwards resigned these offices, and followed his patron to Berlin.

The advantages he enjoyed in this family, of being introduced into the best company, tended to polish his manners and to form, even at an early period, a style of writing which served as a model to many of his contemporaries. His residence at Berlin gave him an opportunity of extending his knowledge, and of cultivating the acquaintance of some of

the most eminent literary characters in Germany. Amongst these were Nicolai and Mendelssohn, with whom he associated upon terms of intimate friendship.

In 1768 he accepted the situation of preacher or chaplain to the workhouse at Berlin, along with that of preacher in the neighbouring fishing village of Stralow. The income from these livings was small; but his object was to continue at Berlin, and he had at the same time the promise of further preferment upon the first vacancy. He now applied with renewed ardour to the study of theology, philosophy, and history; and the first fruits of his talents and application soon appeared in his *New Apology of Socrates;* a work exhibiting such originality of thought and eloquence of style as at once established his character as a writer. This work was occasioned by an attack which was made on the sentiments contained in the fifteenth chapter of Marmontel's *Belisarius* by one Peter Hofstede, a clergyman of Rotterdam, who, with a misdirected industry, raked up the vices of the most celebrated characters in the pagan world, and even went so far as to maintain that the most virtuous amongst the heathen were no fit objects of divine mercy. He seemed particularly desirous to blacken the character of Socrates; and from this circumstance Eberhard was induced to give to his work the title which we have mentioned above. The greater part of it is occupied with an investigation of some of those peculiar doctrines which have been admitted as dogmas of the Christian church, upon the authority of some of the early fathers; and an examination of those texts of Scripture upon which they are founded. The *Apology* itself, which constitutes but a small part of the book, is esteemed a masterpiece of clear, dignified, and persuasive eloquence. The whole work exhibits much reading and philosophical reflection; but the liberality of his reasoning gave great offence to many of the strictly orthodox divines of his time, and is believed to have obstructed his preferment in the church.

In 1774 he was appointed to the living of Charlottenburg; and he employed the leisure he had in this situation in publishing a second volume of his *Apology;* in which he not only endeavours to obviate some objections which were taken to the former part, but continues his inquiries into the doctrines of the Christian religion, religious toleration, and the proper rules for interpreting the Scriptures. Perceiving that his further promotion in the church would be attended with difficulty, he resolved, although reluctantly, to accept the situation of professor of philosophy at the University of Halle, which became vacant in 1778 by the death of G. F. Moier. But, however excellent as a writer, and however just his ideas upon philosophical subjects, he does not appear to have been peculiarly qualified to excel as a teacher. He was highly esteemed, indeed, both by professors and students; but his lectures, although they attracted at first a considerable concourse, never acquired any degree of popularity. He continued, however, to lecture very regularly; and published several manuals for the use of his pupils.

On his arrival at Halle, the philosophical faculty presented him with a diploma as doctor in philosophy and master of arts. In 1786 he was admitted a member of the Berlin Academy of Sciences; and in 1805 the king of Prussia conferred upon him the honorary title of a privy-councillor. In 1808 he obtained the degree of doctor in divinity, which was given him as a reward for his theological writings. He married in 1778, but had no children. He died Jan. 6, 1809, being then in the seventieth year of his age.

Eberhard's attainments in philosophy and literature were extensive and profound. He was master of the learned languages, spoke and wrote French with facility and correctness, and understood English, Italian, and Dutch. He had read a great deal, was thoroughly versed in the philosophical sciences, and possessed a just and discriminating taste for the fine arts. He was a great lover of music, and was himself a proficient in that science. His manners were mild and unassuming; and his amiable and cheerful disposition, no less than his talents and virtues, endeared him to a numerous circle of friends.

The following is a list of his works:—*Neue Apologie des Socrates*, &c., 2 vols. 8vo, 1772–8; *Allgemeine Theorie des Denkens und Empfindens*, &c., Berlin, 1776, 8vo,—this essay obtained the prize assigned by the Royal Society of Berlin for that year; *Von dem Begriff der Philosophie und ihren Theilen*, Berlin, 1778, 8vo,—a short essay, in which he announced the plan of his lectures on being appointed to the professorship at Halle; *Lobschrift auf Herrn Johann Thunmann, Prof. der Weltweisheit und Beredsamkeit auf der Universität zu Halle*, Halle, 1779, 8vo; *Amyntor, eine Geschichte in Briefen*, Berlin, 1782, 8vo. This work was written with the view of counteracting the influence of those sceptical and Epicurean principles in religion and morals which were then so prevalent in France, and thence rapidly spreading amongst the higher ranks in Germany. It is composed with great elegance and perspicuity, and exhibits much philosophical reflection, and knowledge of the world. The story is simple, and seems to have been merely intended as a vehicle for the sentiments. *Ueber die Zeichen der Aufklärung einer nation*, &c., Halle, 1783, 8vo; *Theorie der Schönen Kunste und Wissenschaften*, &c., Halle, 1783, 8vo, 3d ed. 1790; *Vermischte Schriften*, Halle, 1784; *Neue Vermischte Schriften*, Ib. 1786; *Allgemeine Geschichte der Philosophie*, &c., Halle, 1788, 8vo; 2d ed. with a continuation and chronological tables, 1796. Eberhard published also an abridgment of this work in 1794. *Versuch einer Allgemeinen-Deutschen Synonymik*, &c., Halle and Leipsic, 1795–1802, 6 vols. 8vo. This is esteemed a classical work on the synonymes of the German language. An abridgment of it was published by the author in one large volume 8vo, Halle, 1802. *Handbuch der Aesthetik*, &c., Halle, 1803–1805, 4 vols. 8vo. Besides the works above mentioned, Eberhard contributed a number of small tracts and essays to various periodical and scientific publications, and translated several foreign works. He was also the editor of the *Philosophical Magazine*, Halle, 1788–1792, and of the *Philosophical Archives*, Halle, 1793–1795. These two periodical works, which are now little read, were instituted for the purpose of controverting the metaphysical principles of Kant, and of vindicating the doctrines of Leibnitz and Wolf. Frederick Nicolai published a Memoir on the life and character of Eberhard, Berlin and Stettin, 1810, 8vo. See also K. H. Jördens, *Lexicon Deutscher Dichter und Prosaisten;* and *Biographie Universelle.* (J. C.)

EBINGEN, a town of Würtemberg, circle of Balingen on the Schmieha, with 4400 inhabitants, engaged chiefly in the manufacture of woollen cloths, hosiery, hats, and leather.

EBIONITES, a Jewish-Christian sect of the first century, who separated themselves from that branch of the Nazarenes that remained faithful to the apostolic doctrine. They differed from the Nazarenes in this, that they asserted the permanent obligation of the whole Mosaic law, and on this account they retained circumcision, and highly valued the Pentateuch. They regarded Christ as a mere man; and used a translation of the Gospel of Matthew in Greek characters, but in the Syro-Chaldaic dialect. At a later period they adopted other books attributed to St James, St Peter, and Clement. Epiphanius and Tertullian both derive the name from Ebion, a disciple of Cerinthus, who is said to have founded the sect. Others derive it from the Hebrew *Ebionim, i.e.* poor people, a name at first either given to the Christians by the Jews, or probably assumed by the former on account of their poverty. They originally planted themselves at Pella, on the other side of Jordan, and gradually spread from thence into the Decapolis, Peræa, and Syria. They were afterwards merged with the Elcesaites. The ancient authorities on the subject of the Ebionites are Origen, Epiphanius, and Eusebius. See also the dissertations of Mosheim, Credner, Detmer, and Walch.

EBONY (ἔβενος), a species of wood, brought principally from the East. It is exceedingly hard and heavy, of great durability, and susceptible of a very fine polish; and hence it is wrought into a variety of toys, and used in mosaic and other kinds of inlaid work. As a dye also it yields a fine green tincture. There are several varieties of ebony, namely, black, red, green, and yellow; but the black is the most valuable. Ebony is obtained from several species of *Dios-*

pyros ebenus, a tree of the natural order *Ebenaceæ*. The supply of this valuable wood comes principally from Madagascar, the Mauritius, and Ceylon. The heart of the tree yields the finest ebony. The best is jet black, free from veins and rind, of a very dense structure, astringent, and of an acrid pungent taste. When laid on burning coals it yields an agreeable perfume; and when green it readily takes fire from its abundance of oil. See BOTANY, Nat. Ord. 135.

The facilities for staining pear-tree and other hard woods of a fine black colour has greatly limited the use of genuine ebony in modern times. It is stated in M'Culloch's *Commercial Dictionary* that the price of ebony varies in the London market from L.5 to L.20 a ton, and that the quantities imported are but inconsiderable.

EBORACUM, or as it is sometimes written EBURACUM, the ancient name of York, which in the days of the Roman empire in Britain was a place of considerable importance. It was at Eboracum that the Emperors Constantius and Severus died, and that Constantine the Great was born. Numerous remains of the Roman occupation have been found at York, throwing much light upon the social customs and domestic manners of that people. See YORK.

EBRO, a river of Spain. See SPAIN.

EBUDÆ, or HEBUDES, the ancient name of the Hebrides or Western Isles.

EBULLITION, the motion produced in any liquid by the escape of a portion of it converted into an aeriform state by heat; as exemplified in the boiling of water, the slaking of lime, &c.

ECASTOR, or MECASTOR, an oath in which Castor was invoked. It was not the custom for men to swear by Castor, nor for women by Pollux.

ECATÆA, Ἑκάταια, in *Grecian Antiquity*, statues erected to the goddess Hecate, as the giver of riches and prosperity, and the protectress of new-born babes.

ECBATANA, now ACHMETHA, a city in Media. The derivation of the name is doubtful; but Major Rawlinson (*Geogr. Journal*, x. 134) has left little question that the title was applied exclusively to cities having a fortress for the protection of the royal treasures. In Ezra we learn that in the reign of Darius Hystaspes the Jews petitioned that search might be made in the king's treasure-house at Babylon for the decree which Cyrus had made in favour of the Jews (Ezra, v. 17). Search was accordingly made in the record-office ("house of the rolls"), where the treasures were kept at Babylon (vi. 1): but it appears not to have been found there, as it was eventually discovered "at Achmetha, in the palace of the province of the Medes" (vi. 2). It is here worthy of remark, that the LXX. regarded "Achmetha," in which they could hardly avoid recognising the familiar title of Ecbatana, as the generic name for a city, and accordingly rendered it by πόλις; and that Josephus, as well as all the Christian Greeks, while retaining the proper name of Ecbatana, yet agree, with the Greek Scriptures, in employing the word βάρις to express the Hebrew *Birtha* ("the palace"), which is used as the distinctive epithet of the city.

In Judith i. 2-4, there is a brief account of Ecbatana, in which we are told that it was built by Arphaxad, king of the Medes, who made it his capital. It was built of hewn stones, and surrounded by a high and thick wall, furnished with wide gates and strong and lofty towers. Herodotus ascribes its foundation to Deioces, in obedience to whose commands the Medes erected "that great and strong city, now known under the name of Agbatana, where the walls are built circle within circle, and are so constructed that each inner circle overtops its outer neighbour by the height of the battlements alone. This was effected partly by the nature of the ground (a conical hill), and partly by the building itself. The number of the circles was seven, and within the innermost was the palace of the treasury. The battlements of the first circle were white, of the second black, of the third scarlet, of the fourth blue, of the fifth orange; all these were brilliantly coloured with different pigments; but the battlements of the sixth circle were overlaid with silver, and of the seventh with gold. Such were the palace and the surrounding fortification that Deioces constructed for himself; but he ordered the mass of the Median nation to construct their houses in a circle around the outer wall." (Herodot. i. 98). It is contended by Major Rawlinson (*Geogr. Journal*, x. 127) that this story of the seven walls is a fable of Sabæan origin, the seven colours mentioned being precisely those employed by the Orientals to denote the seven great heavenly bodies, or the seven climates in which they revolve. He adds (p. 128), "I cannot believe that at Agbatana the walls were really painted of these colours: indeed, battlements with gold and silver are manifestly fabulous; nor do I think that there ever could have been even seven concentric circles; but in that early age, where it is doubtful whether mithraicism or fire-worship had originated in this part of Asia, it is not at all improbable that, according to the Sabæan superstitions, the city should have been dedicated to the seven heavenly bodies, and perhaps a particular part assigned to the protection of each, with some coloured device emblematic of the tutelar divinity."

This Ecbatana has been usually identified with the present Hamadan. Major Rawlinson, however, while admitting that Hamadan occupies the site of the Median Ecbatana, has a learned and most elaborate paper in the *Geographical Journal* (x. 65-158; *On the Site of the Atropatenian Ecbatana*), in which he endeavours to show that the present Takht-i-Suleiman was the site of another, the Atropatenian Ecbatana; and that to it, rather than to the proper Median Ecbatana, the statement in Herodotus and most of the other ancient accounts are to be understood to refer. The major, indeed, seems inclined to consider the Ecbatana of the apocryphal books as his Atropatenian Ecbatana; but is rather more doubtful in claiming it as the Achmetha of Ezra. But without undertaking to determine what amount of ancient history should be referred to the one or to the other, we feel bound to conclude that Hamadan was the site of the Achmetha of Ezra, and the Ecbatana of the Apocrypha: 1. Because it is admitted that the Median Ecbatana was a more ancient and more anciently great city than the Atropatenian metropolis; 2. Because the name "Achmetha" may easily, through the Syrian Ahmethan, and the Armenian Ahmetan, be traced in the Persian Hamadan; 3. And because all the traditions of the Jews refer to Hamadan as the site of the Achmetha and Ecbatana of their Scriptures.

Hamadan is still an important town, and the seat of one of the governments into which the Persian kingdom is divided. It is situated in N. Lat. 34. 53., E. Long. 40., at the extremity of a rich and fertile plain, on a gradual ascent, at the base of the Elwund Mountains, whose higher summits are covered with perpetual snow. Some remnants of ruined walls of great thickness, and also of towers of sun-dried bricks, present the only positive evidence of a more ancient city than the present on the same spot. Heaps of comparatively recent ruins, and a wall fallen to decay, attest that Hamadan has declined from even its modern importance. The population is said by Southgate to be about 30,000, which probably exceeds the truth very considerably. It is little distinguished, inside, from other Persian towns of the same rank, save by its excellent and well-supplied bazaars, and the unusually large number of khans of rather a superior description. This is the result of the extensive transit trade of which it is the seat, it being the great centre where the routes of traffic between Persia, Mesopotamia, and Persia, converge and meet. Its own manufactures are chiefly in leather. Many Jews reside here, claiming to be descended from those of the Captivity who

remained in Media. Benjamin of Tudela says that in his time the number was 50,000. Modern travellers assign them 500 houses; but the Rabbi David de Beth Hillel (*Travels*, pp. 85-87, Madras, 1832), who was not likely to understate the fact, and had the best means of information, gives them but 200 families. He says they are mostly in good circumstances, have fine houses and gardens, and are chiefly traders and goldsmiths. They speak the broken Turkish of the country, and have two synagogues. *They* derive the name of the town from "*Haman*" and "*Mede*," and say that it was given to that foe of Mordecai by King Ahasuerus. In the midst of the city is a tomb which is in their charge, and which is said to be that of Mordecai and Esther. It is a plain structure of brick, consisting of a small cylindrical tower and a dome (the whole about 20 feet high), with small projections or wings on three sides. Within are two apartments—a small porch formed by one of the wings, and beyond it the tomb-chamber, which is a plain room paved with glazed tiles. In the midst, over the spots where the dead are supposed to lie, are two large wooden frames or chests, shaped like sarcophagi, with inscriptions in Hebrew and flowers carved upon them. There is another inscription on the wall, in bas-relief, which, as translated by Sir Gore Ousley, describes the present tomb as having been built over the graves of Mordecai and Esther by two devout Jews of Kashan, in A.M. 4474. The original structure is said to have been destroyed when Hamadan was sacked by Timour. As Ecbatana was then the summer residence of the Persian court, it is probable enough that Mordecai and Esther died and were buried there; and traditional testimony, taken in connection with this fact, and with such a monument in a place where Jews have been permanently resident, is better evidence than is usually obtained for the allocation of ancient sepulchres. The tomb is in charge of the Jews, and is one of their places of pilgrimage. Kinneir, Ker Porter, Morier, Frazer, and Southgate, furnish the best accounts of modern Hamadan. (See PERSIA.)

History mentions another Ecbatana, in Palestine, at the foot of Mount Carmel, towards Ptolemais, where Cambyses died (Herod. iii. 64; Plin. v. 19). It is not mentioned by this or any similar name in the Hebrew writings: and we are at a loss to discover the grounds which Major Rawlinson says exist for concluding that there was a treasury in this position (*Geogr. Journ.* x. 134).

ECCENTRIC, deviating or departing from the centre. In geometry the term is applied to circles and spheres which have different centres, and consequently are not parallel; as opposed to *concentric*, or such as have a common centre. In astronomy it denotes the distance of the centre of a planet's orbit from the centre of the sun—or the distance between the centre of an ellipse and its focus. In mechanics the term is applied to any revolving motion of which the axis is not placed in the centre.

ECCHELLENSIS, ABRAHAM, a learned Maronite, associated with Le Jai in the preparation of his Polyglott Bible. He was at first the coadjutor of Gabriel Sionita, a countryman of his, who afterwards quarrelled with him, and brought his case before parliament. In 1636 the congregation *de Propaganda Fide* associated him with those whom they had employed in making an Arabic translation of the Scriptures; and he removed to Rome for that purpose in 1652. While professor of oriental languages at Rome, he translated into Latin the fifth, sixth, and seventh books of Apollonius's Conics; a task in which he was assisted by John Alphonso Borelli. Ecchellensis died at Rome in 1664.

ECCLES, a manufacturing parish of Lancashire, England, 4 miles from Manchester. Pop. (1851) 41,497, chiefly engaged in the several branches of the cotton manufacture.

ECCLESALL-BIERLOW, a village in the west riding of Yorkshire, parish of Sheffield, $3\frac{1}{2}$ miles from the town of that name. The inhabitants, like those of Sheffield, are engaged chiefly in the manufacture of iron and steel articles. Pop. of township, which includes 26 hamlets, (1851) 24,552.

ECCLESHALL, a market-town of England, in the county of Stafford, on the river Sow, $6\frac{1}{2}$ miles W.N.W. of the town of Stafford. It is a neatly built place, and contains a castle, the residence of the bishop of Lichfield. In its church Bishop Halse concealed Queen Margaret when she fled from Muckleston. Market-day Friday. Pop. of parish (1851) 4696.

ECCLESIA, in *Grecian Antiquity*, the general assembly of Athenian citizens, who met from time to time to discuss public affairs. Ecclesiæ were of two kinds, ordinary and extraordinary. The first of these were held three times every month; while the others were only summoned on some pressing emergency. When any measure of unusual importance was to be publicly debated, the people were summoned from the country by special messengers. An assembly thus convened was called a *cataclesia*.

Much discussion has taken place as to the exact days of the month on which the ecclesiæ were held; but the result has only been to prove either that there were no days invariably fixed for them, or that we have no data by which to determine accurately what these days were. In Ulpian it is stated that when there were three assemblies a-month, the first fell on the eleventh, the second on the twentieth, and the third about the thirtieth of the month.

Ecclesiæ were originally held in the Agora or Forum. The place of meeting was subsequently removed to the Pnyx, and afterwards to such of the greater temples as might be most convenient. The Pnyx lay to the west of the Areopagus, and commanded an extensive view. It was partly within the city walls, and had an area of about 12,000 square yards. On its northern side, cut out of the solid rock, was the *bema* or hustings from which the speakers addressed the people. From this tribunal a splendid view of the principal buildings of the city might be had. The right of assembling the people lay with the presidents of the senate or Council of Five Hundred, who both advertised beforehand the business to be discussed, and on the day of meeting sent round a crier to remind the citizens that their presence was required. In times of war, however, or other national crises, the generals of the army sometimes assumed this privilege, though it was necessary for them in doing so to give notice of their intention by a public proclamation. They also sometimes claimed the right of preventing the ecclesia from assembling; but their claims to this privilege were not generally recognised. Such of the citizens as refused to attend were fined, and six magistrates called Lexiarchs were appointed to collect the fines. To assure a full meeting, the custom was ultimately introduced of paying the poorer classes a small sum for their attendance. This sum was originally an obolus, but after the time of Pericles it was raised to three.

ECCLESIA is also the name in Hellenistic Greek for the Christian Church.

ECCLESIASTES, or the PREACHER, one of the canonical books of the Old Testament. The Hebrew word *Coheleth*, of which the above two titles are a translation, is of somewhat difficult etymology; but if the merely modern shade of meaning attached to the word *preacher* be avoided, there is no reason to abandon this its ancient title for the fanciful renderings, *collector*, *assembly*, *academy*, &c., which have been popular abroad.

The history of the interpretation of Ecclesiastes presents the same great features with that of the other books of Scripture. Of its admission into the canon there is not even the shadow of a doubt; although some of the learned Jews mentioned in the Talmud seem to have been haunted with scruples in regard to its heresy, its "contradictions," and

its "materialism." From these Talmudists to Theodore of Mopsuestia, and from that period again till the Reformation, its orthodoxy remained generally unchallenged both in the synagogue and in the church. During the last and the present century it has shared the fate of all ancient documents at the hands of Continental Rationalism, and is now emerging from this its fiercest and apparently final ordeal.

The points under dispute are, severally, its unity and plan, its ethical characteristics, its date and authorship. Its unity is denied by the whole Wolfian school of critics; but their schemes of partition into dialogues and disjointed narratives, rival poems, literary discussions, ethical aphorisms, and unfinished practical essays, are more than mutually destructive. The peculiarity of the diction, and the unity of the subject, is too marked to admit of the possibility of divided authorship. In regard to the plan of the book, their rival theories are equally at fault. Between the scheme of Kaiser, who detects throughout historical and prophetic delineations of the characters and reign of the later kings, and that of Ewald and Hitzig, who recognise in it the utterances of incarnate wisdom, it may easily be imagined that there are intermediate hypotheses interminable. The most plausible ground for recognising a plurality of authors, and consequently a frequent divergence of plan in the book, lies in the abruptness of its transitions, which are in fact made without regard to logical accuracy or rigorous simplicity of method; but this can hardly be recognised as necessarily inconsistent either with a fixed plan or with a unity of authorship, since, as is the case with the Song of Solomon, it enters into the very conception of the book, that it should present its main theme abruptly from a variety of opposite points of view. The theme itself, which is the vanity of all earthly things, is never lost sight of; and however far the orbit of its illustration sweeps, there is ever a periodical return to this dreary central thought. So entirely, however, does the ethical value which we attach to it depend on the hypothesis which we hold in regard to its structure, that De Wette on one theory rejects the book entirely as unhinging the doctrine of final retribution, and Moses Stuart on another receives it as containing more explicit reference to this grand event than any other book of the Old Testament. If, as some have supposed, it be a mental autobiography of Solomon, in which he brings to light the Epicurean maxims that soothed and incited him in his career of folly and dissipation, the ethical difficulties vanish.

The date of Ecclesiastes is not so precisely determined by its diction as was at one time confidently supposed. Its alleged Hellenisms, at one time triumphantly paraded as the demonstration of its late origin, have been entirely eliminated by later scholars; and the rash assertion that it is coloured with the peculiar Greek philosophizing in regard to the chief good, has been successfully disproved. Its Chaldaisms, which have at least as great affinity to patriarchal as to modern Hebrew, have been reduced to some eight or ten instances. And taking into account the necessities, or even the eccentricities of philosophical language, it is not too much to say that these might have been written in the golden age of Hebrew literature. The political sketches in the book have also been employed with a view to ascertain its date. Setting out on the principle that the author is depicting the miseries of contemporary history, almost all the leading epochs of later Jewish history have been adduced as answering the description. The absence, however, of certain well-known features, such as the prevalence of idolatry, is fatal to such a theory; and it is somewhat remarkable that later writers have been compelled to abandon all except the *terra incognita* of Jewish history, and to regard the description as alone applicable to the time when the Holy Land was a mere Persian province. The researches of Kaiser, above alluded to, at least show that the delineations do not refer to any well-defined period. They are in truth only vivid sketches of phenomena that are ceaselessly repeated in Eastern political history.

The authorship of Ecclesiastes, if not attributed to Solomon, must remain for ever a matter of uncertainty. All other names rest merely on conjecture. To those who regard Solomon's name as introduced merely as the representative of wisdom, it must on the one hand be conceded that such a practice was common with writers who flourished after the exile; but on the other hand it seems equally clear, that as the whole scope of the book points naturally to the real authorship of Solomon, the book of Ecclesiastes, if this authorship be disproved, must be ranked as at the best a pious forgery, and must be condemned to take its place with other apocryphal productions. Much, however, yet remains to be done in investigating the minutiæ of this question. The affinities of Ecclesiastes in thought and style with the book of Proverbs are certainly as marked as the discrepancies of the two books in diction. The proverbial style in both is the same; and even the varieties of the diction, although they may seem to indicate that they are the production of different authors, cannot be adduced as proving that they were written at widely different epochs. The sketches are undoubtedly such as might have been anticipated from a king, who, in his own history and in his relation to foreign despotisms, had brought everything that was false in morality and false in politics within the circle of his own experience; and it seems strange that the incongruity of the sentiments should not have been detected by those who knew the social condition of the people in Solomon's reign far better than we can ever hope to do. The expression (i. 12), "I the preacher *was* king," does not decide the question of the authorship; it has evident reference to the *testamentary* character of the treatise, which, as the last of Solomon's productions, we might beforehand expect to be written in a dialect somewhat marked with foreign idioms. Twenty years of habitual intercourse with the representatives of foreign nations, whose languages, though distinct, had yet a very close resemblance to Hebrew, must have sensibly affected the dialect of the court; and to us it seems not unsuitable that the penitential acknowledgments of Solomon should be handed down to posterity in the broken dialect which was the very symbol of his self-degradation. (R. W—N.)

ECCLESIASTICAL (ἐκκλησία, *an assembly or meeting*), pertaining or relating to the church; as ecclesiastical polity, jurisdiction, history, &c.

ECCLESIASTICUS, or the Wisdom of Jesus, son of Sirach, one of the apocryphal books of the Old Testament. It consists of an anthology of proverbs drawn from other compilations of same kind, and also from the experience of the writer, who lived about 210–180 B C. Its Hebrew original is now lost. It is called Ecclesiasticus because put into the hands of the catechumens in the early church.

ECCOPROTICS (ἐκ and κόπρος, *fæces*), in *Medicine*, laxative remedies which purge gently; mild cathartics.

ECDICI, Ἔκδικοι, among the ancients, patrons of cities, who defended their rights, and took care of the public money. Their office resembled that of the modern syndics.

ECHELON (Fr. *échelle, a ladder*), in military tactics, the position of an army when its divisions are arranged one behind the other, in the form of steps.

ECHINADES, a group of islands at the mouth of the Achelous, off the coast of Acarnania. In the days of Herodotus some of these islands had become incorporated with the mainland, in consequence of the great quantities of alluvial soil annually brought down by the Achelous. Thucydides expected that in course of time the entire group would in this manner become part of the continent; but his anticipations have not even yet become realized. The alluvial deposits had ceased to a great extent in the time of Pausanias, who attributed this circumstance to the fact

that the lands of Ætolia were no longer cultivated so well as they once had been. Notice is taken of the Echinades by Homer, who mentions that Meges, the son of Phyleus, joined the Grecian expedition against Troy with 40 ships. Dulichium is specified as the particular island over which this Phyleus reigned, and its fertility is highly praised by the poet. It is not exactly known what this Dulichium really was. Some ancient writers identified it with Cephalonia; Strabo maintains that it was the same with *Dolicha*, one of the Echinades. None of these islands, however, as they now exist, bear out the Homeric description of Dulichium. Col. Leake observes that Petala, the largest of the group, seems to have the best claim to that distinction. Pliny gives a catalogue of nine of these islands: the group as it now stands comprises between twenty and thirty islands, some of which, however, are little more than barren reefs. Nine only of the whole number are at present under cultivation.

ECHINATE or ECHINATED (Lat. *echinus, a hedgehog*), set with prickles or spines; prickly like a hedgehog; a term of frequent use in natural history.

ECHINITE, a name of the fossil sea-urchin, frequently found in chalk pits.

ECHINODERMATA, the first class of Cuvier's fourth great division of the animal kingdom, commonly called Zoophytes, or radiated animals. It includes, among numerous other species, the star-fish, sea-urchins, &c. See ZOOPHYTES, and ANIMAL KINGDOM.

ECHINUS, the general name of the sea-urchins. See ZOOPHYTES.

ECHINUS, in *Architecture*, a kind of egg-shaped moulding. See Glossary to ARCHITECTURE.

ECHO, a mountain-nymph, employed by Jupiter to baffle and mislead Juno, while he himself sported with her sister Oreades among the glades of Bœotia. As soon as Juno discovered the deception, she punished the nymph by changing her into an echo. In this condition she became enamoured of Narcissus; and when that youth failed to return her love, she pined away, till at length nothing remained of her but her voice.

ECHO, from ἦχος *a sound*, or rather from ἠχώ *an echo*. Sounds are reflected from the surfaces of hard bodies, such as hills, rocks, walls, &c., in such a manner that the angle of reflection is equal to the angle of incidence; and, in certain circumstances, these reflexions produce very remarkable echoes. The form of the reflecting surface, plane, or convex, or concave, &c., modifies the reflection. Sounds are also reflected by the surface of water, and sometimes even by clouds. In an elliptical room, if the sound proceed from one of the foci of the ellipsis, a person placed in the opposite focus will hear the sound much more distinctly than if placed in any other part of the room. The phenomena of whispering domes and whispering galleries depend on similar principles,—for example, in the case of the dome of St Paul's Cathedral, London. Some echoes repeat only sounds of a certain pitch. Others are said to repeat sounds, but not at the same pitch as the original sounds. Such is the echo at Roseneath in Scotland, which is said to repeat a musical sound three times, but each time lower and lower by the interval of a tone. There seems to be some error in this observation at Roseneath. An echo at Genetay, six miles from Rouen, is said to repeat words several times in varied tones. Other echoes, called *polysyllabical*, repeat many syllables or words. *Multiple* or *tautological* echoes repeat the same word several times; as at the castle of Simonetta, about two miles from Milan, where the echo repeats a word about twenty times over. Another, near Coblentz, is said to repeat a word seventeen times. Gassendi mentions an echo near the tomb of Cecilia Metella at Rome, which repeated the first verse of the Æneid eight times. Dr Plot, in his Natural History of Oxfordshire, mentions a remarkable echo at Woodstock Park, near Oxford, which repeats seventeen syllables in the day time, and twenty at night. Another echo, on the north side of Shipley Church, in Sussex, is said by Harris (*Lex. Tech.*) to repeat distinctly, in favourable circumstances, twenty-one syllables.

ECHO is also used for the place where the repetition of the sound is produced or heard. In echoes, the place where the speaker stands is called the *phonic centre*, and the object or place that returns the voice the *phonocamptic centre*.

ECHO, in *Music*, is a term applied to that sort of airs or pieces in which certain passages are repeated with diminished intensity of sound. Paisiello, in his *Proserpina*, and Mayer, in his *Elisa*, employed this kind of echo. Skilful performers on the horn, the flute, the clarinet, &c., produce echo passages with great effect. A certain organ stop is also called an echo; and on the same instrument an echo is imitated by means of alternate loud and soft stops,—the latter repeating phrases given out by the former. (G. F. G.)

ECHO, in *Architecture*, a term applied to a certain kind of vault or arch, made commonly of an elliptic or parabolic figure, for the purpose of producing artificial echoes.

ECIJA, an ancient city of Spain, province of Seville, on the Xenil (a tributary of the Guadalquiver), which is here crossed by a fine old bridge, 53 miles E.N.E. of Seville. Pop. 23,722. It was a considerable city in the time of the Romans, by whom it was called *Astigo;* and, according to Pliny and Pomponius Mela, was the rival of Cordova and Seville. Many inscriptions and interesting relics of antiquity are to be found in the town and its vicinity. It is surrounded by old walls, and the streets are narrow and crooked: but it has a noble square in its centre adorned with a fine fountain. There are six churches, several of them richly adorned, and many hospitals and monasteries. From the extreme heat of this town, it has acquired the sobriquet of *la Sartenilla* or the frying-pan. Outside the town near the river is a fine *alameda* or public promenade, planted with trees, and adorned with statues and fountains. Ecija has manufactures of coarse cloths, linen, and leather; and the vicinity is fertile in corn and wine.

ECKERNFORDE, a seaport-town of Denmark, duchy of and 15 miles E.S.E. of Schleswig. It is situated on an inlet of the Baltic, and has a good harbour and a considerable trade. Pop. 4058.

ECKIUS or ECHIUS, JOANNES (1483–1543), the antagonist of Luther, was born in Suabia. His family name was Mayer. He was professor at Ingolstadt, and at the Reformation disputed both with Luther and Carlstadt. At the diet of Augsburg he argued against the Protestant Confession. He wrote a work entitled *Enchiridion Controversiarum; Apologia contra Bucerum;* a tract on the Mass; an Exposition of Haggai; and several smaller works.

ECKMUHL or EGGMUHL, a small village of Bavaria, on the Great Laber, 15 miles S.S.E. of Regensburg, celebrated for the important victory gained here by the French over the Austrians on 22d April 1809, and which obtained for Davoust the title of prince of Eckmühl.

ECLECTICS (*Electici*), a name given to some ancient philosophers, who, without attaching themselves to any particular sect, took whatever they judged good and solid from each; and hence their denomination, from ἐκ and λέγειν to choose. Laertius observes that they were also, for the same reason, denominated *analogetici;* but that they call themselves *philalethes*, or lovers of truth. The chief or founder of the eclectics was Potamon of Alexandria, who lived under Augustus and Tiberius, and who, weary of doubting of all things with the Sceptics and Pyrrhonists, formed the Eclectic sect, called by Vossius the Eclective.

Towards the close of the second century, a sect arose in the Christian Church under the denomination of Eclectics,

or modern Platonists, professing to make truth the only object of their inquiry, and to be ready to adopt from all the different systems and sects such tenets as they thought agreeable to it. However, they preferred Plato to the other philosophers, and looked upon his opinions concerning God, the human soul, and things invisible, as conformable to the spirit and genius of the Christian doctrine. One of the principal patrons of this system was Ammonius Saccas, who laid the foundation of that sect afterwards distinguished by the name of the New Platonists in the Alexandrian school.

There was also a certain ancient sect of physicians called Eclectics, of whom Archigenes, who lived under Trajan, was the chief, and selected from the opinions of all the other sects those which he considered best and most rational. Hence they are called *eclectics*, and their prescriptions *medicina eclectica*.

ECLIPSE (ἔκλειψις, from ἐκλείπειν *to forsake, to fail*), in *Astronomy*, an obscuration of the light of the sun, moon, or other heavenly body, by the interposition of another heavenly body between us and that body. See ASTRONOMY.

ECLIPTIC, in *Astronomy*, a great circle of the sphere, supposed to be drawn through the middle of the zodiac, making an angle with the equinoctial of about 23° 30′ which is the sun's greatest declination; or, more strictly speaking, it is that path or way among the fixed stars which the earth appears to describe to an eye placed in the sun. The angle of inclination of the equator and ecliptic is called the obliquity of the ecliptic. This has been subject to a small irregular diminution since the time of the earliest observations on record. Its mean diminution per century is about 48″. See ASTRONOMY.

ECLIPTIC, in *Geography*, a great circle on the terrestrial globe, answering to, and falling within, the plane of the celestial ecliptic. See GEOGRAPHY.

ECLOGUE, in *Poetry*, a kind of pastoral composition, in which shepherds are introduced conversing together. The word is formed from the Greek ἐκλογή *choice;* so that, according to the etymology, eclogue should be a select piece; but custom has assigned to it a further signification, namely, a little elegant composition in a simple natural style and manner.

The idyl and the eclogue, in their primary sense, are the same; but custom has appropriated the name of *eclogue* to pieces in which shepherds are introduced; and *idyl* to those written in a simple style, but without any pastoral interlocutors.

ECLUSE. See CLUSIUS.

ECONOMISTS.

IT is not generally known how much the science of politics, that master science, the late offspring of the improved reason of modern times, is indebted to the philosophers who are known to the world by the title of economists. They were, it is true, preceded in this country by Hobbes and by Locke, and in France by Montesquieu; but in analysing the frame of civil society, they added considerable lights to those which had been communicated by their predecessors; and they attempted to point out the mode of combining the various springs of social action in a more liberal and beneficent system than had yet been recommended to the world.

It is worthy of remark, that the merits of this sect, in the secondary department of *political economy*, have so much obscured their important speculations on the great questions respecting the best possible order capable of being given to society, that they are, in this country at least, wholly unknown, except in the character of political economists; though their political economy formed only a small and subordinate branch of their entire system; and, what is indeed extraordinary, we know not a book in the English language in which an account of that system is to be found.

This article is intended to contain, 1*st*, the history of the sect; 2*dly*, an account of their system; and, 3*dly*, some observations, pointing out the principal errors into which they have fallen.

I. M. de Gournay appears to have been the first man in France who had formed any systematic notions on the real principles of trade. It is true, indeed, that Fenelon had recommended, on the direct suggestion of good sense, detached from theory, the practice of freedom of trade. The Marquis d'Argenson was celebrated for the sound and important maxim, *Pas trop gouverner;* and the memorable advice of the merchants to the meddling Colbert was well known, *Laissez-nous faire.* Another of the more peculiar doctrines of the economists was expressed in the famous maxim of the great Duc de Sully, *Que le labourage et le pâturage sont les mammelles de l'état;* and Montesquieu had brightly but superficially run over several of the questions relative to trade.

For such lights as M. de Gournay did not derive from his own reflections, he seems to have been chiefly indebted to the writers of England; but there appears some reason to conclude that the best of these had not fallen in his way. We do not perceive, for example, any sign of acquaintance with the writings of Locke.

Jean-Claude-Maria Vincent, Seigneur de Gournay, was an extraordinary man for the age and country in which he was produced. He was born at St Malo, in the month of May 1712, the son of Claude Vincent, one of the most considerable merchants of the place. Destined to commerce by his parents, he was sent to Cadiz when scarcely seventeen years of age. His vigilant attention to business did not hinder him from finding time, well husbanded and diligently applied, not only for storing his mind with general knowledge, but for unravelling the combinations of commerce, and ascertaining its elementary principles. After he had raised himself to great eminence as a merchant, and to a high reputation for knowledge of the principles of commerce, the ministers of France conceived the design of turning his knowledge to advantage in the office of intendant of commerce, as they call it, to which he was raised in 1751.

No sooner was M. de Gournay invested with his office, than he began to wage war with the established system of regulations and restrictions, which the experience of twenty years of mercantile practice the most varied and the most extensive, discussions with the most intelligent merchants of Holland and of England, the perusal of the best writers on the subject, and the impartial application of his own philosophical thoughts, had all conspired to make him regard as a source, not of national advantage, but of continual vexation and hardship to individuals, and of poverty to the state. "He was astonished," says M. Turgot, "to find that a citizen could neither make nor sell a commodity, without having purchased a privilege, by getting himself made, at a great expense, a member of some corporation; that if he made a piece of cloth, for example, of any quantity and quality different from those commanded in certain regulations, instead of being allowed to sell it to those purchasers whom such quantity and quality suited the best, he should be condemned to see it cut in pieces, and to pay a fine heavy enough to reduce a whole family to beggary. He could not conceive

how, in a country where the succession to titles, to estates, and even to the crown itself, rested upon custom, and where the application of even the punishment of death was rarely guided by any written definitions, the government should have thought proper to fix by written laws the length and breadth of each piece of cloth, and the number of threads which it ought to contain. He was not less astonished to see the government take in hand to regulate the supply of commodities; proscribe one sort of industry in order to make another flourish; shackle with peculiar restrictions the sale of the most necessary articles of subsistence; prohibit the storing of commodities, of which the quantity produced varies greatly from year to year, while the quantity required for consumption is pretty nearly the same; restrain the export and import of a commodity subject to the greatest fluctuation of price; and dream of insuring the plentiful supply of corn by rendering the condition of the labourer more uncertain and more wretched than that of any other part of the community." (*Œuvres* de M. Turgot, iii. 333.)

It may easily be imagined that M. de Gournay would find himself encountered by opposition the moment he endeavoured to introduce his beneficial views into practice. The grand instruments of this opposition were certain words and phrases, which have been used to screen misrule in every country in which the voice of reform has begun to be raised. "M. de Gournay," says Turgot, "was opposed, under the names of an 'innovator' and a 'theorist,' for endeavouring to develop the principles which experience had taught him, and which he found universally recognised by the most enlightened merchants of every part of the world among whom he had lived. The principles marked out for reprobation, under the title of the 'new system,' appeared to him to be exactly the principles of plain good sense. The whole of this system was founded upon the certain maxim, that, in general, each man is a better judge of his own interest, than another man to whom it is a matter of indifference. From this M. de Gournay concluded, that, when the interest of individuals is precisely the same with the general interest, the best thing to be done is, to leave every man at liberty to do what he likes. Now he held it as impossible, that in commerce, fairly left to itself, the interest of the individual should not coincide with the interest of the community." The proof which M. Turgot gives of the fundamental proposition, that the interest of the individual and of the community in a free commerce are the same, we need not repeat; because it can neither be rendered more clear nor more cogent than it is already in works with which every person is familiar, who is at all conversant with political science.

"From this principle M. de Gournay concluded, that the sole duties of government with regard to commerce are: 1. To render to all the branches of industry that precious liberty, of which the prejudices of barbarous times, the proneness of governments to lend themselves to the gratification of individual interests, and the pursuit of a mistaken good, have conspired to deprive them: 2. To facilitate the exercise of industry and ingenuity to every member of the community, exciting thereby the greatest competition among sellers, and ensuring the greatest perfection and cheapness of the commodities sold: 3. To admit the greatest competition among buyers, by opening to the seller every possible market; the sole means of encouraging reproduction, which hence derives its only reward: 4. To remove every obstacle by which the progress of industry is retarded, by depriving it of its natural reward."

It is to M. de Gournay, therefore, that Turgot ascribes the origin of political economy in France. "It is to the ardour," says he, "with which M. de Gournay endeavoured to direct to the study of commerce and of political economy, all the talent which he was able to discover, and to the facility with which he communicated the lights which he himself had acquired, that we ought to ascribe the happy fermentation which for some years has been excited on these important subjects; a fermentation which arose two or three years after M. de Gournay was intendant of commerce, and has since that time procured us several works calculated to wipe off from our nation that reproach of frivolity, which, by its indifference for the more useful studies, it had but too justly incurred."

Francis Quesnay was born in the village of Ecqueville in the year 1694. According to M. Dupont de Nemours, the editor and commentator of the works of Turgot, and a zealous economist, he was the son of a small proprietor, who cultivated his own little property; and he was eminently indebted to his mother for the forming of his mind. Though he was educated as a physician, and rose to such eminence in his profession as to be first physician to the king, the early occupation of his mind on the business of agriculture had given the current of his thoughts a permanent direction; and when he was summoned to reflect on the sources of wealth, by the discussions probably to which the speculations of M. de Gournay had given birth, agriculture was the object on which his attention was more particularly fixed. He produced several works on different points of the science and practice of medicine; and it was only at a late period of life that his works on political economy appeared. His chief production on this subject, *Physiocratie, ou du Gouvernement le plus avantageux au genre humain*, was first published in 1768. Not only had the speculations which he broached, and which he propagated with much fervour and diligence, considerable success in the world, but he had the fortune to gain a considerable number of proselytes, who exerted themselves with an ardour for the diffusion of his doctrine, and with a devotion to the opinions of their master, which more resembled the enthusiasm of the votaries of a new religion, or that of the followers of some of the ancient philosophers, than the indifference with which new speculations in philosophy have on all other occasions been received in modern Europe; and which gave to the economists more of the character of a sect or a school, than has appeared to belong to those who have in recent times concurred in any other system of philosophical opinion.

There was, in truth, in the system of M. Quesnay and the other economists, many things well calculated to attract attention and excite enthusiasm. From a few simple principles, they deduced, as they imagined, by a chain of very close and imposing arguments, a system of changes which would easily be introduced, without the smallest interruption to the tranquillity and happiness of the existing generation, calculated to remove from society all the deformities by which it was overspread, and to communicate to the mass of human beings a fulness of happiness hitherto altogether unknown. At this point, therefore, we may close the historical part of this article; for the success of the great work of Dr Adam Smith, in a short time, superseded the *political economy* of the sect; and after the political economy was discredited, the rest of their doctrines met with little regard. The memory of them, however, is well worthy of being preserved; and this task we shall now, in as few words as possible, endeavour to perform.

II. The economists proceeded upon no Utopian plan, which supposes society to be composed of beings different from those with whom we are already acquainted. They took man as he is, a being having wants, and governed by the desire of avoiding pain and obtaining pleasure.

Man must have subsistence. Upon this ground they first took their stand. This being allowed, it followed, of course, that whatever was the best means of obtaining subsistence, would command the operations of men as soon as ever it was sufficiently known.

Of these means, the first and fundamental is the establishment of property. This they proved by convincing arguments. We cannot exist without consuming. The nature of man leads to a rapid multiplication of human beings, and the earth yields a spontaneous nourishment for only a few. To make food keep pace with population, labour must be employed upon the ground. Men would be born for no other purpose than that of destroying one another, if there were not means of increasing the quantity of food in proportion to those that were born. Labour, then, is one of the physical necessities of nature. But if labour be necessary, so is property, because, without property, there can be no labour.

The proof of this proposition is short and irresistible. Nobody would labour under an assurance that he would derive no advantage from his labour. Nobody would labour without a certain probability that he should enjoy the fruits of his labour. Now, this is property. The only question, then, which remains is, what is the degree of assurance with respect to the fruits of a man's labour; in other words, what are the laws of property which tend most to secure the benefits which human beings derive from their labour? This, said the economists, is the object and the end of our researches.

They proceeded in their inquiry by the following steps. As a means to this labour, on which every thing depends, a man must be free to use his natural faculties of labour —his muscular powers. This freedom they called *the property of his person.* As another means to the same end, he must be free to use exclusively, and to preserve, what he acquires by his labour. This they call his *moveable property.*

Here we see the origin of that to which men have assigned the names of *rights* and *duties.* The exclusive powers assigned to the man over his person, and over the fruits of his labour, are called his *rights.* To allow these exclusive powers, by abstaining from every act which would impair them, is called the *duties* of all other men. Here we see, also, that *rights* and *duties* are reciprocal; that they imply one another, that they are created together, and that the one cannot exist without the other. Destroy the *rights* of property in the man, you destroy, by the same act, the *duties* of other men to exclude themselves from what was called his property. Destroy, in the same manner, the *duties* of other men to exclude themselves from what was called his property, and you destroy, at the same time, his *right* to that exclusion. *Rights* and *duties* are, in fact, but different names given to the same thing, according as it is regarded under one or another of two points of view.

Another important concatenation is here also to be seen. *Rights* are advantages; things to be enjoyed. *Duties* are burthens, abstracted from things to be enjoyed. Why should men accept these burthens, submit to these duties? Why, but because they find their advantage in doing so. It is plain how they find their advantage in doing so, and there is, there can be, no other reason. Men submit to the *duties* of respecting other men's *rights,* that they may have *rights* themselves. It is good for them to have *rights;* there can be no rights without *duties.* It is better to have the *rights* submitting to the *duties,* than, by renouncing the *duties,* to have no *rights.* The *duties* are then the price which is paid for the *rights.* The *duties* which one man yields to other men, are the price which he pays for having *rights* of his own. *Duties,* then, are in themselves *evils;* and they never ought to exist, except when they are compensated by a greater good. Nobody ought to be subjected to a burthen, which is not, either to himself, or to the community in which he has clubbed his private interests, attended with a good sufficiently great to overbalance the evil which he is made to endure. *Utility,* then, is the exclusive foundation of *duty.*

Having laid this foundation, the economists proceed.

On the necessity of subsistence rests the necessity of property, and on the necessity of property rests the necessity of a certain inequality in the conditions of men. This inequality exists, because a good is obtained through it, which can in no other way be obtained; and that good the parent of every thing else to which the name of good is applied. " Those who complain of it," says Mercier de la Riviere, one of the chief expositors of the doctrines of the sect, " see not that it is a link in the chain by which the human species must drag from the abyss of non-production every thing which they enjoy. As soon as I have acquired the *exclusive* property of a thing, another man cannot have the property of it at the same time. The law of property is the same for all men; each man, however, acquires in proportion to his faculties of acquiring: but the measure of these is different in different men. And besides this fundamental law, there is, in the whirlpool of accidents, a continual succession of combinations, some more, some less fortunate, which increase the causes of that inequality of acquisition, without which the motives to acquisition cannot exist.......................I admit, however," he in conclusion adds, " that in any given community, these differences in the possessions of different men may become the source of great disorders, and which augment again these same differences beyond their natural and necessary degree. But what follows from this? That men ought to establish an equality of conditions? Certainly not; for to that end, it would be necessary to destroy all property, and, by consequence, all society: it only follows that they should correct those disorders which make that which is an instrument of good become an instrument of evil: which alters in such a manner the distribution of things, that *force* places all the rights on one side and all the duties on the other."

We have seen that the necessity of labour to procure the means of life and the means of enjoyment, produced a necessity of *property personal* and *property moveable,* as the two sorts were named by the economists. The necessity of raising food, as well as the first material of most of the other articles of human enjoyment, by labour upon the *land,* produces a like necessity of creating a *property in the soil.* The proof of this proposition is not less short and convincing than that which regards the other species of property. To make the land yield a produce useful to man, it must be cleared of many incumbrances, and prepared with much labour and expense. No adequate return can be obtained for this labour to the man who would bestow it, without a perpetuity of possession. It is essential for the well-being of the species that the labour should be yielded, and in the greatest degree of perfection. It cannot be yielded perhaps at all, certainly in no tolerable degree of perfection, without that exclusive possession which constitutes property. Property in land is, therefore, essential to the well-being of the human species.

We see in this manner what are the *rights* and what are the *duties* which the supply of the first wants of human nature renders it necessary to constitute; but as all mankind are not disposed to respect *rights* and *duties,* it is necessary, in order to obtain the advantages which they are destined to produce, that measures should be taken to protect them.

The measures taken to protect them are generally com-

prehended under one name, that is, *government*. The protection of the rights, or, which means the same thing, the insuring of the duties, is the *end*, the government is the *means;* and the question is, what combination of means is best adapted to the purpose?

This assuredly is the most important question to which the human faculties can be directed; and the economists have never yet received the credit which is their due, for the ability and success with which they laboured to resolve it. No speculations can be conceived of more importance than those in which they engaged, nor has it yet become easy to throw upon them a greater portion of light.

The grand classes of means by the skilful combination of which they conceived that the end might be obtained, were either more direct or more indirect. The more indirect were liberty and evidence; the more direct were laws exactly adapted to the end, magistrates exactly adapted to the execution of these laws, and a supreme, or, as they called it, "*tutelary power*." We shall endeavour to communicate their leading ideas on each of these particulars.

1. *Liberty*. We have seen that the end which is aimed at through property, as a means, is the greatest possible abundance of the things adapted for human enjoyment, and that property is a means altogether indispensable for that end. It is now to be proved that liberty is absolutely necessary to enable property to answer the purpose of a means to that end, and that, without liberty, the existence of property is deprived of almost all its advantages. In fact, the right which a man has not the liberty to enjoy is not a right. The right of property in a man's person, in his moveables, in his land, is the right of enjoying; but the *right* of enjoying and the *liberty* of enjoying are the same thing. Liberty, therefore, cannot be hurt without damaging the right of property, and the right of property cannot be hurt without damaging liberty. "It is," says Mercier de la Rivière, "so inseparably connected with the right of property, that it is confounded with it, and that the one cannot exist without the other. Deprive a man," he cries, "of all the rights of property, and I defy you to find in him a vestige of liberty. On the other hand, suppose him deprived of every portion of liberty, and I defy you to show that he truly retains every right of property."

It is now pretty clear that liberty is necessary to produce that abundance of production which is the end aimed at by the constitution of all *rights* and *duties*. Man is excited to labour only in proportion as he is stimulated by the desire of enjoying; but the desire of enjoying can only be a motive of action in so far as it is not disjoined from the liberty of enjoying. You cannot have productions in abundance, without the greatest possible inducement to labour; you cannot have the greatest possible inducement to labour, without the greatest possible liberty of enjoyment. The chain of evidence is therefore complete.

"Let us not," say the economists, "seek in men beings which are not men. Nature has destined them to know only two springs of action, or moving powers; the appetite of pleasure and the aversion to pain. It is in the purpose of nature, therefore, that they should not be deprived of the liberty of enjoying, since, without that liberty, the first of those two powers would lose the whole of its force. *Desire of enjoying, liberty of enjoying;* these are the soul of the social movements, these are the fruitful seed of abundance, because that precious combination is the principle of all the efforts made by human beings to procure it."

2. *Evidence*. Property, and by consequence liberty and security of enjoying, being proved to constitute the essence of what they called the natural and essential order of society, it was seen to be in reality a chain of *physical* consequences, involving nothing arbitrary, nothing changeable; evident, on the other hand, simple, and resting on no other ground than that of being the most advantageous possible to the whole body of the community, and to every one of its members.

"The best possible order of society, however," they observed, "cannot be established where it is not sufficiently known; but for that very reason, that it is the best order, the establishment of it, as soon as it is known, must become the common ambition of men; it must then introduce itself by *necessity*, and, once established, it must by *necessity* continue for ever." These were bold promises, but the proof was correspondent. "The best possible order of society must introduce itself as soon as known, and preserve itself for ever as soon as introduced, because the appetite of pleasure, and the aversion to pain, the only moving powers within us, lead naturally and constantly toward the greatest possible augmentation of enjoyments; and the desire of enjoying implies by necessity that of the means by which enjoyment is procured. It is, then," said the economists, "impossible that men should know their best possible condition without a consequent union of all wills and all power to procure and to preserve it. Imagine not," they cried, "that for the establishment of this essential order it is necessary to change the nature of men, and divest them of their passions; their passions, on the other hand, become auxiliaries in this establishment, and, for the most complete success, it is only necessary to place them in a condition to see with *evidence* that it is in this order alone they can find the greatest possible sum of enjoyments and of happiness."

These philosophers made some admirable observations upon the nature of evidence, and the important purposes to which it is subservient. They made a distinction between those propositions which a man receives without evidence, and those which he only receives upon the strength of evidence. The first they denoted by the word *opinion*, the second they marked by the names of *knowledge* and *certainty*. "As error," they said, "is every thing which is not truth, in like manner, what is not *evidence* is only *opinion;* and whatsoever is only opinion is arbitrary, and liable to change. It is evident, therefore, that these opinions are not a sufficient foundation for the natural and essential order of societies. A solid edifice cannot be erected on a basis of sand; and that into which nothing arbitrary can enter, which is and must be unchangeable as the ends to which it is directed, can never be founded on a principle so arbitrary and various as opinion; opinion which, however just and true it may accidentally be, so long as it is not founded on evidence, is but opinion still, and liable every moment to be subverted and expelled by any other opinion, however extravagant and absurd."

Evidence is the knowledge, clearly attained and possessed by ourselves, of all that is necessary to see the truth or falsehood of an object of belief. This excludes all doubt, all uncertainty, every thing arbitrary, all exercise of will. A man can no more help believing that which he actually holds in his mind evidence sufficient to prove, than he can help seeing the object which is painted on his retina.

From this irresistible power of evidence the economists deduced the most important consequences. "Not only is it," they said, "the essential characteristic of evidence to stand the test of the most severe examination, but the most severe examination can have no other effect than that of displaying it to more advantage; that of giving to

it a power more predominating and supreme; while, on the other hand, sufficient examination destroys prepossession and prejudice, and establishes in their place, either evidence, or at least suspension of judgment, where evidence on which to found a judgment is out of our reach."

On the first of these propositions, that "evidence can stand the test of the most severe examination," they said, "that all attempt at proof was surely unnecessary,—it was self-evident; and hence," they said, "was evidently deduced this most important consequence, 'that the liberty of examining, of criticising, and of contradicting evidence, is always and necessarily without inconvenience.'"

"That a sufficient examination destroys prepossession and prejudice," they regarded as a proposition equally indisputable; and from this it followed, as an irresistible consequence, "that the most unbounded liberty of examination and contradiction is of primary and essential importance; for no examination can be *sufficient* till all the reasons of doubt are exhausted."

"That a sufficient examination establishes evidence in the place of error in the case of all questions where evidence is within our reach," was a truth, they said, resting on the same immoveable basis; and from this it followed, as an evident consequence, "that liberty of inquiry will lead by necessity to the clear and public knowledge of what is the best possible order of human society; for on this subject evidence is undeniably within our reach."

"We may thus regard evidence as a sort of beneficent divinity, whose pleasure consists in spreading peace on earth. Never do you behold mathematicians at war with mathematicians on account of the truths which they have established on evidence; if they enter into a momentary dispute, it is only while they are yet in the avenue of inquiry, and have investigation solely in view; but as soon as evidence has pronounced either on the one side or the other, every man lays down his arms, and only thinks of enjoying in peace the good which is thus acquired in common."

"Pass now," say the economists, "from the evidence of *mathematical* to that of *social* truths; to the evidence of that order of human affairs in society which would produce to men the greatest possible amount of happiness. From the known effects of evidence in the first of these cases, try to conceive what would be the effects of it in the second; what would of *necessity* be the internal condition of a society governed by that evidence; what would of *necessity* be the political and respective situation of all nations if they were illuminated by its divine effulgence; consider if men, rallied under the standard of that evidence, would have any division among them; if any motive for war would be sufficiently powerful to make them sacrifice to it their best, and to themselves *evidently* best possible condition: penetrate still deeper, and see if the pictures which that medium presents to you do not excite in you sensations, or rather transports, which elevate you above yourself, and appear to indicate that, by means of evidence, we communicate with the divinity.

"But to increase your sensibility to the impressions which those pictures will make upon your understanding and your heart, place in opposition all the inconveniences which, in a state of ignorance, arise from the force of *opinion.*

"A certain thing is forbidden under the sanction of punishments capable of inspiring the greatest terror. What power can such prohibition and punishments have against an opinion which tends to despise them? None; we have too many examples to prove it.

"A man is placed by his birth in a situation in which he might effect the happiness of a great number of other men, if he made a beneficent use of his advantages; what is it the man performs when his *opinion* is wrong? He sacrifices his advantages to the disorder of his opinion, lives and dies unhappy.

"One man unarmed commands an hundred thousand with arms in their hands, of whom the weakest is stronger than he. What constitutes his power? Their opinion; they obey him in obeying it; they follow their leader because they have an opinion that they ought to follow him.

"Do you wish to see other effects which characterize the force of opinion? Consider the effects of honour; of that sort of enthusiasm which prefers toil and fatigue to repose, poverty and privation to riches, and death to life, on which it finds the secret of shedding a lustre.

"*Opinion*, of one sort or another, governs the world. Even when it is but a prejudice, an error, there is no power in the moral world comparable to its power. Fruitful in phantoms, it borrows all the colours of reality, in order to deceive. Source inexhaustible of good and of evil, it is through it alone that we see, by it alone that we will and we act. According as it borders upon truth or falsehood, it produces virtues or vices, the great man or the villain. No danger stops it; difficulties render it more intense; at one time it founds empires, at another destroys them.

"Every man is therefore a little kingdom upon the earth, governed despotically by opinion. He will burn the temple of Ephesus, if it is his opinion that he should burn it; in the midst of the flames he will brave his enemies, if his opinion is that he ought to brave them. Our physical powers themselves are so completely subordinate to the power of opinion, that, to have the command of our physical powers, it is necessary to begin by having the command of our opinion; but how is it possible to have the command of opinion, while it is the sport of ignorance, and its nature arbitrary? How is it possible to fix and to unite the opinions of men, but by the agency of evidence? Is it not visible that the Author of nature has appointed no other means for chaining our arbitrary will?

"We ought to look, therefore, upon ignorance as the necessary principle of all the evils which have afflicted society; and upon the knowledge, that is, the evidence of the best possible order of society, as the natural source of all the good which is destined for the inhabitants of the earth.

"But as all the physical forces in the world cannot render that evident which is not so, and as evidence can spring from nothing but *adequate examination*, from the necessity of that evidence clearly follows the *necessity of examination*, from the necessity of examination clearly follows the necessity of the *greatest possible liberty of contradiction*, and, in addition to that liberty, the existence of all those political institutions which are required to give to evidence its greatest possible *publicity*."

The *publicity of evidence* was a subject on which the economists dwelt with peculiar emphasis, and which they branched out into a number of the most important consequences. "The necessity of it," they said, "was apparent from this, that the proper order of society cannot be solidly established, but in proportion as it is sufficiently known. In any society, if some men only had knowledge and evidence of this order, while the multitude rested in other opinions, it would be impossible for this order to govern; it would in vain command; it would not be obeyed. This state would be that of a perpetual intestine war of one part of the nation with another. By *intestine war* they did not, however, mean," they said, "only that which is performed with arms in the hands, and by open force; they more peculiarly referred to those disguised and clandestine ravages and oppressions exercised under forms of law; to those dark and predatory practices, which sacrifice all the victims which artifice is able

to bring within their power; to all those disorders, in a word, which tend to make all particular interests enemies of one another, and thus to uphold, among the members of the same political body, an habitual war of clashing interests, the contending effects of which tear in sunder all the bonds of society. This situation is so much the more dreadful. in as much as, excepting the superior and governing force of evidence, there is no power in nature equal to that of opinion; as in its aberrations opinion is tremendous, and as no means exist by which we can make sure of retaining it always within proper limits, when it is once given up to its own inconstancy, and to seduction.

" From the *publicity*, which is an indispensable condition to possession of evidence respecting what is best in the social order, we are conducted to the necessity of *public instruction*. Though faith," said the economists, " be the gift of God, a peculiar grace, which cannot be the work of men alone; nevertheless it is held that the preaching of the gospel is peculiarly necessary to the propagation of the faith. Why, then, should not every one have the same opinion with regard to the publication of the social order, more especially as that publication has no need of being aided by grace and supernatural light? This order is instituted for men, and all men are born to live under it; it is then required by this order that men should know it, and accordingly they have all a sufficient portion of natural faculties, to be able to elevate themselves to that knowledge. For the same reasons that knowledge is required, instruction is required, by which alone certain kinds of knowledge can be attained."

The economists did not enter into details respecting establishments necessary for instruction. They, however, affirmed, that such establishments " constituted a part of the essential form of a society, and that they could hardly be too numerous, because instruction can never be too common." They affirmed, also, that " verbal instructions did not suffice; that it was necessary to have doctrinal books, suited to the purpose, and in every body's hand. This help," they said, " was so much the more important, as it was clear of all inconvenience, for error cannot stand in the presence of evidence; and contradiction is not less advantageous to evidence than it is fatal to error, which has nothing to fear so much as examination."

What they affirmed with respect to the necessity of those which they called doctrinal books, and of the liberty which ought to reign with regard to them, " was founded," they said, " upon the very nature of that order which is due to society, and of the evidence which belongs to it. That order," they observed, " is either perfectly and evidently known, or it is not. In the first case, its evidence and simplicity render the formation of heresies on the subject of it altogether impossible. In the second case, men cannot arrive at knowledge or evidence, but through the conflict of opinions. It is certain that an opinion can be established only upon the ruins of those which are opposed to it; it is further certain, that every opinion which is not founded upon evidence will be contradicted, until it is either destroyed, or recognized on evidence for a truth, in which case it ceases to be a bare opinion, and becomes an evident principle. And thus, in the pursuit of truths, capable of being established on evidence, the conflict of opinions leads, of necessity, to evidence, because it is by evidence alone it is capable of being terminated."

This doctrine is of such infinite importance, that we are willing to prolong it, by adding the illustration which the economists were accustomed to adduce. " If a man should be actuated by any motives to write a book endeavouring to persuade his countrymen that they might live without subsistence, that they ought to make commodities without the materials, that they multiply themselves by change of place, or any other extravagant opinion, it would be highly useless for the public authority to give itself any concern or labour to prevent such a book from making an impression upon the public mind; and, far from feeling any alarm, every body would rest securely upon the evidence of the contrary truths, assured that this evidence would always be sufficient for itself, and would quietly triumph over all the ridiculous efforts which would be made to oppose it.

" So absolutely necessary is it to leave to the whole body of society the greatest possible freedom of examination and contradiction; so absolutely necessary is it to abandon evidence to its own strength, that there is no other power which can supply its place; physical power, of what magnitude soever, can command actions alone, never opinions. The experience of every day affords to this truth the evidence of the senses. So little have our physical powers any influence over our opinions, that our opinions, on the contrary, exercise an uncontrollable dominion over our physical powers. Our physical powers are put in motion, and guided by our opinions alone. The common or social, called the *public force*, is formed by the union of the physical powers of many individuals. This supposes, necessarily and invariably, a correspondent union of evils; and this can never exist but in consequence of an union of opinions, good or bad. It is, therefore, to reverse the order of things, and take the effect for the cause, to desire to give the public force a power over opinion, while it is from the union of opinions that public force holds its own existence, and while, by consequence, it can have no stability but in proportion to that which reigns in the opinion on which it is founded, that is to say, in proportion as bare opinions, stripped of evidence, are replaced by opinions fixed and invariable, because founded upon evidence which cannot deceive."

3. *Laws*. Having established as incontrovertible truths, that property is necessary to the production of the means of human life and enjoyment, that the system of human rights and duties spring from it as natural consequences, and that the natural and essential order of societies is nothing in reality but the chain or connected order of these same rights and duties, the economists laid down the following definition: " That the essential form of a society is the continuation of all those social institutions which are necessary to consolidate the right of property, and secure to it all the liberty which essentially belongs to it."

Among these instrumental establishments, an important place is held by laws, of which they communicated the following very striking and original idea.

" A multitude of men assembled without acknowledging any respective rights, any reciprocal duties, would not form a society. That does not consist in the meeting of a number of men in a particular place. It may subsist among men very remote in respect of place, and not subsist among men very near in respect of place. *That which really constitutes the union, are the conditions of the union.* These conditions are the systems of rights and duties, in other words, the conventions entered into for their common interest by the members of the associated body. The laws, then, are precisely those conventions, by operation of which, the reciprocal rights and duties are established in such a manner that the members of the society are no longer permitted arbitrarily to depart from them.

" Of these conventions, some are of such a nature as cannot be defined very exactly, or at least cannot be enforced by artificial sanction, but must be left to the natural coercion of the approbation and disapprobation of mankind. Such are the common duties of morality; gratitude, veracity, charity, and the like. But the next class

of these conventions are those which are capable of being defined exactly, and enforced by artificial sanctions; as, that murder shall not be committed, property shall not be stolen. This last class of conventions are those which are properly called *laws*.

"The first property necessary to give those laws their best possible *form* (for, in regard to their substance, it is always supposed that they are strictly conformed to that utility from which the whole system of rights and duties takes its origin) is, that they be definitive; to distinguish, by an incontrovertible line, what each of them does, from what it does not, comprehend. This is implied in the very notion of a law, which is to render something *positive*, which would otherwise be *arbitrary*.

"The second property necessary to give laws their best possible form is, that they be written. This is indeed implied in the first property; because no combination of ideas can be rendered *positive* and *unvarying*, of which the *expression* is not *positive* and *unvarying*. But nothing can render an expression positive and unvarying but a permanent sign; and, of permanent signs, none is equal to writing.

"The third property necessary to give to laws their best possible form is, that the reason of each be annexed to it. The distinction is very important between the *letter* of the law, and the *reason* of the law. The *letter* of the law is its textical composition; the *reason* of the law is the motive by which it was dictated. *The man who is guilty of murder shall receive a certain punishment.* This is the *letter* of the law. The *reason* is, that *if murder were common, and not restrained by adequate motives, the happiness of human beings, if not the species, would soon be destroyed.* Having thus acquired a knowledge of the reason of the law, I possess the *evidence* of its *utility*. And of this I should not have been possessed, had I seen in the law nothing more than the *letter*. Let us suppose two laws, which equally assign the punishment of death; the one for homicide, the other for walking at certain hours in the day. Is it not clear that they would be viewed with different eyes; that the one would appear to be just, the other tyrannical; that we should feel within ourselves a natural disposition to submit to the one, a disposition to avail ourselves of every thing which might serve as a means to deliver us from the hateful yoke of the other? This difference arises from the different judgment we form of the *reason* of these bad laws. The first carries with it the *evidence* of its *utility*; and that *evidence* overcomes and binds without resistance the understanding and the will. The other carries with it, instead of the evidence of utility, the evidence of nothing but a disproportional rigour, of a manifest evil, to which our understanding, and consequently our will, can never submit.

"It is not, therefore, in the *letter*, but in the *reason* of the laws, that we must seek for the first principle of a constant submission and obedience to the laws; for that principle can be nothing but the dominion exercised over our minds by the *evidence* of the justice of necessity, that is, the *utility* of the laws; now this evidence is not in the *letter* of the laws; to establish that submission, therefore, generally and invariably, two conditions are requisite; one is, that the reason of the laws contain conclusive *evidence* of their *utility*, commonly called their justice and necessity; the other is, that the publication of this evidence be so complete, in respect both of clearness and diffusion, as to lodge it in the mind of a majority of all classes of the people. Men, persuaded that their laws were bad laws, might indeed for a time be constrained to observe them; but such a submission, contrary as it is to nature, could not be durable, nor escape daily breaches on the part of those who regarded themselves as suffering by the injustice of the laws. *Submission to the laws is always, and necessarily, proportional to the idea which we hold of their justice and necessity;* that is, their indispensable use in procuring good and eschewing evil.

"If laws," said the economists, "are any thing but the results of the natural order of society, or of that system of duties and rights which are rightly founded upon the interest of all; if the legislature of any country sets up rights and duties of another sort, these new rights and duties are contrary to the first; and hence, of necessity, the laws which prescribe them are in a state of perpetual opposition with our understandings and wills." This contrariety they proved in the following manner: "All the rights which a reasonable being can desire are summed up in that of property; because from the right of property results the liberty of enjoying; a liberty which ought to have no bounds but those which are assigned to it by the similar rights of property belonging to other men. As the essential order of society thus determines the measure of liberty belonging to each of its members, and as that measure is the greatest which can be, without disturbing that essential order itself, it is impossible that any thing should be added to the liberty, that is, to the rights of one set of men, without taking from the liberty, and by consequence from the property, of other men; and this is an injustice and disorder, the tendency of which is destructive to the society."

It is destructive to the society, because it throws it into a state of violence. "My neighbour," says Mercier de la Rivière, "will be content that he is not allowed to reap or to injure my crop; but for the same reason he will not be content that I should be allowed to reap or to injure his. On the view of such an injury permitted in regard to any other man, he will take the alarm, his fears will be excited for himself, and this anxiety will be a state of torment, from which his reason will perpetually urge him to seek relief. A law which violates the principle of utility, is a law therefore resisted by that evidence which governs beyond control the human will. To make such a law, is to put the society into a state of violence, because it is to put the minds of men into a state hostile to one another, and more or less hostile to the laws.

4. *Magistrates.* By this term the economists understood judges, and, in a word, all the leading functionaries employed in giving execution to the laws. Agreeably to the doctrines already exhibited, they conceived that the first service of the magistrates is that of shedding the light of *evidence* upon the particular cases which have been too obscure for the parties. But as there are some minds with which you cannot be sure of being able in every case to bring evidence, as it were, in contact, the magistrate needs to be armed with a coercive power; and all that is necessary is, that he affords to the rest of the community *evidence* that in such cases the power has been used agreeably to the principle of general good.

From these premises, the chief consequence which they deduced was, that the legislative and judicial powers are never to be united in the same hand, without destroying among the people all certainty of the justice and necessity of their laws, that is, the very essence of the laws themselves.

"The essential form of positive laws," they said, "in that which makes them to be what they ought to be, is, that they consist of certain visible signs, which show, that in the institution of them, that order has been followed which is necessary, 1*st*, to ensure their justice and necessity, that is, their adaptation to the ends of obtaining good and avoiding evil; 2*dly*, to render their adaptation to those ends evident or certain to the individuals whom

they concern. Now it is clear that these conditions could not be fulfilled if the legislative power was to engross the judicial functions. The legislator and judge being the same person, neither could the legislator find any resource against his own mistakes in the close review and experience of the judge; nor, on the other side, could the arbitrary will of the judge find any bridle or chain in the authority of the legislator; but the laws, however good in themselves, would be rendered evil by a variable and corrupt administration.

"If the legislator were judge also, his business would be to consummate and to crown all the mistakes which he incurred, or the abuses which he committed, in the formation of the laws. If the judge were legislator also, the laws existing only in conformity to his will, he would be under no necessity to consult the laws in passing his judgment, and would always ordain as law-maker, what he should have to determine as law-interpreter. Thus the *reason* of the positive laws would be found to consist in nothing but the will of the legislator, as he would be guided in making them by nothing but its arbitrary impulses; and, in the same manner, the *reason* of the judicial decisions would be found to consist in nothing but the mere will of the judge, whose independence would enable him to make them whatever he pleased. This double malady abundantly proves that those laws would be stript of the essential characteristics of law, the evidence of their justice and necessity, and an absolute exemption from every thing arbitrary."

The duties of the judge they deduced in the following order: As the laws are in themselves mute, and the magistrate is the organ through which they speak, he is particularly charged with the *guardianship* of the laws. It is of importance to know what is implied in the term guardianship of the laws. It relates either to the laws which *are* made, or to those which are *to be* made. The natural strength of the laws consists in the evidence of their goodness. Their weakness consists in the strength of the hands which dispose of the physical power. As the laws are mute in themselves, they cannot wield that evidence in which their strength consists. The magistrates, who are the mouth of the laws, ought therefore to wield it for them, and to resist the hands in which the physical power is deposited, when they attempt the infringement of the laws, with all the force which evidence can be made to exercise over the minds of the community.

The same principles demonstrate what are the duties incumbent on the depositaries of the judicial power with regard to laws *to be* made. As laws ought all to be founded on that concatenation of the causes of human good which the economists denominated "the primary and essential reason of all laws, the *evidence* of that primary and essential reason was," they said, "a deposit, so to speak, in the hands of the judicial instruments, of which they owed an account to the legislature, to the nation, and to God himself, of whose supreme will that evidence is the decisive token. It was their first duty, therefore, to have a perfect *knowledge* of that primary and essential reason." Their next duty was, on all occasions, as far as their utmost efforts could extend, to impart that evidence to the governing power, and to make it as clear as it can be made, what laws, not yet proposed, that evidence shows that the society requires.

The economists further affirmed, "that no man can, without rendering himself criminal towards earth and heaven, undertake to perform the office of judge, according to laws that are *evidently* unjust. He would in that case cease to be a minister of justice, in order to become a minister of iniquity. If any law, for example, ordained that a man should be condemned to the ultimate punishment, on the mere denunciation of another man, and without any inquiry into the truth of the allegation, is it not evident that such a law would be a law of murder? And is it not equally evident, that the barbarian who should pronounce a judgment agreeably to that law, would be the voluntary instrument of murder? It is necessary, however, either to go the full length of saying that a man can, without guilt, become the instrument of such a law, or allow that no minister of the law ought to lend his ministry to the execution of a law evidently unjust; for if he may for one such law, so he may for all, however atrocious; no outrage to humanity, no excess of evil, presents any limiting point."

5. The *tutelary authority*. "The union of wills to form that of individual powers; the union of individual powers to form a common or public force; the deposit of that force in the hands of a chief, by whose ministry it may command, and make itself obeyed,—these," said the economists, "are the component parts of the tutelary authority. The tutelary authority is nothing more than a physical force resulting from an union of wills; and, by necessary consequence, it is impossible for it to be either powerful or secure, unless the intuitive and determining force of evidence be the principle of that union.

"In one sense, it may be affirmed that the right of commanding belongs to evidence alone; for, in the order of nature, evidence is the only rule of conduct bestowed upon us by the Author of nature. But all men are not equally capable of seizing evidence; and even if they were, the interest of the moment often operates upon them with such vehemence, that the appetite of enjoyment will not, in a state of disorder, be restrained by the evidence of duty. Among human beings, therefore, it is necessary that the natural authority of evidence be armed with a physical force; and that the legislative power, though it commands in the name of evidence, have the disposal of the public force to ensure obedience to its injunctions."

From the analysis of what is necessary to constitute the tutelary authority, the key-stone, as it were, of the arch of human society, that which gives to the whole its binding force, and retains the parts in their order, the economists deduced a variety of most important conclusions, of which we can only present the more striking as a sample.

The first is, that the legislative and executive powers are essentially inseparable, and that all the fine-looking theories, which have solicited and obtained so much of the admiration of a superficial world about the virtues of their separation, are phantoms in the air, the mere visions of imagination. "To dictate laws is to command; and as our passions render it impossible that commands should be more than useless sounds without the physical power of making them obeyed, the right of prescribing laws can have no existence without the physical power of enforcing them. The depositary of the power is, therefore, and necessarily, the master of the right; and the executive power is always and certainly the legislative power. Let the enemies of this conclusion turn and torture the subject which way they please, they never can escape from it. Suppose, in order to form two powers, that the legislative right is confided to one organ, the public force to another, when opposition arises, which of the two is to be obeyed? As it is impossible that two contradictory commands can be obeyed at the same time, it must be absolutely decided which of the two is in preference to be obeyed. Now, this decision is, by the very fact, the destruction of the other power, and the establishment of that one. These two powers, therefore, unavoidably run into one; the legislative power necessarily becomes the executive power, or the executive becomes the legislative.

The second is, that the legislative never has, never can have, a right to make *bad* laws. A right to make bad laws, they said, is a contradiction in terms. A right supposes a *compact;* it is the offspring of an agreement, tacit or express; the idea of it can no more exist without that of a mutual convention, than a debt without the contract of debtor or creditor. The compact upon which all rights are founded is that of mutual advantage; it is the union of all wills, freely determined by a great interest, of which the *evidence* is visible to all. How can that union which only exists for the sake of a good continue to exist if it is seen to produce evil? The hope cannot be framed of maintaining it by force, because force is its effect; force can exist only subsequent to union, and in consequence of union. The horrid prerogative of being able to make bad laws supposes necessarily a state of ignorance, a state in which the vices of the laws are not illuminated by evidence; for it is impossible that a community should consent to uphold that which visibly hurts them. The power exists in this hateful situation, but the right as little there as anywhere else.

The economists come next to the important question, What is *the security for the right use of the legislative power?* On this subject their anxiety to secure to their opinions the benefit of publicity, and the favour of those in whose hands the governing powers were actually deposited, led them to use the veil of expressions too general, and into some positive mistakes. "The security," they said, "for the right use of the legislative power, is the interest of that same power, which can, in the general order alone, find its own best possible state The irresistible force which evidence acquires by publicity is also that security. This evidence exists in its greatest force in the body of the magistrates, who cannot, without ceasing to be ministers of justice, lend their ministry to the execution of laws evidently unjust; or forbear, without being criminal, their utmost endeavours to make the *evidence* of that injustice as clear as possible both to the legislature and to the nation."

The grand question followed, *What are the hands in which the legislative power ought to be deposited?* Having demonstrated that the legislative and executive powers cannot by possibility exist in any but the same hands, and that they form together what they denominated the *tutelary authority,* they proceeded to inquire what was implied in the idea of authority. "Unite," said they, "upon one object a multitude of opinions and of wills; from that union will arise naturally and necessarily an union of physical forces for the accomplishment of those wills; and from the whole together will result an authority, or, in other words, *a right of commanding, founded upon a physical power of procuring obedience to what is thus commanded.* If these opinions and wills should disunite, and form, for example, two parties, the forces will for that reason be divided; there will be two forces, two authorities, and, by consequence, two societies. That two authorities cannot exist in the same society, they maintained by the following proof. Such authorities must be either equal or not equal. If equal, each of them taken separately is null. If unequal, the superior is the real and only authority. That, in the first case, each taken separately would be strictly and literally null, arose, they said, from the very nature of equality, which rendered it absolutely impossible that the one could do any thing without the other. Neither of them, therefore, could procure a single act of obedience, except by their union; but, at the very moment of their union, they cease to be two authorities, and form both together only one authority made out of the union of both. Unity is, then, a part of the very essence of authority; to divide it is to reduce it to an incapacity of acting, that is, to extinguish it; for authority is not authority but in so far as it can act to procure the execution of its will."

From the necessary unity of the tutelary authority it followed, they said, by necessary consequence, that the organ of that authority must be one man. That the physical force which is one of its component parts can be directed only by one will, is above the need of proof. But it is said that one will may be formed out of the union of several wills, and that the public force is not subject to the separate wills till the union takes place.

To this the economists made answer, that if the opposition of one will can suspend the effect of all the others, it reduces authority to inaction, and for that reason destroys it. The reason why physical force is necessary is, that you cannot count upon the union of all wills. If, to avoid this objection, you have recourse, they said, to plurality of suffrage, you build no longer on the basis of evidence. That which divides opinions is not yet evident. As nothing in government ought to be arbitrary, and every thing that is not arbitrary is founded on reasons, that is, *evidence,* there cannot be diversity of opinions on matters of government, except from the effect of ignorance, or of bad design on the part of the deliberants. But it cannot be determined by a few voices less or more, on which side the ground of evil lies. Experience shows that an accredited error may long unite partizans in much greater number than the truth by which it is opposed. The number of those who concur in an opinion cannot render that evident which is not evident; their opinion is only opinion still, which is of course subject to change; for nothing but evidence is unalterable. And with respect to bad design, as that results from particular interests, it can never be determined whether the number of those whom such interests command is the greatest or the least. On both accounts, then, plurality of suffrage is not security.

But the greatest evil, they said, of the mode of determining, by majority of votes, the question respecting the social order, was, that it set individual interest in opposition to public; in which case the public interests are sure to be sacrificed. "How great soever the differences among men, they have within them, nevertheless, two grand moving powers common to all, and which are the source of all their actions—the appetite of pleasure and the aversion to pain. To suppose that men can move in opposition to those powers, is to suppose that the cause can depend upon the effect. But the desire of enjoyment, and opinion by which it is modified, cannot act naturally and constantly in the direction of the public interest, when authority is divided among several persons who are liable to have interests opposite to one another. For it may be laid down as a truth which will not admit of contestation, that the public interest cannot be considered as generally safe when it is in opposition to the private interests of those who are entrusted with it. If one or more of the public administrators behold any great advantage to themselves in a sacrifice which has been made, or which may be made, of the public interest, we ask, said the economists, What can prevent the sacrifice from being made? Not the two springs of action which nature has placed within us to be the cause of all we do; for they are in this case put in opposition to the public interest. Not any other authority in opposition to that of the public administrator, since by the supposition they themselves engross the whole of the governing power."

The remaining evil which the economists ascribe to this expedient was, that it attached to the number of votes a despotical authority, which can safely and usefully belong to *evidence* alone. "Under this system it is not evidence," they said, "which governs; it is opinion, or the will of a certain number of men actuated by the same opinion.

The mischief apt to result cannot be estimated; it is without bounds. Suppose, in fact, that the vote of the majority is dictated by private interests, and that *evidence* is on the side of the minority, is it not monstrous that the former should command, and that the form of the government should lend to bad design a title to triumph over evidence itself? This excess of disorder is nevertheless inevitable under so defective a plan of government; and the nation remains absolutely without protection against the scourges with which, under private interest set in opposition to public, it may be lacerated, especially if these private interests are the interests of men who, by their riches or otherwise, are in possession of power.

"We forget not," they said, "that the mischievous tendency of private interest would find a counterpoise in the *knowledge of the nation.* It is very true, that in a nation really enlightened, a nation that had from *evidence* the knowledge of its own true interests, the body of rulers could not abuse their authority. But why? because the evidence of the abuse would in that case annihilate the authority. But the idea of a nation governed by plurality of suffrage, and by evidence at the same time, involves an absurdity. Again, a nation sufficiently instructed to know all the links in the chain of social good and evil, would never sanction a form of government which places the common interest in opposition to the private interests of those to whom it is entrusted. Besides, it would be ridiculous to suppose a nation sufficiently instructed to have the wills of all united under the evidence of what is best in the social order, and to suppose its rulers at the very same time so ignorant as to be divided on those subjects, and reduced for a ground of decision to plurality of suffrage.

"So long, on the other hand, as a nation is not thus instructed, the people properly so called, sunk in ignorance and prejudices, see no farther than the nearest objects by which they are surrounded; each canton thinks the interest of the state is all summed up in the interest of that canton; each profession in the interest of that profession; the knowledge of relations and dependencies is absolutely wanting. Such men cannot ascend from effects to causes, much less enumerate the links in the chain of causes and effects. It becomes, therefore, morally impossible for them to act by principle and by rule. Ever credulous, and prone to prepossession, they must be gained in order to be persuaded; the same artifices must be practised upon them which are used to seduce them. The resolutions of men, the sport of momentary impressions, must have all the inconstancy of these impressions. Divided into rich and poor, the rich look upon the poor as made for them, and upon every power which they wish to possess as naturally their due. The poor, justly discontented with the treatment they receive, and mistaking the cause, are tempted to envy the condition of the rich, and to regard as injustice the inequality of the partition which is made between them. It is evidently, therefore, unsafe to choose the body of administration exclusively from either of these two classes. Nor would much be gained if one half were chosen from the one and the other from the other. If the separate portions continued to be governed by the prejudices and views of the classes to which they belonged, they would do nothing but contend; and there is only one way in which they could receive a motive to cease,—*if collusion would enable them to serve their own private interests by sacrificing the interests with which they were entrusted.*"

The economists come then to their grand conclusion with respect to the artificial or physical security of the social order. To the question, what is the best form of government, they answered, the government of a single individual, uniting in his own person the whole of the legislative and executive powers; in other words, absolute. "All men," they said, "would confess that the best form of government was that which was so perfectly conformable to the natural and essential order of societies, that no abuse could result from it; that form, in short, which renders it impossible to make gain out of misrule—which subjects him who governs to the absolute necessity of having no greater interest than that of governing well." This advantage would be found, they affirmed, in the government of an hereditary sovereign, and it would be found in no other.

The reason was, that in no other could the interests of governor and governed be rendered absolutely the same. As the hereditary sovereign is the hereditary proprietor of the sovereignty, the interest of the sovereignty is his interest. The interest of the sovereignty means the most perfect possible state of the governing authority; that is, the most perfect possible assurance of obedience to its command. But obedience to command can only arise out of the union of wills. And there can be no perfect assurance of the union of wills to obey but from one cause; the evidence that what is commanded is for the benefit of those who are to obey. The interest of the hereditary sovereign, therefore, and the interest of the community, is one and the same.

With regard to the famous idea of the *balance* of a constitution, that fancied arrangement of things in which the power and will of one part of the instruments of government finds a counterpoise in the power and will of another; this pretended counterpoise the economists treated as a perfect chimera, a mere imposition of the imagination, a sort of day-dream.

The nation, they said, is either instructed or not instructed. Let us examine the supposition of the balance in both cases. If it is instructed, or, in other words, possesses the evidence of the causes of good and evil in society, there is no balance of forces; there is only one force, because force follows will, and here wills are united. They carry the development of this idea to a great length, to which our limits will not permit us to follow them.

If the nation is not instructed, or, in other words, does not possess the evidence of the causes of good and evil in society, the establishment of counter-forces is impracticable. To ignorance there can be only one salutary counteracting force, and that is evidence. The effect of ignorance in the sovereign is dreaded; and to remove the dread, another man's ignorance is provided. This is what people call making counter-forces. It must be confessed that they are not of the very best sort of materials. How could it ever be imagined that confidence for any thing stable could be laid on any thing so unaccountable as the results of ignorance?

Let us adopt this chimera for a moment, and ask if it be possible to assure ourselves that each force will be the same to-morrow which it appears to be to-day. It is evidently impossible; nay, what each appears to-day may be a *false* appearance; for, resting only on opinion, detached from evidence, it rests on what can never be exactly known.

The idea of a balance is the idea of two powers, one tending by its own force in one direction, another urging it by an equal force in an opposite direction. The effect is rest. To balance the power of the sovereign acting in one direction, you provide another power acting in an opposite direction. If the powers are equal, they destroy one another, and there is no action. If they are unequal, there are not two powers, but only one power; for the greater swallows up the less.

The theory of a constitutional balance is founded on a metaphor, a contrivance of language; and moral forces are supposed to be subject to the laws of material forces. Material forces acting on a body in different directions,

make it assume a certain determinable duration between the two. But it has not been considered, that in physics the direction given does not depend upon the opinion of the things which act. In morals, on the other hand, the things which are depended upon for counteraction change their duration according to their opinion. A theory which supposes that to be uniform and constant which is known to be the reverse, is evidently absurd.

Suppose every thing which the theory needs to be supposed. Conceive an assembly, or assemblies, provided to counteract the sovereign, and so constituted, as to form the most perfect counteraction possible; that the sovereign can ordain nothing but with the consent of the assemblies, and the assemblies nothing but with the consent of the sovereign. In this case, it is not a government of one, but a government of many; each member of the assemblies shares in the sovereignty; they are so many partners, therefore, with a particular partner at their head. The question is, what are the interests of the partnership? Those of the nation or not? The interests of the partnership doubtless are, to make it as profitable to the members as possible; for it would be absurd to suppose them not governed by their private interests. Suppose, then, that there is originally a tendency to counteraction between the sovereign and the assemblies. It is very obvious that they will put an end to this counteraction, as far as they discover that the suspension of it is conducive to their private interests. This is a law of nature, and may be taken for granted. As far, then, as the serving of the private interests of the members is concerned, there is no balance of opposite forces; the forces combine instead of opposing, and so far the balance is lost. The loss of the balance to this extent may be a loss engrossing the whole of the protection to the common interest which it was expected to yield, or it may be a loss not extending so far. If it goes to the whole extent of that protection, there is to the purpose in question no balance at all. If it does not go to the whole extent, there will still be some balance, more or less. What then is the case? The case is, that the loss goes to the whole, and that the balance does not exist. The balance does not exist, as far as the private interests of those who share among them the governing powers are concerned. But it is only from the private interests of those who govern that the nation has any thing to fear; it is only against these interests that the balance is provided. As far, however, as these private interests are concerned, the balance does not exist. As far, therefore, as the balance is even *supposed* to be of any service, the balance is excluded by the law of nature. It follows as a corollary, that in a country where the people depend upon what is called *a balance* as the whole of their security for good government, they have no security at all.

Such is the analysis which the economists present of the causes of good and evil in human society, and of that order of things which best insures the presence of the one and the absence of the other. That part of their doctrine which alone is yet known to the mere English reader, their *Political Economy*, is introduced as only an auxiliary exposition. It is part of the development by which they endeavoured to prove the identity which they supposed between the interests of the sovereign and the interests of the people. But, as a very distinct account of this part of their system has been given by Dr Adam Smith and other writers, and as our object rather was the exhibition of those doctrines of the sect which nobody has yet presented to our countrymen in their own language, we shall content ourselves with only marking the place which their political economy held in their general system.

As the society has public expenses, it is necessary that it also have a public revenue. To reconcile the formation of a public revenue with the idea of social order, it ought to be formed, if possible, without infringing the property of individuals, for the sake of which the order of society itself is established. It ought, therefore, if possible, to be formed without diminishing the revenue of individuals. When the real origin of revenue, the source from which it all is drawn, is sufficiently understood, the mode of forming a revenue for the sovereign, without diminishing that of individuals, would be immediately apparent. *The source of all riches is the land; because the land alone, of all the sources of production, yields a produce greater than the cost of the production.* The surplus produce of the land, therefore, constitutes a fund, which is over and above the remuneration to the agents of production, and out of which the revenue of the sovereign may be taken, without diminishing the motive to production; that is, without retarding the natural progress of the state in wealth, population, and felicity.

To lay the foundation for this plan of a public revenue, it was necessary to prove that the land is the only source of production; and that manufactures and commerce, though they alter the form of things, never add any thing to the amount or value of production. In the development of these views, one of the most remarkable results at which the economists arrived was the necessity of perfect freedom to all the proceedings which lead to production; as giving to produce that form which is most agreeable to those who are to make use of it. Till the time of the economists, the necessity of holding those proceedings in chains, and binding them to the will of governments, was the universal doctrine of governments, and, to a great degree, of speculators themselves. The general principles of the economists respecting the *freedom* of property necessary to constitute the foundation of social order, led them to infer the evil of those abridgments of freedom; but they examined the inference in detail, and showed that the meddling officiousness of governments to compel industry to one thing, and exclude it from another, not only failed to effect any good purposes, but of necessity created obstructions of the greatest magnitude to production in general, and tended powerfully to keep down the wealth, population, and prosperity of the state. The light which they diffused on this subject, and which soon produced a grand effect on the minds of men, was a good, the magnitude of which is beyond calculation.

Another of their conclusions is, that the revenue of the sovereign, taken, as they said it ought to be, wholly from the net produce of the land, ought to be a fixed and unalterable proportion of that produce. The reason appeared to them conclusive. If the proportion was variable, and depended upon the will of the owners of the land, they might be induced to break upon the public revenue, and deprive the state of those benefits which the public revenue is necessary to produce. If it depended upon the sovereign, the property of the land might be detached from that of its produce; nobody would have a motive to become a proprietor in land, and all the advantages which depend on the existence of that property would be lost the production of subsistence would fail, and the community could not exist.

This proportion being once fixed, there is no longer any contrariety between the interest of the sovereign and the interest of any portion of his people; and the proprietors of land are as completely and securely exempt from contributing to the expense of the state, as any other class of the community. The sovereign derives no part of his revenue from the subject; and this deplorable source of the conflict of interests is wholly cut off. The proportion being settled for ever between the sovereign and the land-

owners, that alone is the property of the landowner which is the proportion remaining to him. The rest is, with regard to him, as if it did not exist. The sovereign they denominated, therefore, *co-proprietor* of the land; and between him and the landowner, commonly so called, a perfect community of interests is fixed. It is the interest of the sovereign that the produce of the land should increase, because, with every increase in the produce of the land, his revenue increases. It is also the interest of the landowner that the produce of the land should increase, because it is from the same cause that his revenue increases. See the article POLITICAL ECONOMY.

III. In the remarks which we have to offer on the doctrines of this sect, we must content ourselves with a few general strictures on one or two leading points.

The most important slips which the economists made in tracing the laws of the social order, are found in their deductions respecting the *tutelary authority*. Many steps, nevertheless, in that doctrine they have established. That the legislative and executive power are essentially the same, and cannot be separated except in *appearance*, they seem to us to have placed beyond the reach of dispute. That no security for good government can be found in an organization of counter-forces, or a *balance* in the constitution, they have proved in a manner equally satisfactory. But we think they have not proved that a security for good government can ever be found in the personal interests of a sovereign who unites in himself the whole of the legislative and executive power. And we think they have not proved that this security, if it cannot be found in the interests of such a sovereign, can be found in nothing else.

1. That the economists do not reason correctly from their own principles, when they regard the interests of the sovereign as an adequate security for good government, may be made apparent, we should hope, by an argument of a very few steps.

In a perfect state of the social order, they say that the interest of the sovereign would be the same with that of the community; and the evidence of this identity would be so clear to the sovereign, that the effect of it would be irresistible on his mind. But in a perfect state of the social order, they say also, that the interest of *every* man would consist in the most exact conformity to all the rules of that order, and that the evidence of this truth would be so apparent as to be sure of its effect. In the only state, therefore, in which the interest of the individual entrusted with the tutelary authority could be relied on as a security, the tutelary authority itself would not be required; for in a state in which every man would, of his own accord, do what is best, an authority to compel him to do so would be worse than useless.

The moment when you suppose a tutelary authority to be necessary, the moment at which you suppose there is any man in the community who can regard his private interest as consisting in any degree in what is hurtful to the community, how can you be sure that the depositary of the legislative and executive powers will not be that man? It can be easily shown that no man is acted upon by stronger forces to impel him in that direction.

In order to prove that the legislative power cannot be exercised by the community at large, the economists declare expressly, " that if we study the nature of each man in particular, we shall find in general that he would if possible have nothing but rights on his own side, nothing but obligations on the side of other men. The legislative power can be exercised with safety only by those who possess in perfection the evidence of the justice and necessity of the original and pervading laws of social order. It cannot, therefore, be exercised in safety by a body of men, among whom unequal rights exist, and must exist; and who at the same time are all separately desirous that the inequality should be in their favour."

Admit this—admit that all men in general desire to have nothing but rights on their own side, obligations on the side of other men; to have the inequality all in their own favour; to possess advantages, in short, over their fellows in the community; and it is surely absurd to talk of security in the interest of the sovereign.

It is a part of their doctrine, that he who is entrusted with the legislative power cannot be entrusted with the judicial power; because in that case the same party, both legislators and judges, would destroy law, by the exercise of arbitrary will. This is a direct admission, or rather an unlimited affirmation, that the interest of the sovereign is not a security such as good government requires. Again, it is said by the economists, " that under a government conformable to the principles of order, the positive laws would be of a justice and necessity *publicly evident;* and that in order to apply these laws, the judges would unite two sorts of knowledge, both of its meaning and of its reason; and, secondly, a knowledge of the facts which constitute the case in which they are required to decide." No men, according to them, are more urgently called upon, none can be more reasonably expected to be in full possession of the evidence of that interest which every man has in the preservation of the social order. Yet so far are the economists from saying that the interest of these men, and the evidence they could possess of that interest, would be a sufficient security for the right administration of their trust, that they declare them liable to the greatest malversations, and that the ultimate security would lie in the sovereign, who would check them. It is surely matter of wonder how the economists could fail to perceive, that the very same motives which they rejected as security for the right use of authority in the judges, they trusted to as complete security in the sovereign; though likely to operate on the judges with greater force than upon him.

2. We think it may also be made apparent, that the economists do not reason correctly from their own principles, when they conclude, that if security for good government cannot be found in the interests of one man entrusted with the whole of the legislative and executive powers, it can be found in nothing else.

They expressly state, that " the first, the real depositary and general guardian of the laws, is the nation itself, at the head of which is the sovereign. Accurately speaking, the deposit and guardianship of the laws *can* belong to those alone who are armed with the superiority of the physical force, to procure to that deposit its necessary superiority. This being evident, it is the nation as a body which naturally and necessarily is the depositary and guardian of its own laws; because there is in the nation no power comparable to that which results from the combination of its powers." Again,

In contending that the legislative and executive powers must always be exercised by the same hands, they affirm that those powers could only be exercised by those who had in their hands the superiority of the physical force. Observe, now, the legitimate conclusion:

The people alone have the physical force necessary to constitute them guardians of the laws. The same force is necessary for the makers and the executors of the laws. No body, therefore, but the people ever can, accurately speaking, have either the legislative or the executive powers. In a state of ignorance they may be led by fraud to lend their powers to their own destruction. But it is a part also of the doctrine of the economists, that in a state of knowledge, in which they may be easily placed,

Economy || Ecuador.

it is not possible they should make any but a good use of their power.

"A nation," they said, "governed according to the natural and essential order of society, has *necessarily* the perfect evidence and knowledge of it, and therefore sees with certainty that it enjoys its best possible situation. This perception, of necessity, unites all the wills and all the forces in the nation for the support of that order, and, by consequence, for the creation and preservation of all the institutions which are best adapted to that support." The people, therefore, may be safely trusted.

In a nation governed badly, governed not according to "the natural and essential order," but according to what the economists call the "*political* order," "it is always," they said, "one part of the nation which governs the rest; the weaker which governs the stronger. In this case, too, the power of him who commands consists in nothing but the powers united of those who obey him. And this union of their forces supposes, of necessity, the union of their wills; which can be founded only upon the persuasion that this obedience procures them their best possible condition. The powers of the nation in this vicious order are less at the disposal of the sovereign than at the disposal of those who hire to him their agency, and, by consequence, sell to him the means of procuring obedience from the nation; his situation is therefore at bottom a real dependence; his situation is precarious, uncertain, changeable; he is put in chains, which he dares not attempt to break." In every situation, therefore, it is the will of the people, either of the whole of the people united, or of a part of the people united against the rest, which is in reality both the legislative and the executive power. Estimate, therefore, as high as you please, exaggerate to any excess, the inconvenience of being governed by the people, you have that inconvenience still; you are bound to it by the inexorable law of nature; it is not within the range of possibility that you should escape from it.

Ecuador.

We have already seen that the economists declare that "every man wishes to have all the rights on his own side, all the duties on the side of other men; that every man likes inequality, in short, when the inequality is in his own power." From this they infer, that the community cannot safely govern; but from this it may with much more justness be retorted upon them, that nothing else can safely govern. The interest of the community, say the economists, is easily known; the evidence of it is within the reach of all descriptions of the people, and so cogent as to be irresistible. The union of wills, according to their doctrine, follows as a matter of course. Here, therefore, it should seem we have a much better security than can be found in the interest of any *individual*, sovereign or subordinate.

It is remarkable enough that the economists have wholly overlooked, in their criticism on the plans opposed to their own, *the representative system;* and yet it is pretty evident that it is by means of the representative system that the grand problem of government must finally be resolved. The speculations connected with this subject will, however, find a more fitting place under the article GOVERNMENT. (J.M—L.)

ECONOMY, POLITICAL. See POLITICAL ECONOMY.

ECSTACY. See EXTASY.

ECSTATICI (Ἐκστατικοί, from ἐξίστημι, *I am entranced*), in *Antiquity*, diviners who were cast into trances or ecstacies, in which they lay as if dead, but who, on recovering their senses, gave strange relations of what they had seen or heard.

ECTHESIS, in *Ecclesiastical History*, a confession of faith, in the form of an edict, published in 639 by the Emperor Heraclius, with a view to allay the troubles occasioned by the Eutychian heresy in the Eastern Church. He revoked it, however, on being informed that Pope Severinus had condemned it as favouring the Monothelites; declaring at the same time that Sergius, patriarch of Constantinople, was its author.

Name, situation, and boundaries.

ECUADOR, an independent state of South America, lying under the equator, from which it takes its name. It corresponds, with a trifling difference, to the old Spanish province or intendancy of Quito; but formed anciently the northern portion of the empire of the Incas of Peru, and latterly the south-western province of the now dissolved republic of Columbia. It is situate between S. Lat. 6. and N. Lat. 2., and W. Long. from Greenwich 70. and 82.,—being about 830 miles in length from E. to W., and 560 in breadth from N. to S.,—and only contains an area of about 320,000 English square miles. It is bounded on the S. by the state of Peru, on the N. by New Granada, on the E. by Brazil, and on the W. by the Pacific Ocean; but the boundaries of the eastern portion of the state are not yet very well defined.

Physical formation.

The western portion of the state, to the extent of about a third of its area, is covered with mountains. These consist principally of a cross section of the Andes, about 7° in length, forming at the northern and southern boundaries respectively the two large mountain-knots of Loja or Loxa, and Pastos. Between these knots the range of the Andes forms a single mass, about 300 miles in length and from 70 to 80 miles in breadth, rising with a steep acclivity at the distance of about 70 to 90 miles from the shores of the Pacific Ocean to a mean elevation of about 9000 feet, and forming on its summit a long plateau or table-land, bordered on each side by parallel ranges of mountains, which again rise several thousand feet higher, and have their peaks covered with perpetual snow. The highest, or those on the E. and W. sides of these ranges, are about 50 miles apart, while the lower and interior ranges occupy a breadth of several miles on each side, leaving between them a narrow belt of flat ground—from 15 to 24 miles in width, and 300 miles in length from N. to S.—divided into three parts by two cross ridges. The southmost portion forms the valley of Cuença, which has an elevation of about 7800 feet; the northmost is the celebrated plain of Quito, which has a mean elevation of about 9600 feet; and between them is the valley of Alausi and Ambato, with a mean elevation of 8000 feet. The valley of Cuença is connected with the middle valley by the pass of Assuay, the crest of which rises to the great elevation of 15,520 feet; but the ridge between Allausi and Quito, called the *Alto de Chisinche*, rises only about 500 feet above the contiguous plains on the N., and is of inconsiderable width. Among the lofty summits that border these valleys, the following table gives the names of the principal, with their elevations in feet above the level of the sea:—

	Feet.		Feet.
Chimborazo	21,424	Chumbal	16,824
Cayambe-Urcu	19,534	Carguairazo	16,663
Antisana	19,137	Cotocache	16,448
Cotopaxi	18,875	Tunguragua	15,960
Iliniza	17,376	Pichincha	15,936
Sangay	16,827		

With the exception of Chimborazo, all these are active, or only recently quiescent volcanoes; and the surrounding districts are subject to frequent earthquakes, some of which have been terribly destructive.

Between the Andes and the sea the country is covered with mountains, which, however, do not seem to form continuous ridges. The shores themselves are high, rising along the Pacific with a bold and broken line of gulfs, bays,

Ecuador. and headlands, except at the S.W., where the Gulf of Guayaquil, 70 miles wide, terminates inland, with an alluvial valley, or long plain, several miles in breadth, and so low as to be always flooded in the rainy season. In the bosom of the gulf lies the island of *Puna*, with an area of more than 200 square miles, but inhabited only by a few fishermen.

To the eastward the Andes sink abruptly into the great plain which extends eastward to the Atlantic Ocean along the river of the Amazons and its mighty tributaries, some of which have their sources among the mountains of Ecuador. In this direction flow the waters of the valleys of Cuença and Alausi, and Hambato, while those of Quito find their way to the Pacific through the rivers of Patias and Esmeraldas. So far as within this state, the great plain is partly wooded and partly a savannah interspersed with many lagunes and stagnant pools, and intersected by innumerable streams flowing from the Andes.

Geology. Granite seems to form the basis of the whole range of the Andes, but it rarely appears on the surface. Gneiss is sometimes found in connection with the granite, but mica-schist is by far the commonest of the crystalline rocks. Quartz is likewise very abundant, and vast tracts of red sandstone with gypseous and saliferous marls occur near Quito. Porphyry and greenstone abound all over the range, and great masses of trachyte, from 14,000 to 18,000 feet thick, are visible on Chimborazo and Pichincha. Basalt, of columnar structure, inclosing olivine, and overlaid with thick beds of clay, is found on the table-land of Quito. Immense quantities of lava, tufa, obsidian, and other volcanic products, are likewise found, particularly along the western face of the Andes.

Climate. Although this state lies under the equator, the great elevation of the mountain mass of the Andes renders the climate, in the elevated districts, mild and temperate. In the valley of Quito there prevails an everlasting spring, so equal in its temperature that vegetation never ceases; and the city has acquired the title of *Sempre verde* (ever-green), and *Eterna primavera* (everlasting spring). The change of seasons is scarcely perceptible, while the mean temperature of the day, all the year round, varies only from 60° to 67°, and that of night from 48° to 52° Fahr. The season between September and May is called winter, and the rest of the year summer; but the winter is only distinguishable by a somewhat greater quantity of rain, and the summer by a greater number of fine days. All the year round, however, scarcely a day passes without rain. In the mornings and evenings the sky is generally clear and serene, but in the afternoon it is generally overcast with dark clouds, which pour down torrents of rain, often accompanied with awful storms of thunder. Sometimes, however, the rain continues all night, and occasionally three or four days together. Wind blows continually along the valley, either from the north or from the south, but never with great violence. In the low country on the coasts the climate is very different. At Guayaquil the temperature is generally between 98° and 104°, and people complain of cold when it falls to 84° or 86°. In the other valleys along the coast the mean temperature of the year varies between 78° and 82°; but from December till April the heat rises to 95°, and during these months rain falls with little interruption, frequently accompanied with violent tempests. The floods at that season are so great, that in the valley of Guayaquil the country becomes one sheet of water even to the base of the Andes, to which the people betake themselves for refuge, with their herds and flocks. Fevers, diarrhœas, dysentery, vomiting, and spasms, then prevail, and the mortality is often very great. On the acclivity of the Andes, at the elevation of 3000 to 5000 feet, a soft spring temperature prevails, never varying more than 7° or 8°, and the mean temperature of the year being from 68° to 70°. The great eastern plain has a hot climate, the mean temperature being probably from 75° to 85°. The heat sometimes rises to 95°; but every day, early in the afternoon, a wind, generally accompanied with rain, begins to blow from the eastward with great force, and continues till sunset.

Vegetable productions. In the low countries that flank the base of the Andes the banana, cycas, plantain, cacao, jatropha which produces cassava and manioc, the cotton tree, indigo, coffee, and the sugar-cane abound; beneath the elevation of 4000 feet, the plants chiefly cultivated for food are the sweet potato, mandioc, yam, and banana, with rice, maize, and some legumes; but above 3100 feet most of these become rare, and thrive only in particular situations. The sugar-cane, however, has been grown so far up as 7500 feet. In some of the valleys are extensive plantations of sugar-cane, cotton, tobacco, and cocoa. The valley of Guayaquil is particularly fertile; the soil is alluvial, and there are few spots even between the tropics which can vie with it in richness and variety of vegetation. It is covered with groves of every kind of tropical fruits, either wild or cultivated, as the pine-apple, pomegranate, shaddock, orange, lime, lemon, peach, apricot, cherimoyer, pulta, granadilla, tuna, and pacay. In the same region are found the olive, pepper plant, tomatas, and sweet potatoes, gum copal, copaiba balsam, carana, dragon's blood, sarsaparilla, and vanilla. To these succeed, in the humid and shaded clefts on the slopes of the mountains, tree ferns and cinchona or Peruvian bark, the finest kind of which is obtained about 8 to 12 miles S. of Loja among the mountains of Uritusinga, Villanaco, and Rumusitana, where the trees that yield it grow in a soil resting on mica-slate and gneiss, at the moderate elevation of 5756 to 7673 feet above the level of the sea. Between the elevations of 6000 to 9000 feet is the region best suited for the European cereals. Wheat will not form the ear lower than at 4500 feet, or ripen higher than at 10,000 feet; but barley and rye grow at an elevation 2500 feet still higher. To these may be added the guinoa, a most useful production for domestic purposes. In this region also, and a little above it, grow the potato and its congeners, all of which are extensively used as food; the chick pea, broad bean, cabbage, and other European vegetables, are likewise abundant. Within the cereal limits are found the oak, elm, ash, and beech, which never descend lower than 5500 feet, and are seldom found higher than 9200 feet above the level of the sea. Higher up, the larger forest trees, except the pine, begin to disappear; and on the mountains of Quito the escallonia mark the highest limit of trees at an elevation of 11,600 feet. The bejarias, the highest of shrubs, terminate at 13,400 feet, above which, in rich and beauteous verdure, rises the zone of the grasses. Above these, among the trachyte rocks, only lichens, lecideas, and the brightly coloured dust-like lepraria are met with; and to these succeed the region of perpetual snow.

Animals. In some parts of the low country the air swarms with musquitoes and other flies still more tormenting, while the ground teems with snakes, centipedes, and other reptiles. The banks of the great rivers are crowded with caimans or alligators. Bats are exceedingly numerous and of great size; the forests of the warmer regions abound with armadillos, monkeys, and cavys; and everywhere are found the jaguar, the puma, the ounce, the ocelot, and several varieties of the wild cat. The pecari and deer are likewise common, as well as that singular animal the ant-eater. The characteristic animals of the Andes are the llama, the guanaco, the vicuña, and the paco or alpaca, some of which are trained as beasts of burden, while others, particularly the vicuñas, run wild among the mountains, where they are hunted by the Indians. Sheep and cattle are reared in great numbers, especially the former, in the valleys of the Andes, and on the declivities of the mountains. Horses, asses, and mules, are reared in sufficient numbers to be articles of export. The chief of the birds is the condor, which is found all along the Andes southward as far as the

Ecuador.

Strait of Magellan, but nowhere to the north of the equator. The turkey, vulture, and gallinago, are frequently met with, together with many kinds of smaller birds. In some districts, particularly along the coasts, considerable quantities of bees-wax are collected; and higher up there are spots in which the cochineal insect is reared. Along the rivers of the great plain turtles are numerous; and their fat, called *manteca* butter, forms a considerable article of trade. Fishing is carried on to some extent along the coasts, and a good deal of salt-fish is prepared. A murex is also found which yields a juice used in dyeing purple.

Mineral productions.

Ecuador is less rich in minerals, especially in the precious metals, than any other of the South American states. There are indeed several mines of gold and silver, but the yearly produce is inconsiderable. In some places are found lead and quicksilver, but the latter is found, as usual, in combination with sulphur, in the form of cinnabar. Near Azogue, 15 miles N.E. by E. of Cuença, the ore is found in an immensely thick bed of quartzose sandstone, containing fossil wood and asphalt. Sulphur is prepared in considerable quantities; gold has been washed from the sands of some of the rivers; and salt is obtained from sea-water along the coasts.

Population.

The settled population is composed of Spanish creoles of pure descent, meztisos, mulattoes, and negroes, the greater part of them being agriculturists, graziers, and growers of cocoa. These form about a half of the population. The other half are native Indians, of whom those that live among the mountains are mostly agriculturists, cultivating their lands with much care, and making for themselves coarse stuffs of wool and cotton. The Indians who inhabit the eastern plains are in a much lower degree of civilization. They cultivate only small patches of ground, and apply themselves chiefly to hunting and fishing. Three-fourths of the population dwell in the western or mountainous part of the state; and the total number is now estimated at about 800,000.

Manufactures.

The manufactures are unimportant, consisting chiefly of coarse woollen and cotton cloths and other necessary articles. The foreign trade is almost confined to Guayaquil, and is so trifling as scarcely to deserve notice.

Political condition.

Till 1812 Ecuador remained a portion of the Spanish empire of the Indies. It then threw off the yoke of Spain, and in 1821 became a part of the newly constituted republic of Columbia. This union, however, lasted only till 1831, when Ecuador became an independent state. It has gone through several revolutions; and by the last (1852–3) the democratic party has gained the ascendency, and shown a tendency to adopt the United States of North America as their political model. The state has in consequence received a new and more liberal constitution; the Jesuits have been expelled; and laws have been made for the abolition of slavery. The government is vested in a president, with a vice-president and two chambers, all elective; but the constitution is still notably complicated by what has always been its principal characteristic, a predominating mixture of military despotism, the president being always the master of the state. More, perhaps, than any other country of South America, Ecuador has been slow in the development of her resources and national industry. Frequent revolutions have paralysed its trade, and prevented the regulation of its finances. No interest has been paid on its public debt since 1826. It is emphatically the country of natural convulsions and political revolutions.

For adminstrative purposes the state is divided into the three departments of *Ecuador*, *Guayaquil*, and *Assuay;* and these are subdivided into the seven provinces of *Quito*, *Riobamba*, *Ibarra*, *Guayaquil*, *Babahoyo*, *Cuença*, *Loja*, or *Loxa* (Loh-ha), and *Jaen de Bracamor.* The state likewise claims the sovereignty of the *Islas de los Galapagos*, or islands of land turtles, lying under the equator at a distance of 700 to 900 miles from the mainland. The chief towns are, *Quito*, with from 50,000 to 80,000 inhabitants; *Guayaquil*, 25,000; *Cuença*, 20,000; *Riobamba*, 15,000; *Loja*, *Babahoyo*, and *Ibarra*, about 10,000 each. Quito is beautifully situated in the elevated plain to which it gives its name; and Guayaquil on the banks of a navigable river, opening into the spacious bay to which it gives its name.

Edda.

EDDA, a system of the ancient Icelandic or Runic mythology, containing many curious particulars of the theology, philosophy, and manners of the northern nations of Europe; or of the Scandinavians who had migrated from Asia, and from whom our Saxon ancestors were descended. Mallet was of opinion that it was originally compiled soon after the Pagan religion was abolished, as a course of poetical lectures, for the use of such young Icelanders as devoted themselves to the profession of scald or poet. It consists of two principal parts; the first containing a brief system of mythology, properly called the *Edda;* and the second being a kind of art of poetry, and called *Scalda* or *poetics.* The most ancient Edda was compiled by Soemund Sigfusson, surnamed the Learned, who was born in Iceland about 1057. This was abridged, and rendered more easy and intelligible, about 120 years afterwards, by Snorro Sturleson, who was supreme judge of Iceland from 1215 to 1222; and it was published in the form of a dialogue. The latter added also the second part in the form of a dialogue, which is a detail of different events connected with the heathen divinities. The only three pieces which are known to remain of the more ancient Edda of Soemund are the Volupsa, the Havamaal, and the Runic chapter. The Volupsa, or prophecy of Vola, or Fola, appears to be the text on which the Edda is the comment. It contains, in two or three hundred lines, the whole system of mythology disclosed in the Edda; and may be compared to the Sibylline verses, on account of its laconic yet bold style, and its imagery and obscurity. It is professedly a revelation of the decrees of the father of nature, and the actions and operations of the gods. It describes the chaos, the formation of the world with its various inhabitants, the functions of the gods, their most signal adventures, their quarrels with Loke their great adversary, and the vengeance that ensued; and it concludes with a long description of the final state of the universe, its dissolution and conflagration, the battle of the inferior deities and the evil beings, the renovation of the world, the happy lot of the good, and the punishment of the wicked. The Havamaal, or Sublime Discourse, is attributed to the god Odin, or Woden, who is supposed to have given these precepts of wisdom to mankind. It is comprised in about 120 stanzas, and resembles the book of Proverbs. Mallet has given several extracts from this treatise in his Northern Antiquities. The Runic chapter contains a short system of ancient magic, especially of the enchantments wrought by the operation of Runic characters, of which a specimen is also given. A manuscript copy of the Edda of Snorro is preserved in the library of the university of Upsal: the first part of it was published with a Swedish and Latin version by M. Goranson. The Latin version is printed as a supplement to Mallet's Northern Antiquities. The first edition of the Edda was published by Resenius, professor at Copenhagen, in the year 1665, in a large quarto volume, containing the text of the Edda, a Latin translation by an Icelandic priest, a Danish version, and various readings from different manuscripts. Mallet has also given an English translation of the first part, accompanied with remarks; from which we learn, that the Edda teaches the doctrine of the Supreme, called the Universal Father, and Odin, who lives for ever, governs all his kingdom, and directs the great things as well as the small; who formed the heaven, earth, and air; who made man, and gave him a spirit or soul, which will live after the body shall have mouldered away · then all the just shall dwell with him in a

place called Gimle or Vingolf, the palace of friendship; but wicked men shall go to Hela, or death, and thence to Niflheim, or the abode of the wicked, which is below in the ninth world. It inculcates also the belief of several inferior gods and goddesses, the chief of whom is Friga or Frea, that is, *lady*, meaning thereby the earth, who was the spouse of Odin or the Supreme God; and hence we may infer that, according to the opinion of these ancient philosophers, this Odin was the active principle or soul of the world, which, uniting itself with matter, had thereby put it in a condition to produce the intelligences or inferior gods, and men, with all other creatures. The Edda likewise teaches the existence of an evil being called Loke, the calumniator of the gods, and the artificer of fraud, who surpasses all other beings in cunning and perfidy. It teaches the creation of all things out of an abyss or chaos; the final destruction of the world by fire; the absorption of the inferior divinities, both good and bad, into the bosom of the grand divinity, from whom all things proceeded as emanations of his essence, and who will survive all things; and, lastly, the renovation of the earth in an improved state.

EDEMATOUS, or Edematose, (οἴδημα, *a swelling tumour*,) filled with a serous humour; dropsical.

EDEN, the country and garden in which Adam and Eve were placed by God himself. The term denotes pleasure or delight. The garden is also called Paradise—a term of Persic original, signifying a garden. In regard to its locality, it is generally agreed that we ought to look for it in the south of Armenia. See Paradise.

Eden, a river of England. See Cumberland.

EDENDERRY, a market-town of King's County, Ireland, at the N.E. extremity of the bog of Allen, 33 miles W. of Dublin. It is a neat, clean, and comparatively prosperous town; and has a considerable trade in corn. Pop. (1851) 1804, besides 1023 in the Union workhouse.

EDENTATA, Cuvier's sixth order of mammiferous animals, characterized by the absence of fore-teeth. See Mammalia.

EDER, a town of Hindustan, province of Guzerat, and the principal place of the rajpoot state of the same name. The town contains 1200 houses, with a population of about 10,000. The petty state of Eder was founded in the early part of the eighteenth century by Anund Sing and Raee Sing, sons of the celebrated Ajeet Sing, rajah of Joudpore; the territory having been assigned to them by their elder brother the viceroy of Guzerat. The annual revenue is estimated at about L.24,000; of which L.3300 is paid as tribute to the Guicowar. The political connection of the British government with this state commenced in 1820 in the arrangement with the Guicowar, under which that prince stipulated to withdraw his troops from the district, and the British government engaged to collect the Guicowar's dues free of all deduction. Upon the election in 1841 of Tukht Sing, the rajah of Ahmednuggur, to the throne of Joudpore, his possessions in Guzerat were claimed by the ruler of Eder as the feudal superior; and the claim having been recognised by the British government, the possessions of Ahmednuggur thenceforward merged into those of Eder. The town of Eder is in Lat. 23. 50., Long. 73. 3. (E. T.)

EDESSA, a later name of the ancient Ægæ, the capital of Macedonia, was situated in the very centre of that kingdom, at the head of a defile commanding the approaches from the sea-coast to the interior of the country. Its lofty and commanding position, and the magnificent surrounding scenery, combined with its historical interest, caused it to be regarded by the Macedonians with peculiar veneration, more especially as from it sprang the dynasty of their kings. Even after the seat of government was removed to the more accessible Pella, Edessa continued to be the burial-place of the royal family. It was at this town that Philip fell by the hand of his murderer Pausanias; and it was originally intended that the remains of the great Alexander should here repose beside the ashes of his ancestors, though the scheming Ptolemy contrived that they should be interred at Memphis. When Pyrrhus and his Epirotes overran the country, they opened the tombs of the Macedonian kings, in the vain hope of bringing to light some buried treasures of great value. The site of Edessa is occupied by the modern Vodhena, where a few unimportant remains of the ancient town may still be seen.

Edessa, or Callirrhoe, a city in the north of Mesopotamia, in the province of Osrhoëne, on the banks of the small river Scirtus, a tributary of the Euphrates. The time and manner of the foundation of this city are very variously given by different authors: by some writers its origin is even referred to Nimrod; and though this account may be very safely rejected, yet the extreme antiquity of the place is undeniable. Its very position is also variously given by the ancient geographers. Strabo, for instance, confounding it with Hierapolis, places it in Syria, while Pliny makes mention of it as being in Arabia.

It was not till the Christian era that Edessa began to play a part in history. In the wars between the Eastern empire and the Persians, and in the early history of the church, the name of Edessa very frequently occurs. One of the most important theological schools of the primitive church had its seat in this city, and distinguished itself by the zeal with which it maintained the Nestorian heresy. This zeal ultimately proved the ruin of the school, whose professors were banished from Edessa by the orthodox bishop Martyrus, while the building in which they had taught was pulled down by order of the emperor Zeno, towards the end of the fifth century.

In the wars with the Persians, Edessa frequently suffered great damage; and though this was immediately repaired, yet the destructive inundations of the Scirtus on more than one occasion threatened to endanger the very existence of the town. In 718 Edessa was nearly destroyed by an earthquake; and in 1184 it fell into the hands of the Saracens, under whose rule its prosperity rapidly declined. Under the name of Orfah, Edessa has recovered to a certain extent its ancient greatness, as it stands on the great route between Kurdistan and Aleppo, and has consequently become a place of very considerable commercial importance.

EDFU, a village of Upper Egypt, remarkable for its two temples. See Architecture, vol. iii., p. 458; and Egypt.

EDGEWARE, a village of Middlesex, 10 miles W.N.W. from London. It was formerly noted for the magnificent palace of the Duke of Chandos; the site of which is now occupied by a villa constructed out of the materials of the former palace.

EDGEWORTH, Richard Lovell, a distinguished essayist, was born at Bath in 1744. He received his education at Oxford, and in his after-life devoted himself to literary pursuits. His name is honourably known from his efforts in the cause of education and agricultural science. He is also said to have been the originator of several ingenious inventions, and some have claimed for him the invention of the telegraph. Most of his works were written in conjunction with his daughter; and she has also published a continuation of his "Memoirs." Mr Edgeworth was a member of the Irish House of Commons about 1794. He was four times married; and died at Edgeworth's Town in June 1817.

Edgeworth, *Maria*, an eminent English novelist, and daughter of the preceding by his first wife, was born in Berkshire, Jan. 1, 1767. She removed to Ireland when her father succeeded to the family estate in 1782, and there she spent the greater part of her life. Her literary career began with the publication of *Castle Rackrent* in 1801; and this was soon followed by the *Moral Tales*, *Belinda*, *Leonora*, *Tales of Fashionable Life*, *Patronage*, *Harring-*

Edinburgh. *ton and Ormond*, and other works. It was the humour, tenderness, and tact displayed in her admirable delineations of Irish character that first suggested to Sir Walter Scott the design afterwards carried into effect in the Waverley Novels. Parallel with this series of works of fiction, Miss Edgeworth directed her literary efforts to the cause of education. Her essays on *Practical Education* were published so early as 1798, and her latest work was the child's story of *Orlandino*, which appeared in 1834. The *Parent's Assistant*, and numerous other educational works, fill up the intervening period. Among the works to which her father's name is attached along with her own, the most famous is the *Essay on Irish Bulls*, published in 1803. The latter part of Miss Edgeworth's life was spent in peaceful retirement at Edgeworth's Town, whence, with the exception of a trip to the Continent and a short residence at Clifton, she had scarcely ever removed, and where she died in May 1849.

Edhiling || Edinburgh.

EDHILING, Edhilingus, an ancient appellation of the nobility among the Anglo-Saxons. It is sometimes written *atheling* or *ætheling;* which appellation properly pertained to the presumptive heir of the crown.

EDICT (*edicere, to publish*), that which is uttered or proclaimed by authority as a rule of action; as an order or ordinance issued by a prince to his subjects, either as a temporary regulation or as a permanent law. Strictly speaking, edicts cannot exist in Britain, since the power of enacting laws is lodged not in the sovereign but in the parliament.

EDINBURGH.

Situation.

Edinburgh, the capital of Scotland, and chief town of Mid-Lothian, or Edinburghshire, is situated within two miles of the south shore of the Firth of Forth, at the distance of about 392 miles north from London, in N. Lat. 55. 57. 20.; and W. Long. 3. 10. 30. The situation of this ancient city is pre-eminently romantic. It occupies a congeries of hills and elevated grounds, rising gradually from the shore of the Forth, and attaining in some parts to a considerable height above the level of the sea. The central elevation, which has been aptly compared to a wedge lying flat upon the ground, is terminated at its highest or western extremity by a mass of rock, seven acres in superficies at top, and about 250 feet above the surrounding country; on which stands Edinburgh Castle, the nucleus of the city. From the castle, along the slope towards the east, and for a mile in length, the Old Town was built, with a spacious street in the centre, and narrow alleys or closes diverging down the north and the south sides of the ridge. In later times the city, by means of bridges, was extended to the grounds on the south and north.

Origin and name.

The etymology of the name Edinburgh has been supposed to be found in the history of its origin. It is said that subsequently to the year 449, or the era of Anglo-Saxon dominion in Lothian, the castle became the occasional residence of the chiefs of the Northumbrian dynasty; and from Edwin, the potent king of the territory, the appellation *Edwin's burgh* was introduced and afterwards retained. At a period coeval with or preceding the era of Edwin, the name applied to the fort was *Mai-din* in British, or *Magh-dun* in Gaelic, which may either signify the fortified mount in the plain, or the good fort; but when the English language came into use, the *Maiden* Castle gave occasion to fanciful etymologists to connect the title it obtains in old writings—that of *Castrum Puellarum*, the Castle of Maidens—with the fable that it had been the residence of the daughters of the British kings. The origin of Edinburgh can now with tolerable accuracy be traced to the beginning of the seventh century, or the era of Edwin, from which period it gradually though slowly increased in size. In the year 856 it is described as a considerable village; and, with the castle, it was often the object of contest in the wars which took place between its Anglo-Saxon possessors and the natives of Scotland. From the period of the cession of Lothian to the Scots in 1020, the castle continued to be the frequent residence of their monarchs; and here the widowed consort of Malcolm Ceanmore, the pious and worthy Margaret, died in the year 1093. In the reign of David I. the castle continued a royal residence, and the town increased so much as to be considered one of the four chief burghs in the kingdom. Soon after his accession, the munificent David founded the Abbey of Holyrood on the plain at the eastern extremity of the rising ground on which Edinburgh was built. On the canons of this abbey he conferred the privilege of building a suburb westward from their church, along the ridge, in order to meet the burgh; and the new town thus reared by the monks received the name of *Vicus Canonicorum*, or popularly *Canongate*, which title the eastern part of the old city still retains. For a considerable period after the reign of David, the houses of Edinburgh were all thatched with straw; but the town nevertheless rose into importance, and in the twelfth century it was constituted a royal burgh by William I., surnamed the Lion.

The death of Alexander, king of Scotland, proved disastrous to Edinburgh. In June 1291 the town and castle were surrendered to Edward I.; but in 1313 they were recovered by assault, under the conduct of Randolph earl of Moray, and the castle was destroyed. The English again took and repaired the castle under Edward III., who resided there and placed a strong garrison in it. In 1337 the castle, still in the custody of the English, was besieged by Sir Andrew Moray, the guardian of Scotland, though without success; and it was only by an ingenious stratagem, employed by Sir William Douglas, in 1361, that the fortress was secured by the Scottish patriots.

From the era of the murder of James I. at Perth, in 1436–37, the origin of Edinburgh as a national capital may be dated. Neither Perth nor Scone, Stirling nor Dunfermline, being able to secure royalty against the designs of the nobility, Edinburgh and its castle were selected as the only places of safety for the royal household and the functionaries of government. The infant sovereign was crowned in the chapel of Holyrood, in which sat the first parliament of his reign. James II. was particularly attached to Edinburgh, and bestowed on it a variety of grants as to the holding of fairs and markets, the levying of customs, and also rights to property. Besides, in 1450, he sanctioned the erection of walls and bulwarks for its defence. Edinburgh was the seat of the court and regular parliament throughout the turbulent reign of James III., who conferred additional immunities upon the city, and granted to the magistrates, town-council, and community, the office of heritable sheriff of the burgh. On account of the loyalty of tne people in assisting him against Edward IV. he moreover granted the inhabitants a banner, with power to display the same in defence of their king, their country, and their own rights. This flag, which is still esteemed a sort of palladium of the city, is called from its colour the *Blue Blanket*, and remains in the custody of the Convener of the Trades. In 1497, Edinburgh was visited by a loathsome distemper imported from abroad, and the king by a proclamation ordered the magistracy to put out of the town all infected persons, who, in order to free the city, were transported by boats to the island of Inchkeith in the Firth of Forth, which thus served as a lazar-house for the time. James III., in his latter years, made Edinburgh castle the repository of his treasure, valuable effects, and ordnance. In

1488, when this prince was murdered near Stirling, the whole fell into the hands of his rebellious subjects.

The first parliament of James IV. was held at Edinburgh; and in 1503, on the marriage of this prince with Margaret, the eldest daughter of Henry VII. of England, the capital was the scene of a gorgeous pageant, which is fully recorded by the historians of the time. In 1508 the king empowered the town to feu the grounds of the Boroughmuir on the south; but the citizens were no sooner in possession of this grant, than they set about clearing the ground of its wood, and so many trees were cut down that they could not be disposed of; wherefore the magistrates enacted, that whosoever should buy as many trees as would form a new front to a house, might extend the same seven feet farther into the street. The consequence of this was, that Edinburgh was in a short time filled with houses of wood, and the principal street was reduced fourteen feet in breadth. The year 1513 was the epoch of a dreadful plague; and also of that great national calamity, the defeat at Flodden. With James perished the magistrates and many of the burgesses; the privy-council removed to Stirling for safety; the Cowgate and Grassmarket, at that time southern suburbs of the town, were inclosed with a wall; and at the same time the corporation of the burgh raised the civic military corps called the town-guard, which was not finally disbanded till the year 1817.

Throughout the minority of James V. the capital was the constant scene of tumults. One especially, between the Hamiltons or Arran's party and the Douglases or party of Angus, is known in history by the name of *Clear the Causeway.* May 1532 is the era of the greatest event in the annals of the Scottish metropolis. This was the establishment of the College of Justice, or series of supreme courts and their functionaries. The city now became a place of resort from all parts of the kingdom, and the magistrates for the first time had the High Street repaired and paved, and gave orders to the citizens to light it. In 1538 the town was the scene of rejoicings, on the entrance of James with his wife Mary of Guise.

In 1544, on the refusal of the regency to ally the young Queen Mary to the son of Henry VIII., an English fleet and army were sent to ravage Scotland; and in prosecution of this object the earl of Hertford landed with a force near Leith, and set fire to the city in several places. In 1548 Edinburgh was garrisoned by French troops under D'Essé, who prevented the English from committing any further serious damage.

Disturbances consequent on the change of religion in Scotland broke out in 1556, at which time a concourse of people assembled to protect John Knox from the violence of the ecclesiastical judicatory. During the struggle which ensued in effecting the Reformation, Edinburgh formed the chief position of the Reformers, as Leith was that of the French and Catholic party. By the assistance of a Protestant army sent by Queen Elizabeth the Reformers were finally triumphant, and the first assembly of the Reformed kirk met at Edinburgh on the 15th of January 1560.

A new object of excitement soon appeared in the person of Mary, the young queen of Scots, who on the 9th of August 1561 arrived at Leith from France. On the 1st of September she made her public entry into the city. Darnley was proclaimed king at the market-cross in July 1565, and next morning was married to the queen in the chapel of Holyrood. In June following the queen was delivered of a son, afterwards James VI.; and in February 1567 Darnley was blown up by gunpowder in a house at the Kirk of the Field, on the site of which the university now stands. Mary's marriage with Bothwell occasioned fresh disturbances in Edinburgh; and during the period of the irregular warfare which ensued between the king's and queen's parties the city suffered very severely. At length the young king himself entered upon public life, and on the 17th of October 1579 arrived in the metropolis with a cavalcade of 2000 horse, and held his first parliament in person. In the year following the Earl of Morton was beheaded in Edinburgh, by an instrument called the *Maiden,* which it has been said he had himself introduced, and which is now preserved in the Museum of the Society of Antiquaries. The character of the city was about this period greatly improved by the erection of the college, which was commenced in 1581, and to which the first professor was appointed in 1583. The infant institution was warmly patronized by King James, who, on the occasion of a temporary visit which he made to Scotland in 1617, desired that it should thenceforth be called King James' College. In 1585-86 the city was visited by the plague, and suffered severely from that disease. In 1591 the inhabitants were alarmed by an attempt of Francis Stewart Earl of Bothwell to seize upon the person of the king in Holyrood Palace. The attempt, however, was defeated by the promptitude and vigour of the citizens. Bothwell himself escaped, but eight of his followers were taken and put to death on the following day. In 1596 the clergy and citizens united in tumultuary resistance to an attempt made by the king to control the language of the pulpit. Unable to subdue or restrain the insurrectionary spirit which he had excited, James withdrew from the town, and ordered all the public courts to be removed from it. A reconciliation, however, soon afterwards took place, and the offended monarch returned peaceably to his capital. In 1599 the first regular dramatic actors appeared in Edinburgh. They came from England, and there is some reason to suppose that the immortal Shakspeare was amongst the number.

Three years later the regal dignity of Scotland became extinct, or rather merged in that of England. On the 24th of March 1603 James was called to the throne of the sister kingdom. Two days before his departure he addressed the citizens in St Giles' Church; promising them a continuation of his countenance, and expressing the regret which he felt at leaving them. Among the marks of royal favour with which James visited Scotland after his accession to the throne of England, was his empowering the magistrates of Edinburgh, in 1609, to have a sword of state carried before them, and to wear gowns. This, it is believed, was the earliest appearance of magisterial robes in Scotland. In 1617 James paid a long-promised visit to his native country. He entered Edinburgh by the West Port, and was conducted through the city with great pomp, and every demonstration of rejoicing. On the 28th of June he convened his twenty-second parliament at Edinburgh. In this assembly there were several remarkable acts passed, including one for the restitution of archbishops, bishops, and chapters. Four years after this, namely, in 1621, an act of the estates and town-council was passed for coping houses with lead, slates, or tiles, instead of thatch, which had hitherto been the covering commonly employed. In the same year water was introduced by pipes into the city; and three new bells were imported from Campvere in Zealand, two for St Giles' Church, and one for the Netherbow Port. The casting of bells for churches, however, is much more ancient in Scotland. On one of four fine bells in the ancient cathedral of Kirkwall in Orkney there is an inscription—"Robert Borthwik made me in the castel of Edinbrugh in the year of grace MDXXV."

Edinburgh seems to have enjoyed uninterrupted tranquillity during the remaining period of King James's reign. When he died, in 1625, the ministers of the city eulogized him as the "most religious and peaceable prince that ever was in this unworthy world." After the accession of Charles to the throne, which was proclaimed at the cross by the officers of state, a convention was held; and the town-council, in consequence of certain ships of war being wanted, and forts for securing the coasts, not only agreed to advance

the assessment when called upon, but also to contribute towards the maintenance of 10,000 men. Some time afterwards, a subsidy for four years having, at the king's desire, been granted by parliament, the inhabitants of Edinburgh generously advanced at once their quota, amounting to L.40,000 Scots. For these acts of kindness His Majesty expressed his gratitude by sending a sword and gown to be worn by the provost in the manner appointed by his father. Like his father, too, Charles resolved to visit his native country, and though prevented for some years from fulfilling his design, he at last accomplished it in 1633. He was received by the inhabitants with much pomp, and the celebrated Drummond of Hawthornden was appointed to address him on his arrival, which he did with all the characteristic poetical embellishment peculiar to the times. On the 18th of June, Charles was crowned in the Abbey Church of Holyrood, and on the 20th he assembled his first Scottish parliament in the Parliament House. During his residence in the city on this occasion, Charles erected the bishopric of Edinburgh, a measure which was by no means popular, and gave rise throughout the country to a series of civil disturbances, the principal focus of which seems to have been Edinburgh. During the civil war in 1640, the magistrates fortified the town against the castle, and disciplined the citizens. The governor, on perceiving these demonstrations of hostility, fired upon the city; but being soon afterwards besieged by General Leslie, he was compelled to surrender from want of provisions.

Charles visited the city a second time in 1641, and was received and entertained by the magistrates with the utmost deference and respect. A parliament met on the 15th of July, the result of whose proceedings was an entire change in the government, Charles retaining only the name of king, and the kingdom only the appearance of a monarchy. He agreed to an act of oblivion, by which his opponents were pardoned at the expense of his friends; and after a residence of four months in the northern metropolis, he returned to London, having intrusted his Scottish affairs to a committee of the estates. Two years after this, in the month of July, the Solemn League and Covenant for the extirpation of prelacy was signed in the High Church; and shortly afterwards the city raised and supported a regiment of 1200 men, to assist the English parliamentary forces against Charles, at a cost of L.60,000 Scottish money. For this and several other acts of hostility to the king, the town was in 1645 threatened with a visit from the Marquis of Montrose; but it was saved from this disaster by the breaking out of the plague, which committed great ravages amongst its population. This was, however, the last visit which this dreadful scourge paid to the metropolis. Shortly after this the city borrowed L.40,000 Scots to raise troops for the national engagement in favour of Charles; which debt they afterwards refused to pay, on the plea that it was contracted in an unlawful cause. The impartial justice of Cromwell, however, subsequently compelled them in 1652 to repay the money. In May 1650 the Marquis of Montrose was conveyed a prisoner into Edinburgh. Three days afterwards he was brought to trial, condemned to death, and suffered on a gallows erected at the cross. Two months subsequently Charles II. was proclaimed on the same spot; and in the end of September following, the town was in the possession of Cromwell. On this occasion the magistrates fled to Stirling, then the headquarters of the king's forces. The town was thus left without any other civic rulers than that of a body of 30 citizens, chosen by the inhabitants to discharge in part the functions of the magistracy, who absented themselves from the 2d of September to the 5th of December 1651. About this period the town-council granted liberty to one Adam Woodcock to establish a stage-coach between Edinburgh and Leith; which is amongst the first notices of a public conveyance of the kind in Scotland.

On the 11th of May 1660, the magistrates sent the town-clerk to Charles, who was at Breda, expressing their concurrence in his meditated restoration, already agreed to by both houses of parliament in England, and their joy at the prospect of such an event. Their messenger "had a most gracious reception;" and, in the name of the burgh, presented "a poor myte of L.1000, which he did graciously accept, as though it had been a greater business." The feelings of delight which the arrival of the king in England excited in Edinburgh, were expressed in the customary mode of costly feasting, a sumptuous banquet having been served up by the town-council at the cross. This attachment on the part of the citizens was ill requited by Charles, who, in settling the affairs of the kingdom, re-established episcopacy in Scotland, in opposition to the oath and obligation of honour by which he was bound. It is not surprising, therefore, that the Scottish people, so attached to Presbyterianism, should have expressed their indignation at his conduct in the most open manner. But when the liberty of the press, and freedom in matters of religion, were in consequence also speedily infringed upon, the whole country rose in arms, particularly the western counties. The attempt, however, which was made upon the life of Archbishop Sharp in the streets of Edinburgh, led to those milder measures which were soon afterwards adopted by government. In 1679, James, then Duke of York, came to reside in Edinburgh, and took up his abode in the palace of Holyrood, where he remained till May 1682. During this period he rendered himself extremely odious by his opposition to the Covenanters, and by his attempting the revival of the drama, and encouraging other amusements to which the people were exceedingly averse.

Two years after this, the magistrates set up for the first time a regular state carriage; and were so much pleased with the accommodation and conveniency of this novelty, that they ordered two coaches from London for their own especial use, with the addition of four horses. On the demise of Charles II. in 1685, the town-council erected an equestrian statue to him in the Parliament Square, as a proof of their gratitude to and affection for that monarch. Soon after James's accession, the unfortunate Earl of Argyll was brought a prisoner to Edinburgh; and after being ignominiously paraded through the streets, his head was struck off by the Maiden, this being the last time, it is believed, that the instrument was employed. After a series of disturbances and tumultuary proceedings, occasioned by the attempts of James VII. to restore the Roman Catholic religion, a convention of estates was held at Edinburgh, in which it was declared that James had forfeited the crown; and in March 1689 it was offered to William and Mary.

In 1696 Edinburgh was deeply interested in the celebrated Darien expedition, and was full of the high anticipations which this speculation had diffused throughout Scotland. About L.400,000 sterling were subscribed in the country. Six ships of considerable force and burthen, and laden with various commodities, sailed from the Firth of Forth; and in 1699, when intelligence arrived of the settlement being formed, the rejoicings in Edinburgh were unbounded. On the other hand, the disappointment excited on learning in the following year of its failure, filled the streets for several days with tumult and riot; and the city altogether presented such a scene of lawless anarchy, that the commissioner and officers of state deemed it necessary, for their personal safety, to retire until the popular fury had somewhat abated.

In 1704, on the occasion of a Captain Green and two of the crew of the Worcester, connected with the East India trade, being convicted, on circumstantial and insufficient evidence, of piracy and murder on the high seas, a commotion was excited by an apprehension on the part of the populace that they were to be permitted to escape the consummation

Edinburgh. of their sentence through the connivance of the authorities. The lord chancellor, in passing from the privy-council in his coach, was attacked at the Tron Church, the glasses were broken, and he himself was dragged from the carriage. He was rescued by some of his friends; but it was found necessary to sacrifice the seamen to the resentment of the populace. The year 1703 had been distinguished by its presenting the last exhibition of the ancient Scottish national pageant called the Riding of the Parliament, which took place on the 6th of May: in 1704 the inhabitants of Edinburgh were gratified by another ceremony quite in accordance with the spirit of the age, when, under the authority of an act of the privy-council, a large quantity of vestments, beads, chalices, crucifixes, and other appurtenances of Catholic worship, were brought to the cross, and there publicly burnt before the eyes of a delighted populace.

The tumults to which the city had been so frequently subject were revived in 1706, on the occasion of the proposed union of the kingdoms. This, as is well known, was at first vehemently opposed by the Jacobites and ultra Covenanters in Scotland, and gave rise to a series of the most violent and outrageous proceedings on the part of the mob, in order to intimidate those members of the Scottish parliament who were favourable to the measure. The deed, however, was finally accomplished, though not without great danger to the lives of its most active promoters. On the 6th of March 1707, the act received the royal assent in the House of Lords.

In the civil war of 1715 an unsuccessful attempt was made by the Jacobites to surprise the Castle. About this period the provost received a regular salary of L.300 per annum in order to defray his expenses; and in 1718 the scheme which had for some time been framed of extending the pier and building docks at Leith was in part executed; the town's debts, which even then amounted to L.25,000, being thereby, in the space of five years, nearly doubled.

The celebrated tumult designated the Porteous Mob took place in September 1736. The accounts of this remarkable affair are so numerous, so easily accessible, and withal in general so full, that it is deemed unnecessary to give more than a mere outline in this place. Porteous, whose name distinguishes the transaction, was captain of the city guard. At the execution of a criminal of the name of Wilson, whose fate had excited an extraordinary sympathy, Porteous, dreading a rescue by the mob, who suddenly became tumultuary, ordered the guard to fire on them. Six people were killed by the discharge, and eleven wounded. For this Porteous was tried and condemned to death; but he was afterwards reprieved by Queen Caroline, then regent. Resolved however that he should not thus escape the fate which they conceived he merited, the mob, on the evening of the day previous to that on which he was to have been executed, broke into the jail in which he was confined, and having dragged him out, led him to the Grassmarket, the usual place of execution at that period, and there hanged him by torch light on a dyer's pole.

On the 17th September 1745, a party of the Highlanders having made themselves masters of the Netherbow Port, Edinburgh was taken possession of by the rebels under Prince Charles Edward. The main body of the rebel army arrived shortly afterwards at the King's Park, headed by the Chevalier in person, who took up his residence in Holyrood, where he held open court, and was visited by great numbers of the inhabitants. The city remained on this occasion in the hands of the rebels till the 31st of October, when, finding it impossible to reduce the castle, they proceeded on their march towards England.

The public transactions of an historical nature which occurred in the metropolis after these events, are not, except in a few instances, such as to require a particular description. On the 2d of February 1779, an infuriated mob, under the influence of religious fanaticism, burnt one Roman Catholic chapel and plundered another. Twelve years later, on the outbreaking of the revolution in France, a considerable body of the inhabitants manifested their admiration of the new political principles which were then brought so prominently forward, by forming themselves into associations for supporting the cause of political regeneration. These societies, the members of which received the appellation of Friends of the People, at length drew down upon themselves the notice and vengeance of government. Several persons accused of having been concerned in spreading sedition, and engaged in treasonable practices, were arrested and brought to trial. One of them, named Watt, was condemned and beheaded, whilst others were transported. Subsequently, during the war with France, the citizens showed great zeal in support of the government, by forming themselves into regiments of volunteers, consisting of yeomanry, artillery, and several corps of infantry. On the last night of the year 1811, being the season devoted to innocent festivity, the streets of Edinburgh were disgraced by a series of riots, outrages, and robberies, hitherto unparalleled. During almost the whole night, after eleven o'clock, a gang, principally composed of young men, armed with bludgeons and other weapons, infested some of the principal streets of the metropolis, and knocked down, robbed, and otherwise wantonly maltreated almost every person who had the misfortune to fall in their way. In the dreadful tumult and scuffles which ensued, one officer of police was killed and many persons dangerously wounded, some of whom died in consequence, whilst a great number received severe contusions. Several rioters were seized, and being brought to trial, three were condemned and hanged, whilst some others were transported. This fearful outbreaking of juvenile delinquency led to the adoption of several beneficial plans for the better instruction of the lower classes, the benefits of which still continue to be felt.

George IV. visited Scotland in 1822, and spent upwards of a fortnight in the metropolis, inspecting its public institutions, and receiving the congratulations of his Scottish subjects.

In 1824 the city suffered from a series of conflagrations of a most destructive and appalling description. The first of these commenced on the 24th of June, when some of the private dwellings in the Parliament Square, with a part of the High Street, and several closes, were consumed. The second and the most extensive began on the evening of the 15th November, and continued for three days, destroying an immense number of houses, chiefly between the High Street and Cowgate, also several fronting the High Street at the Cross, another portion of the Parliament Square, and likewise the spire of the Tron Church, which had accidentally caught fire from the flying brands.

In no part of the United Kingdom was the passing of the Reform bill hailed with more heartfelt demonstrations of joy than in Edinburgh. The first election of members of parliament by the citizens took place at the cross on the 21st of December 1832.

The only important event of interest in the subsequent history of Edinburgh is the "Disruption" of the Church of Scotland, which formally took place at the General Assembly convened in St Andrew's Church, George Street, May 18, 1843.

The city: its position. Edinburgh is surrounded on all sides excepting on the north, where the ground slopes gently towards the Firth of Forth, by lofty hills. On the east, in the immediate vicinity of the city, are the abrupt and rocky elevations of Arthur's Seat, Salisbury Crags, and the Calton Hill, the first of which rises to the height of 822 feet above the level of the sea. On the south are the Braid and Pentland Hills, and on the west is the hill of Corstorphine. Salisbury Crags form a con-

Edinburgh. tinued range of naked and perpendicular cliffs, which rise like a mural crown from the summit of the hill, and at a distance have a singularly wild and romantic appearance, the interest of which is heightened by the contrast of the splendid city over which they tower majestically. The town stands on high and uneven ground, being built on three eminences, which run parallel to one another from east to west. The most elevated of these, on which the city was originally built, is terminated abruptly on the west by a precipitous rock surmounted by the castle, whilst to the east it gradually inclines to the plain from which rises the lofty elevation of Arthur's Seat. The valley to the north of this ridge, which was formerly filled with water, has been of late years drained, and is now laid out in public gardens.

Rise and progress of the city.

Till the middle of the eighteenth century, Edinburgh continued to occupy little more than the same space of ground which it had covered in the reigns of James III. and James IV., namely, the ridge between the Castle on the west and Holyrood House on the east, with the hollow called the Cowgate on the south, and part of the rising ground beyond. This was surrounded by a wall with several gates, or ports as they were called, a considerable part of which is still to be seen in the Vennel, leading from Lauriston Place into the Grassmarket. In a great proportion of this Old Town the buildings are crowded and irregular, and the houses in some parts rise to the unusual height of eleven stories. The principal, or High Street, which is somewhat more than a mile in length, and is in some parts ninety feet in breadth, occupies the centre of the ridge, and extends, under different designations, nearly in a straight line from the Castle on the western extremity to the Palace of Holyrood on the eastern. Both sides of the ridge occupied by this street are covered with buildings crowded together in the closest array, and descending from the High Street, chiefly in narrow lanes, or closes as they are termed, which are seldom broader than six feet, and which, consisting of high houses on either side, are inhabited by numerous families, with little regard either to health or cleanliness. A proposal in the reign of Charles II. to extend the town over the lands to the north, beyond the hollow called the North Loch, having been frustrated, nothing was done till 1751, when an old building having fallen, by which one person was killed, a strong feeling regarding the inconvenience and decayed condition of the houses began to be expressed. The first decided step towards extending the city was taken by Provost Drummond, on the 21st of October 1763, when he laid the foundation-stone of what is now styled the North Bridge, in order to connect the town with the properties on the north. This edifice consists of three great arches, each 72 feet in width and 68 in height, with small side arches, making the total length 310 feet. In 1767, whilst this work was proceeding, an act for extending the *royalty* was obtained; and a plan for the New Town being then formed by Mr Craig, architect, the foundation of the first house was laid on the 20th of October the same year. By this plan the chief streets of the New Town of Edinburgh were disposed in three parallel lines from east to west, intersected by cross streets at right angles from north to south. Princes Street, on the south side, is formed like a terrace, facing the Old Town; a similar street, facing the north, is called Queen Street; while George Street is in the centre. Charlotte Square, at the west end of George Street, corresponds with another at its eastern extremity, designated St Andrew Square. Coeval with the erection of these, a spacious street was opened from the extremity of the North Bridge and Princes Street, towards Leith Walk, or main road to Leith, opening an excellent communication with that seaport. The whole of the new edifices, according to Mr Craig's plan, were completed about the year 1815, but the greater part much earlier.

Such was the success attending the building of the New Town, that in time a second extension of the same nature was projected, still farther towards the north, beyond an open area in front of Queen Street. The design of this second town intimately resembled that of its predecessor, consisting of a terrace in front and rear, a large central street, with two intermediate narrow ones, and cross streets in continuation of those in the former New Town. This vast and splendid addition to Edinburgh was commenced in 1801, and was nearly finished in the year 1826.

Edinburgh.

About the time when the second New Town approached its completion, a series of superb edifices began to be erected on its north-western confines, between Charlotte Square and the Water of Leith, on the Earl of Moray's property of Drumsheugh. This magnificent part of Edinburgh was erected during the years 1823, 1824, and 1825. This quarter of the town was greatly improved by the erection, in 1832, of the Dean Bridge, consisting of four arches, stretching across the deep dell or ravine at the bottom of which flows the Water of Leith.

The extension of the New Town to the north and west absorbed public attention till about the year 1813, when the idea was started of opening an entrance from the east. The foundation-stone of the Regent Bridge, to form a connection with the Calton Hill, was laid in September 1815, and the work was completed in 1819. The arch of this structure is 50 feet wide, by about the same in height. On the top of the ledges of the bridge are arches and ornamental pillars of the Corinthian order, which on both sides are connected with the houses in the line of street formed at the same time. The street, or Waterloo Place as it has been designated, is composed of very superb houses of four stories, and each is terminated at Princes Street by a pediment and columns above the lower story. From Waterloo Place, the new road by which most of the vehicles and passengers from the east enter the city, proceeds by a sweep round the southern face of the Calton Hill. The entrance by this thoroughfare is not less commanding and beautiful than that by the west; and the houses in segments of circles, forming the Royal and Regent Terraces, erected on the slope of the hill, have a very striking effect.

Some years prior to the foundation of the New Town, certain private proprietors began to build lines of houses, of a good style of architecture, on the grounds to the south of the Old Town; and in this way George Square, Argyle Square, and Brown Square were opened for the reception of the higher class of citizens. The erection of these and other edifices soon suggested the necessity of a proper communication between them and the High Street, on the plan of the North Bridge; and on the 1st of August 1785, the foundation-stone of a bridge crossing the Cowgate, styled the South Bridge, was laid, and the thoroughfare opened for passengers in March 1788. The South Bridge consists of twenty-two arches, all of which are concealed by the buildings along its sides, with the exception of one at the centre spanning the Cowgate. The formation of the Union Canal, to serve as a water communication with Glasgow, by joining the Forth and Clyde Canal, took place in virtue of an act of parliament procured in 1817 by a joint-stock company. Its eastern termination is about half a mile S.W. from the Castle, near the present terminus of the Caledonian railway. This locality was greatly improved by the formation of the New West approach and Castle Terrace. The greatest recent improvement in Edinburgh has been the construction of the four railways that leave it on each side; the Edinburgh and Glasgow on the west, the North British on the east, the Caledonian on the south, and the Edinburgh, Perth, and Dundee on the north. With the exception of the Caledonian, the stations are concentrated at Waverley Bridge, a most convenient locality, situated in the hollow between Princes Street and the Old Town.

At the present day the city extends about two miles in

Edinburgh.

length and the same in breadth; but with Leith, and the suburbs of Newington, Morningside, Inverleith Row, and Trinity, about $2\frac{3}{4}$ miles by $3\frac{1}{2}$ miles.

Public buildings and institutions.

The Castle, as has already been stated, owes its origin as a regular place of defence to the Anglo-Saxon dynasty, near the end of the fifth century; but its fortifications appear to be of comparatively modern date. The rock, surmounted by battlements, lofty barracks, and other buildings, rises to a height of 300 feet, and is precipitous on all sides except the east, on which it is connected with the town by an open glacis or esplanade. In a small apartment on the ground floor of the palace erected by Queen Mary, that princess was delivered of her son, James VI., on the 19th of June 1566. In the same part of the edifice is situated the crown room, where the regalia of Scotland were lodged in 1707, and found in 1818, after being lost sight of for upwards of one hundred years. These regalia consist of a crown, sceptre, sword of state, and lord treasurer's rod: the former is supposed to be even more ancient than the time of Robert Bruce, though it has undergone several changes since that period; the sword was a present from Pope Julius II. to James IV. The arsenal or storehouse of the Castle is capable of containing 30,000 stand of arms, and the whole buildings about 2000 men. In March 1829 an addition was made to the curiosities of the castle by the restoration of an ancient piece of ordnance called Mons Meg, which had been removed from the fortress and carried into England in 1754. This immense cannon, for it is of an unusual size, was fabricated in the year 1498, and is curious from its structure, being formed of bars bound together with rings. It was employed at the siege of Norham Castle, but was rent in 1682, when firing a salute in honour of James Duke of York.

Holyrood.—The charter of foundation of the Abbey of Holyrood has no date—the Abbey however was founded about the year 1128. It was largely endowed by the founder David I., and was considered as one of the wealthiest ecclesiastical establishments in Scotland. In 1544 it was sacked, and in part destroyed, by the Earl of Hertford when he invaded Scotland; and again in 1547. The nave used as a chapel was desecrated and dismantled by the mob in 1688; and in 1768 the roof fell in, and it was left in the ruined condition in which it now stands. Within this chapel were interred, amongst others, David II., James II., James V., his queen Magdalen, and Darnley. The royal palace is contiguous. It is not known at what time a palace was first erected on this spot. The more ancient parts of that which is now in existence were built by James V.; but it has since undergone many changes, and little if any of the original building remains. It was burnt by the soldiers of Cromwell, and was rebuilt after the Restoration by Charles II. The architect on this occasion was Sir William Bruce, and the builder who carried his designs into execution was Robert Mylne. The edifice is of a quadrangular figure, with an open court in the centre, surrounded with piazzas. Amongst the curiosities exhibited in the Palace of Holyrood is the chamber of Queen Mary, in which may still be seen, though in a decayed state, the bed of that unfortunate princess. In a hall or gallery 150 feet in length, $27\frac{1}{2}$ in breadth, and 18 in height, containing 106 mythical portraits of Scottish monarchs, the election of representative peers for Scotland takes place. The most remarkable circumstance connected with Holyrood House is its privilege of affording a sanctuary to debtors. The limit of this privileged territory is marked in the direction of the town by a channel or gutter at the foot of the Canongate, and at the distance of about 100 yards from the palace. Altogether the sanctuary describes a circle of about five miles, including Salisbury Crags and Arthur's Seat. The immunities of the sanctuary have existed since the date of the monastery. Considerable improvements were made on the exterior walls of the palace during 1832, and some years previously. The locality has also been greatly improved recently by the removal of many of the surrounding old houses, which, with the numerous additional repairs and alterations in the palace that have been made lately, render it an agreeable residence for her present Majesty Queen Victoria.

Edinburgh.

Courts of Law.—Edinburgh is now chiefly distinguished as a capital by being the seat of the Scottish supreme courts or College of Justice, which, as has already been mentioned, was constituted in 1532 by James V. This body consists of persons intimately connected with the various supreme courts, and comprehends the judges or senators, the faculty of advocates, writers to the signet, solicitors in the supreme courts, advocates' first clerks, clerks to the judges, extractors, keepers of the different departments, &c. This influential body at one time possessed some valuable privileges, the chief of which now remaining is exemption from certain local taxes.

The Parliament House.—The edifice, which has been appropriated since the Union as the place of meeting of the supreme courts, is the old Parliament House of Scotland, situated in the centre of the Old Town, and separated from the High Street by the cathedral of St Giles. This structure was erected between the years 1632 and 1640, at an expense of L.11,600 sterling to the civic corporation. In recent times, however, with the exception of the great hall, it has been almost totally renewed. It stands on the southern and western sides of the inclosure called the Parliament Square, a place formerly surrounded with the shops of tradesmen, but entirely remodelled since the destructive fires of 1824. These improvements, which extend over the front of the old parliament house, or present court-house, have been executed chiefly by government at a great expense. The entrance to the courts is at the south-west angle of the square: the great hall is 122 feet by 49, and has a lofty roof of carved oak, arched and trussed in an admirable style of carpentry. This hall is the waiting-room of the advocates and other practitioners in the Supreme Courts; and the floor during session is the daily resort of all persons connected with them. The Lords Ordinary sit in small court-rooms at the south end of the hall. On a pedestal near the south end of the hall is a statue in white marble by Chantrey of Henry Viscount Melville, who died in 1811; and in recesses in the walls other statues have been placed, including those of Duncan Forbes of Culloden, erected in 1752, five years after his death, of Robert Dundas of Arniston, who died in 1819, and of Robert Blair of Avontoun, who died in 1811; the last also by Chantrey. More recently additional niches have been prepared for the reception of the statues of Lord Jeffrey and President Boyle.

Adjoining the Parliament House are certain spacious apartments fitted up as libraries for the Faculty of Advocates, the Writers to the Signet, and the Solicitors of the Supreme Courts. The Advocates' Library was founded in 1682, at the instance of Sir George Mackenzie, then Dean of Faculty. The collection is now the largest and most valuable in Scotland, and is in every sense one of the noblest national libraries. It is one of the five libraries entitled by act of parliament to a copy of every work printed in Britain; and, with the sums annually disbursed in the purchase of useful and rare books, it is rapidly increasing. The library is under the charge of six curators, a librarian, and assistants.

The Library of the Society of Writers to the Signet occupies a modern erection of two stories, in the Roman style of architecture, extending westward from the north-west corner of the Parliament House, and having a front to the Lawnmarket. This edifice contains two large and beautiful apartments, decorated in front of the book-presses with rows of columns. These noble apartments have cost the society L.25,000. The library, like that of the Advocates, is under the charge of curators, a librarian, and assistants.

Register House.—The Scottish Supreme Courts possess accommodations for their records, and the functionaries connected therewith, in a building styled the General Register House of Scotland, one of the most remarkable national edifices in the metropolis. It stands at the eastern extremity of Princes Street, fronting the thoroughfare of the North Bridge. The foundation was laid on the 17th of June 1776, and L.1200 were given by George III. out of the money arising from the sale of the forfeited estates, to assist in its erection. It was fully completed in 1822, at a very great expense, which has been defrayed by an accumulation of fees paid by persons searching the records, and for writs in the chancery office. The building, which was planned by Mr Robert Adam, forms a square, with a quadrangular court in the centre, containing a circular edifice or dome fifty feet in diameter, which joins the sides of the court, leaving spaces at the angles for the admission of light. Viewed from the street, it presents a compact building of 200 feet in length, by a breadth of 120. Each of the corners is surmounted by a small turret, and the central tower is crowned with a dome. The interior consists principally of small fireproof chambers, in which are deposited state papers, copies or records of all the title-deeds of property, and of all legal contracts, mortgages, &c.; also records of all suits at law from an early period. In front of it is an equestrian statue of the Duke of Wellington in bronze by Steele.

Royal Institution.—In looking along the noble line of Princes Street, the eye is arrested by two structures upon the Earthen Mound—the Royal Institution and the National Gallery—both of which were designed and executed by Mr W. H. Playfair. The Royal Institution was originally founded in 1823, but was enlarged, by an extension towards the south, in the year 1832, which was completed in 1836. It is of the Grecian Doric order, of the era of Pericles, and is designed upon the theme of a peristylar temple. The great projection of the north portico surrounded and filled with columns, and the long ranges of pillars upon each flank, preserve the columnar richness of the original; while the necessary departure from the simple parallelogram, caused by the necessities of the plan, is compensated by the introduction of small side porticos of classic design. A statue of the Queen in stone by Mr John Steele, R.S.A., is placed on an attic immediately behind the northern portico. The building, which fronts the opening of Hanover Street, is the property of the Board of Trustees for Manufactures in Scotland; and besides furnishing official apartments for the Board and galleries for the School of Design under their charge, is appropriated by them for the accommodation of the following institutions:—The Board of British White-Herring Fishery; The Incorporation of the Royal Institution for the Encouragement of the Fine Arts in Scotland; and the Royal Society; to which will be added the Society of Antiquaries as soon as the adjoining building of the National Gallery is completed.

The interior accommodations consist below of a large central gallery for exhibitions, the ends of which are formed into octagons of some size. On both sides of this gallery is a range of smaller apartments, those on the east side being reserved as offices for the Board of Trustees and for the Board of Fishery, and those on the west being tenanted by the Royal Society. Above is another spacious gallery in which is a noble collection of casts from the best ancient works of sculpture, with some of modern date. This gallery, along with the adjoining apartments, is occupied by the School of Design. In one of the apartments is contained the admirable set of busts of celebrated Greeks and Romans, known by the name of the Albacini Collection. In the picture gallery is deposited a small but valuable collection of works by ancient and modern masters, among which are some very fine specimens of Vandyck, and in the modern section some masterly paintings by Etty. The collection since its first formation has been enlarged by the addition of the pictures, bronzes, and marbles belonging to the late Sir James Erskine of Torrie, who bequeathed them to the college at Edinburgh, for the purpose of laying a foundation for a gallery for the encouragement of the fine arts; and in the year 1845, with the consent of the Senatus Academicus, an agreement was entered into between the trustees of Sir James Erskine's will and the Board of Trustees for Manufactures, that the collection should be placed in the Royal Institution for public exhibition, where it passes under the name of "The Torrie Collection." The whole of the collections are increased from time to time by gifts or purchases of works of art, or by their temporary deposit in charge of the Board for the purpose of exhibition. The galleries are opened gratuitously to the public; the statue gallery for five days in the week, and the picture gallery for two. On other days the picture gallery is reserved for the use of artists and students.

The Board of Trustees for Manufactures owes its origin to the 15th article of the Treaty of Union between England and Scotland, by which, amongst other provisions by way of equivalent for the increase of the duties of excise and customs then imposed on Scotland, it was agreed that out of certain funds therein mentioned, L.2000 per annum should be applied towards the encouraging and promoting of the fisheries, and such manufactures and improvements in Scotland, as might most conduce to the general good of the United Kingdom; which grant was afterwards made payable out of the customs and excise in Scotland. The Board itself, however, was not constituted until the year 1727, when letters patent were issued by King George II, empowering it to administer this grant upon which accumulations had arisen in previous years so as to form a reserve fund. By the original letters patent the Board was made to consist of 21 trustees: these were afterwards increased to 28 by the act 48 Geo. III., cap. 110. They are chiefly gentlemen of distinction and property, judges of the supreme courts, &c.; and at the present moment three members of the Royal Scottish Academy have seats at the Board. Vacancies are filled up by the crown; five members form a quorum; and meetings are held periodically throughout the year. For many years the Board made specific appropriations of the monies at its disposal, half being usually allotted to the improvement of the fisheries until a separate Fishery Board was established in 1809, the other half to premiums and other measures for the encouragement of the linen and hempen manufactures. Ultimately this system was abandoned, and the funds have now for a long while been almost entirely appropriated to the maintenance of a School of Design, which is justly regarded as the most effective method of permanently improving the arts and manufactures of the country.

This school had its commencement in 1760, when a drawing academy on a small scale was formed, and placed under the direction of M. Delacour, a French artist. He was succeeded in 1768 by M. Pavillon, another French artist. Runciman, an eminent Scottish artist, was appointed in 1772; who, in 1786, was succeeded by David Allan, a Scottish artist of great genius. Under his successor John Graham were brought up Wilkie, Burnet, the late Sir William Allan, and the present President of the Royal Scottish Academy, Sir John Watson Gordon. The sphere of the school has been enlarged of late years, so as to be converted from a drawing academy into a School of Design, embracing, besides the study of the antique, the art of manufacturing design and of architectural and general ornament. In this stage, it has been successively superintended by Andrew Wilson, Sir William Allan, William Dyce, and Thomas Duncan, and is now (1855) directed in architecture and ornament by Alexander Christie, A.R.S.A., and in the antique by Robert Scott Lauder, R.S.A

Edinburgh. In the department of architecture and ornament this school gives instruction in drawing, painting, and modelling, and in architectural and ornamental design of every kind; and in the department of the antique, in drawing, painting, and modelling from the antique; and also from the living model. There are upwards of 180 students attending the school, who are divided into separate male and female classes. Among these, besides the ordinary students, are several schoolmasters and schoolmistresses and pupil teachers; so that the establishment has the character of a normal institution for drawing and painting, as well as that of a school for art. The Board of Scottish White and Herring Fisheries has also apartments in this building. See SCOTLAND, and FISHERIES.

The National Gallery, the foundation stone of which was laid by Prince Albert in August 1850, was finished externally in 1854. It is of the Greek Ionic order, and has a central mass with large hexastyle porticos to the east and west. At each side of this central portion, stretching to the north and south, ranges of antæ are terminated by smaller tetrastyle porticos which form the north and south fronts of the building—two porticos separated by a recessed portico being upon each front. The absence of windows on the flanks increases the classic aspect of the entire building. It was erected at the joint expense of the Board of Trustees for Manufactures and of the Government, under arrangements made with the Lords Commissioners of Her Majesty's Treasury, and confirmed by act of parliament. The Government have made a grant of L.25,000 towards the building, and the Board of Trustees have undertaken to furnish other L.15,000. Its objects are the giving of suitable accommodation for the annual exhibitions of the Royal Scottish Academy, for the extension of the School of Design, and for the institution of a Scottish National Gallery of Painting and Sculpture, and thus to promote the successful progress of the fine arts in Scotland, and afford facilities to the public for viewing exhibitions and collections of modern and ancient art. The site was purchased in part from the city of Edinburgh and in part from the Free Church. By the act 13th and 14th Victoria, cap. 86, the whole of the property and buildings have been vested by parliament in the Board of Trustees, who are appointed to determine and regulate the appropriation thereof, subject to the approbation of the Lords Commissioners of the Treasury.

Royal Institution for the Encouragement of the Fine Arts.—This Institution had its origin in the year 1819 as a private association formed for the encouragement of the fine arts in Scotland, on the model of the British Institution of London. It was not an association of artists, but of noblemen and gentlemen admirers of art, who were desirous by their united pecuniary contributions and personal influence to diffuse a taste for art among their countrymen. The first aim of the institution was to furnish exhibitions of the pictures of ancient masters, drawn from the private collections of members and their friends, and to which, at the same time, professional artists should have private access for the purposes of study. Exhibitions of this nature accordingly took place in the years 1819 and 1820. In 1821 it was suggested that an exhibition of the works of living artists should for that year be substituted, and the exhibitions of modern paintings were continued during the years 1821, 1822, 1824, and 1825. The institution had found great difficulty in procuring commodious rooms for the purposes of exhibition; and when it was subsequently arranged that a building should be erected at the expense of the Board of Trustees for Scottish Manufactures, and that other public societies should become their tenants, the Royal Institution obtained under this arrangement the galleries which were first opened in the year 1826. In March 1827 the institution was incorporated by royal charter from the crown by the name and title of the Royal Institution for the Encouragement of the Fine Arts in Scotland. The charter contains the following provision in regard to the application of the funds:—"The ordinary directors shall be entitled to apply the funds of the institution for the purpose of acquiring such property and buildings as may appear to them necessary and proper for the objects of the institution, and in the purchase of the works of art and books for the institution, and, generally, in such manner as they may consider to be expedient for the encouragement of the arts in Scotland."

The management of the Royal Institution is vested in governors and extraordinary and ordinary directors, a secretary, treasurer, and manager. The directors are likewise trustees for the Spalding Fund for the purpose of providing annuities for decayed and superannuated artists.

This fund was left by the late Peter Spalding, Esq., by his will dated 12th June 1826, and the directors of the Royal Institution were intrusted with its management as trustees. The fund is a limited one, and from the annual proceeds, which amount to about L.200 a-year, annuities are granted to artists rendered incapable, by sickness or age, of maintaining themselves.

The Royal Scottish Academy of Painting, Sculpture, and Architecture was instituted in 1826, and incorporated by royal charter in 1838. It was formed, with some modifications, on the plan of the Royal Academy in London, and its success has been very remarkable, as, besides considerable funds, it has accumulated a valuable collection of pictures, which are made available to the public gratuitously. As yet the academy has received no assistance from government, but its efforts have been favourably recognised, and it is to be placed in Scotland in a position analogous to that held by the Royal Academy in England. The Royal Scottish Academy is not merely the only successful fine-art body in Scotland, but there is no other society in the whole kingdom, out of London, that possesses sufficient vigour within itself to be able to place before the public an exhibition of works, almost all of which are contributed by its own members or artists who have enrolled themselves as candidates for membership.

The Royal Association for the Promotion of the Fine Arts in Scotland.—The first of the societies now generally known in this country under the name of "Art Unions," was founded in the year 1834, and was incorporated by royal charter in 1847.

The association is composed of annual subscribers of one guinea and upwards, and the funds are appropriated to the purchase of modern works of art in painting, drawing, or statuary, and to the execution or purchase of engravings, bronzes, bas-reliefs, models, or other productions of art, for distribution among the subscribers, by lots publicly drawn at an annual general meeting which is held in July for that purpose. A portion of the funds is also devoted to the production of an engraving which is annually given to each subscriber, and to the acquisition of modern works of art, towards the formation of a National Gallery.

Eminent success has attended the association since its commencement; and to its animating influence must mainly be attributed the improved condition of art and artists in Scotland.

The Royal Society of Edinburgh was incorporated by royal charter in 1783, for the purpose of encouraging philosophical inquiry and discussing matters connected with nature and art. Its meetings take place on the evenings of the first and third Mondays of each month during winter and spring; and it has published twenty volumes of transactions. It is governed by a president, six vice-presidents, and twelve councillors. It possesses apartments, an extensive library, and a small museum, in the Royal Institution buildings.

The Society of Antiquaries of Scotland originated in

1780, and was incorporated by letters under the great seal in 1783. Their museum, or collection of antiquities, in the apartments No. 24 George Street, is open to visitors two days in the week on the most liberal terms; and by some arrangements recently made it will, upon the completion of the National Gallery, be transferred to the Royal Institution buildings as national property, but remaining under the custody of the society. The meetings are usually held on the second and fourth Mondays from December to May inclusive; and the proceedings are now printed annually for the use of the members.

The Highland and Agricultural Society of Scotland was the first institution of the kind in the United Kingdom, and the parent of the very numerous bodies which now devote special attention to the advancement of agriculture. The society's chambers are in Albyn Place, where also is the secretary's official residence. The museum and hall for public meetings are on George IV. Bridge; the former being open to the public free every day, except Monday, from eleven o'clock to three. (For particulars of this Society see SCOTLAND.)

Ecclesiastical institutions and buildings.

During the reign of episcopacy in Scotland, Edinburgh was the seat of a bishop. It is now the place of meeting of the General Assembly of the Church, and the seat of a synod and presbytery. Ecclesiastically, the ancient and extended royalty comprehend thirteen parochial divisions, eight of which have one clergyman each, and five are double or collegiate charges. That portion of the town which is not within these divisions belongs to one or other of the parishes of St Cuthbert's, Canongate, and South Leith. Originally the city consisted of only one parish, of which the ancient church of St Giles was the place of worship.

The fifteen city churches are the charge of the civic corporation, who appoint the ministers. The clergy, eighteen in number, are supported by an assessment, called annuity-tax, levied within the ancient and extended royalty on all houses and shops, with the exception of the dwelling-houses of the members of the College of Justice. This tax is six per cent. on the rental of the city, and has been levied for more than two centuries. During the last 100 years the sum so raised has exceeded L.400,000, which, it was urged in a statement of the lord provost, magistrates, and council, unanimously adopted 26th May 1851, should have been provided out of the proper ecclesiastical funds of the nation. This tax has long been a source of strife and heart-burning among the citizens, and many attempts have been made to get it abolished or equitably adjusted, but without effect.

The following statement (from the Report of Select Committee ordered by House of Commons to be printed July 1851—No. 617) shows the free proceeds of the annuity-tax and other revenues belonging to the ministers of Edinburgh, after deducting all the expenses of survey and collection payable in the collector's department; but without deducting the salary paid to the factor for the ministers, law expenses not recovered from parties prosecuted, and general law and miscellaneous expenditure in the department of the factor and law agent, on an average of seven years from Whitsunday 1844 to 1850:—

Average amount of assessment	L.11,168	7	5
Average amount of the annuity-tax collected, including arrears	8,811	6	2
Average expenses of survey and collection	580	15	4
Average net proceeds of the annuity-tax	8,230	10	10
Average net proceeds of the Leith revenue and Lady Yester's fund	2,008	6	8
Average total revenues belonging to the ministers	10,238	17	6
Average stipend to each minister, subject to the deductions above mentioned	568	16	6

Another statement from the same report, made up from the published accounts of the Free Church of Scotland, shows the average stipends of the 25 Free Church ministers of Edinburgh, for the years ended 31st March 1849, and 30th March 1850, including supplementary grants and sums received from the Sustentation Fund, to have been as follows:—1849, L.280, 18s.; 1850, L.289, 18s. 5d.

The following table, from the religious census of 1851, gives the statistics of the several sects in Edinburgh and Leith:

Religious Denomination.	Population of Parishes, . 193,929. Burghs, 191,221.			
	Places of Worship.	Sittings.	Attendants Morning.	Attendants Afternoon.
Established	26	19,994	8,674	6,887
Free	29	20,830	15,315	15,922
United Presbyterian	20	20,465	12,792	15,235
Episcopal	10	3,796	3,052	1,630
Roman Catholics	4	1,500	2.454	2,068
Independent	6	5,610	2,376	2,799
Relief Presbyterian	1	540	317	360
Original Seceders	1	900	250	350
Baptists	7	3,096	1,654	1,265
Friends	1	430	47	58
Unitarians	1	750	110	75
Wesleyans	4	1,865	682	179
Primitive	1	250	...	50
Glassites	1	260	150	180
New Church	1	150	50	...
Evangelical	...	...	...	...
Isolated	8	1,070	750	155
Catholic and Apostolic Church	1	300	185	14
Latter Day Saints	...	...	...	...
Jews	1	67	28	...
Total	123	81,873	48,886	47,227

The evening attendance in the churches of Edinburgh was 11,319. And with regard to Edinburgh it is stated that the number of sittings is not returned for 17 places of worship—3 Established Church, 2 United Presbyterian, 3 Free Church, 3 Episcopalian, 1 Baptist, 2 Roman Catholic, and 3 isolated congregations; and returns are altogether wanting for 16 other places of worship—8 belonging to the Established Church, 2 Original Secession, 1 United Presbyterian, 1 Free Church, 1 Episcopalian, 1 Roman Catholic, 1 Evangelical Union, and 1 isolated congregation.

St Giles.—This venerable fabric, which occupies a prominent situation in the centre of the Old Town, on the south side of the High Street, is of unknown origin and date. It has been presumed that a church existed on its site as early as the year 854; but the first certain intelligence regarding it occurs in 1359, when a charter was granted by David II. bestowing some land on a chaplain who officiated at one of its altars. The building, previously to certain alterations which were made upon it, was cruciform, and of Gothic architecture, but rather substantial than elegant. From the centre of the whole there rises a square tower, the top of which is encircled with open figured stone work, whilst from each corner of the tower springs an arch, and the four meeting together produce the appearance of an imperial crown. These arches are highly ornamented with small pinnacles, and from the apex rises an equally ornamented short spire. This elegant object is prominent above the whole of the town; and being 161 feet in height, it may be seen at a great distance. After the Reformation, the church was divided by internal walls into separate places of worship. By these and other subsequent alterations, the choir or eastern division formed the High Church; the one occupying the centre of the building was styled the Old Church; another, entering from the south-west corner, the Tolbooth Church; and one at the north-west corner was named the New North Church. Between the years 1829–33 this extensive edifice was remodelled by an entire casing of new walls, and fitted for the accommodation of three churches, on a plan by William Burn.

Trinity College Church, which was next in point of anti-

Edinburgh. quity to St Giles, was removed from the low ground east from the North Bridge, by virtue of an act of parliament, procured by the North British Railway Company in 1846. It was founded in 1462 by Mary of Gueldres, widow of James II.; and in 1502 James IV. invested it with some additional revenues. At the period of the Reformation it shared the fate of the other ecclesiastical establishments of the kingdom. In 1567 the Regent Murray gave it to the town-council to "be ane hospital for the poor, to be biggit and uphaldane be the gude toun," and the council soon afterwards founded within its precincts the Trinity Hospital. When the building was taken down, the body of its royal foundress was disinterred from beneath the aisle on the north side of the church, and deposited in Holyrood Abbey; within its walls were likewise the remains of many persons celebrated in Scottish history. As this church was by far the finest specimen of ecclesiastical architecture in Edinburgh, being a noble fragment of the second-pointed style, arrangements were made when it was taken down for restoring it on a new site; and it is hoped that this design may be carried out, so as to continue a valuable architectural ornament to the city.

The Old Greyfriars Church was built in 1612, but it was not constituted a parish church till 1722. Previously to this, in May 1718, its spire was blown up by gunpowder, which had been lodged in it by the town authorities for security. It was destroyed by fire in 1845; but arrangements are in contemplation for its re-erection in uniformity with the New Greyfriars Church, to which it is contiguous. The New Greyfriars Church was built in 1721. Both of these buildings, which were separated only by a wall, were erected on what was formerly the garden ground of the monastery of Greyfriars, in the south part of the town, and which, on the demolition of the friary in 1559, was conferred by Queen Mary on the town, to be used as a public cemetery. The Old Greyfriars Church was remarkable as being the place where the National Covenant was begun to be signed in 1638, and as including amongst its ministers Robertson, the celebrated historian of Charles V.

The Assembly Hall, or *Victoria Hall* as it is sometimes called, was erected in 1843, as a place of meeting for the General Assembly of the Church of Scotland, and also to be used as one of the city churches. The spire is 241 feet high, and, from its elevated position, forms an elegant and conspicuous object from almost every point of view. The design is by Gillespie Graham; and the spire is one of the best specimens of modern Gothic architecture in the kingdom.

St John's, situated at the west end of Princes Street, is the most elegant Episcopal church. It was founded in 1816, and finished in two years at an expense of L.15,000. It is of the florid Gothic style, from a design by Mr Burn, measures 113 feet in length by 62 in breadth, and is terminated at the western extremity by a beautiful square tower, rising to a height of 120 feet. Another Episcopal chapel, of tasteful Gothic architecture, is that of St Paul's in York Place. It was designed by Mr Elliot, founded in 1816, and finished in 1818, at an expense of about L.12,000. It measures 122 feet by 73, and from each corner there rises a small circular turret. St Paul's Chapel, Carrubber's Close, is the oldest Episcopal chapel in Edinburgh, having been erected about the end of the seventeenth century.

Fducational institutions. *The University.*—Edinburgh has long derived celebrity from its educational establishments, the chief of which is the University. This institution was founded by James VI., by charter dated 24th April 1582, and the first professor was appointed in 1583. About the year 1660, by means of benefactions from public bodies and from private individuals, the establishment had attained a respectable rank among similar institutions. As a school of medicine it first rose into repute under Dr Alexander Monro, who became professor of anatomy in 1720; and in this branch of science it afterwards attained a distinguished pre-eminence, from possessing professors remarkable for their abilities and success as teachers. In the other branches of knowledge, its reputation was gradually exalted to the highest pitch by Maclaurin, Black, Fergusson, Stewart, Robertson, and other eminent men. The decay and insufficiency of the old buildings had long been complained of; and at length, in 1789, the foundation was laid of a new and extensive structure, the plan of which had been furnished by Mr Robert Adam. But this plan, after it had been partly carried into execution, was altered and modified; and the building has been finished in conformity with a very skilful and tasteful design furnished by W. H. Playfair. This edifice forms a parallelogram, inclosing an open court which is occupied with the class-rooms, the museum, and the library.

The number of professorships is thirty-two, and these are divided into four faculties, viz., theology, law, medicine, and arts. The latter includes all the chairs devoted to literature and general science. The principal and professors constitute the Senatus Academicus.

The magistrates and town-council are the patrons of the university, and have the nomination to the greater number of the chairs; the others are under the patronage of the crown, except three, the patronage of which is shared by the faculty of advocates, the writers to the signet, and the town-council. The degrees it bestows are the same as in the other Scottish colleges, namely, those of doctor of divinity, doctor of laws, doctor of medicine, and master of arts. The winter session commences on the 1st of November and closes at the end of April, and the summer session begins on the first Monday of May and terminates at the end of June. During the latter term the lectures given are confined to botany, natural history, medical jurisprudence, histology, and clinical lectures on medicine and surgery Those who wish to qualify for a degree in arts are required to attend the classes of humanity, Greek, logic, mathematics, moral philosophy, natural philosophy, and rhetoric. There are 34 foundations for bursaries, of the aggregate value of L.1172 per annum, for the benefit of 80 students. The number of students who matriculated in 1853–4 was 808, of whom 453 joined literary classes, 298 attended the medical faculty, and 57 were students of law.

The College Museum is particularly rich in objects of natural history, amongst which are specimens of from eight to nine thousand birds, foreign and British. The mammifera amount to about 950 specimens. The mineral and geological collections are of immense extent; but can only be partially exhibited for want of sufficient accommodation. The Museum occupies two large rooms, each ninety feet by thirty, besides minor apartments.

Her Majesty's government having resolved to establish in Edinburgh a National Industrial Museum, a first parliamentary grant was obtained for the purpose last session (1854), and a suitable site has been obtained adjoining the west end of the college.

The College Library consists of about 100,000 volumes. It is supported from a fund formed by the contribution of one pound exigible from every student who matriculates, five pounds payable by every professor on his admission, and a portion of the fees of graduates both in medicine and arts. It was besides entitled, along with the other libraries belonging to the Scottish universities, to a copy of every work published in Great Britain, instead ot which it now receives an annual grant of L.575. There is also an excellent collection of books on theology and church history connected with the class of divinity, and which is supported by certain annual fees paid by the students attending the class. The principal apartment, called the Library Hall, is 198 feet in length by 50 in width.

The Botanic Garden, which is connected with the chair

 of botany in the university, may be traced as far back as about 1670. It was founded by Sir Andrew Balfour and Sir Robert Sibbald, who enriched it in part with plants from the garden of Patrick Murray, baron of Livingstone. The garden was first confined to a small spot near Holyrood; it was afterwards transferred to the vicinity of Trinity Hospital, occupying the ground long known as the Physic Gardens, and now covered by railway buildings. In 1767 it was transferred to Leith Walk, and in 1822 it was removed to its present locality in Inverleith Row. It is the only Royal Botanic Garden in Scotland, and is maintained by government. It contains a large collection of plants, an extensive range of houses, including a palm house, and a museum of economic botany. The professor of botany in the university lectures in the class-room at the garden during the summer months.

The Royal Observatory, presided over by the Astronomer Royal for Scotland, who also holds the conjoint office of professor of practical astronomy in the university, is situated on the Calton Hill, in N. Lat. 55° 57′ 23·2″, and W. Long. 0^h 12^m $43{\cdot}0^s$ of time, or 3° 10′ 45″ of space, of the meridian of Greenwich. It is the property of government, who contribute an annual grant of L.100 toward its maintenance. Its principal objects are the provision of suitable instruments for the pursuit of the study of practical astronomy, and also to enable the Astronomer Royal to make those observations and calculations which are regularly published for comparison with those of sister observatories in this and foreign countries.

Besides his duties at the observatory, and the laborious reduction of a vast mass of important astronomical observations with the aid of a single assistant, the Astronomer Royal annually delivers regular courses of lectures on practical astronomy.

The Royal College of Surgeons.—The celebrity of Edinburgh as a place of education has been in some measure derived from the schools of a number of extramural lecturers of eminence in their several departments of science, particularly in medicine. These lecturers are chiefly members of the Royal College of Surgeons. This body, which was incorporated by charter in 1505, confers the same privileges on medical students as the University, that of doctor of medicine excepted. The College possesses a beautiful edifice in Nicolson Street, from a design by Playfair. Towards the street it is adorned with a lofty portico, which has a striking effect; and the details, though elaborate, are exquisitely finished, and in admirable harmony with the design. It cost the Royal College L.19,060, and forms several splendid halls for the accommodation of the members and the pathological museums. These museums, enriched by the collections of the late Dr Barclay and others, exhibit a valuable repository of preparations and objects calculated to advance the study of surgical science.

The Royal College of Physicians was established in 1681, by a charter of Charles II.; and the number of its fellows, resident and non-resident, is now about a hundred and sixty. The meetings of the body take place in the Physicians' Hall, a handsome edifice in Queen Street. It contains a good library, and very valuable museum of materia medica.

The New or Free-Church College was instituted in 1843, for the benefit of students qualifying themselves for the ministry. The session commences on first Tuesday of November and closes early in April. The classes consist of divinity, church history, Hebrew and Oriental languages, exegetical theology, apologetics, and pastoral theology, natural science, logic, and metaphysics. There are six professors, one of whom is principal. It forms one of the schemes of the Free Church of Scotland, and is supported by that body. The building, part of which forms the Free High Church, is plain but handsome, and was designed by W. H. Playfair. It stands at the head of the Mound.

The High School is one of the two chief seminaries in Edinburgh for classical education, and has long maintained an eminent place amongst similar establishments. Its origin may be traced to an early period in the sixteenth century; but it has been greatly extended and improved in recent times. The building now occupies a site on the south side of the Calton Hill, facing the road that sweeps round that eminence. The design was furnished by Thomas Hamilton, and the foundation-stone was laid on the 28th of July 1825. The main building extends about 270 feet in front, and in the centre of the edifice is a magnificent hexastyle Doric portico. On each side of the portico there is a corridor, the entablature of which is supported by six Doric columns. The apartments, which are entered through a spacious play-ground, consist of a large hall of 75 by 43 feet, and rooms for the accommodation of the various classes taught in the establishment. The cost of this extensive building was about L.30,000, which was partly raised by subscription. The patronage of the High School is vested in the town-council of the city. The curriculum of study extends over six years, and embraces the Latin, Greek, French, and German languages; history, geography, and the elements of natural science; with writing, arithmetic, algebra and geometry, drawing, fencing and gymnastics. Each class in the classical department is taught by the same master for the first four years, after which it passes into the charge of the rector. Connected with the school is a library of 7000 volumes, comprising many of the most important works in ancient and modern literature, to which the pupils have access. The vacation is during the months of August and September. The quarterly fees are:—Rector's class, L.1, 5s.; four junior classes, L.1, 1s.; writing and arithmetic, 7s. 6d. each; the other classes, 10s. 6d. each, attendance on the last seven branches being optional. The system of education is divided into two departments—Classical and English, and Commercial; and the whole is conducted by a rector and four classical masters, with teachers for the other branches. The usual number of pupils is from three to four hundred.

The Edinburgh Academy is a similar institution with the High School, but its fees are higher. It was begun a few years ago by a society with a capital of L.12,900, which may be augmented to L.16,000, raised by proprietary shares of L.50 each. The superintendence of the establishment is vested in fifteen directors, chosen by the proprietors from their own body. The system of education is nearly the same as that pursued in the High School. There are here also a rector, four classical masters, besides masters of modern languages and literature, mathematics, elocution, writing, fencing, and drawing. The complete course extends over seven years.

Besides the High School and Academy, there are a number of excellent private academies, many on very moderate scales of charges, and numerous free schools.

Free Schools.—The principal of these are the Heriot Foundation Schools, erected from the surplus revenues of Heriot's Hospital, in accordance with an act of parliament obtained in 1836, for educating within the royalty of the city free of expense poor children of burgesses and freemen deceased, or who are unable to provide for their support, or the children of poor citizens and inhabitants of Edinburgh residing within the royalty. There are twelve of these schools, eight for juveniles and four for infants, attended by about 3000 children; and this number is supposed, according to the census of 1851, to form about one-half of all the children belonging to the poorer classes within the royalty of the city of Edinburgh, from which alone the children are admissible. In the juvenile schools there are Sabbath-morning classes.

Dr Bell's Schools (two in number), under the patronage of the lord provost and magistrates and council, are also noted for the admirable way in which they are conducted.

Edinburgh. In each of them upwards of 300 children, who pay small fees, are instructed in English, grammar, etymology, geography, arithmetic, writing, the principles of the Christian religion, &c. There are attached to the schools eight apprentices, who receive fixed wages, and are indentured for assisting in the business of the school, and being trained as teachers.

Besides these, there are the Local Day Institution founded by Dr Andrew Thomson, the Canongate Burgh School, the Sessional School of Canongate, the Lancasterian School, the Apprentice Schools, and various others.

There are two Normal Schools, one in connection with the Established, and the other with the Free Church, and two Ragged or Industrial Schools.

The following table is taken from a parliamentary paper published in 1854, and, so far as it may be relied on, gives a brief view of the state of education in the city. It is, however, explained in that paper, that, in large towns especially, some schools have been overlooked, which is clearly the case in regard to Edinburgh, particularly as regards private schools not denominational:—

Denomination.	Number of Schools.	Number of Teachers.	Number of Scholars.	Number Educated gratuitously.	Income of Teachers.
Established Church...	20	61	3,271	841	£2,372 15 0
Free Church............	22	98	3.918	176	3,367 5 3
United Presbyterian..	10	17	1,293	159	609 10 0
Scottish Episcopal.....	5	13	919	177	465 0 0
Roman Catholic........	4	33	970	500	739 0 0
No Denomination......	31	183	6,743	3,299	13,661 16 8
	92	405	17,114	5,152	£21,215 6 11

Heriot's Hospital.—The founder, George Heriot, was born in the parish of Gladsmuir, and in the year 1597 he was appointed goldsmith and jeweller to James VI. He died in London (whither he had removed on the accession of James to the English throne) on the 12th of February 1624, leaving a fortune, it is supposed, of not less than L.50,000. Of this sum L.23,625, 10s. 3½d. were, by his bequest, appropriated to the founding and endowing of the hospital which bears his name, for the maintenance and education of children, the sons of burgesses of the city "who are not able to maintain them." The magistrates, town-council, and ministers of the town, were nominated the governors; and certain trustees were appointed to superintend the execution of the will. The building of the hospital was begun in 1628, and, after some interruptions, completed in 1650, at an expense altogether of L.30,000. It was not however opened for its legitimate purpose till 1659, when 30 boys only were admitted. There are now 180 in the establishment, all of whom are comfortably lodged, fed, and clothed; and all pains are bestowed upon their education, which comprehends Greek, Latin, English, writing, arithmetic, book-keeping, mathematics, and geography. On leaving the hospital they are furnished with a liberal supply of articles of dress of their own choosing; and such of them as are apprenticed to trades receive an apprentice fee of L.50, besides an allowance of clothing at the expiration of their indentures. Boys who distinguish themselves by their literary attainments, and who are qualified to enter the university with a view to the learned professions, receive bursaries of L.30 per annum for four years. Ten other bursaries of L.20 each, for the same period, are bestowed upon young men unconnected with the hospital who give proofs of superior talents. Boys are not admitted under seven years of age, and generally leave it at fourteen. As already mentioned under that head, the Free Schools in connection with this hospital form now a most important branch of its operations.

The hospital is situated in the southern part of the town, and is one of the most remarkable buildings connected with the city. It is three stories in height in the central parts, and four stories at the corners, with an interior quadrangle or court. It has been traditionally said to have been designed by Inigo Jones, and though no direct evidence can be produced for this, yet it seems highly probable. The character of the architecture is supposed to be an improvement on the common turreted Scottish style of the day; and the names of two Scotsmen have been brought forward, William Wallace and William Aytoun, both at different times called "master masons" of the work, to one or other of whom the design has also been supposed to be due. In 1832–33 this beautiful structure received some external repairs, and a lodge, which is a miniature of the hospital, was erected at the principal entrance.

Donaldson's Hospital was founded by James Donaldson of Broughton Hall, a printer in Edinburgh, who died in 1830, and bequeathed by his will, dated 4th July 1828, the greater part of his property, amounting to nearly L.200,000, to certain trustees for the endowment and erection of an hospital for the maintenance of poor boys and girls after the plan of the Orphan Hospital and John Watson's Institution. Poor children of the name of Donaldson or Marshall have a preference. The management is vested in trustees appointed in conformity with the deed of constitution. The building, commenced in 1842 and finished in 1850, is a structure of large dimensions, exceeding those of any building in the city excepting the university. The length of its south or principal front is 270 feet, and its depth (exclusive of the chapel which projects 90 feet from the north front) is 260 feet. The size of the quadrangle within is 175 × 163 feet, being greater than the external dimensions of Heriot's Hospital, which is 160 feet square. The style of architecture employed in the design is that which arose in Britain in the sixteenth century, when, upon mediæval architecture (which had been verging from ecclesiastical into civic and domestic application) were engrafted many features of modern Italian buildings; resulting in combinations which assumed a marked and individual style, eminently expressive of a high condition of social refinement and grandeur. On the centre of the south front a tower 49 feet square, with lofty central oriel corbelled above the entrance doorway, and with bold enriched cornices, embattled parapets, and perforated chimney-shafts, rises to the height of 120 feet; at each angle of which are attached octagonal towers pierced with mullioned windows, enriched with multiplied panellings, armorial bearings, devices and ornaments, and finished with ogee leaded roofs surmounted by richly carved stone lanterns and finials The four corners of the building have each a tower 43 feet square, and 92 feet high, with attached square towers terminated by lead roofs and finials, the main tower having oriels, battlements, and chimney-shafts. These corner towers are connected with each other and with the large central tower of the south front by intermediate stretches of building, having mullioned and labelled windows and buttresses surmounted by little curved pediments with angels' heads and terminal ornaments, the whole being crowned by a corbelled cornice and parapet with shields and devices, and terminal shafts above each buttress. The chapel, projecting to the north, partakes of the same general character of detail which obtains throughout the main building, but resumes somewhat of an ecclesiastical aspect by the introduction of archedm ullioned, and transomed windows, which, with a lintelled oriel to the north, serve to mark the idea of a domestic or baronial chapel. The interior, roofed with corbelled beams and panelling and having the walls lined all round with massive panelling and the windows filled with richly stained glass, sustains and enhances the effect of the exterior. The entire structure was designed and carried into execution by W. H. Playfair. It stands on a piece of ground about a mile to the westward of the city, on the line of the Edinburgh and Glasgow road.

Table showing the number of Hospitals in Edinburgh.

Name of Hospital.	For maintenance and education of	Age of admission.	Number admitted or maintained.	Fees on leaving.	Governors or Directors.	Date of Bequest.
Trinity.	Burgesses, their wives, or children not married, nor under 50 years of age.	Above 50.	108	... ...	Magistrates and Town-Council.	1567
Heriot's.	Sons of burgesses and freemen of Edinburgh.	7 to 10, leaving at 14.	180	Apprentice fee of L.50, according to circumstances, and allowance of clothes, or L.30 for 4 years for those who receive a college education.	Magistrates, Town-Council, and City Ministers.	1623
Merchant Maiden.	Daughters and granddaughters of merchant burgesses of city, or of ministers of city and suburbs, or of those who have been governors or benefactors to the hospital.	7 and under 11, leaving at 17.	100	L.9, 6s. 8d.	Five members of the Town-Council, master and 3 assistants of Merchant Company, 3 clergymen of city or suburbs, Earl of Mar, and 9 persons elected by the Merchant Company.	1695
Trades Maiden.	36 daughters and granddaughters of decayed craftsmen in Edinburgh, and the rest from any part of Scotland.	7 to 11, leaving at 17.	48	... ...	Convener of Trades, and deacons of 13 incorporations, 2 trades councillors, 2 persons of name of Erskine, president of Society of Barbers, and 9 persons elected by the other governors.	1704
George Watson's.	Sons and grandsons of decayed merchants, burgesses, or guild-brothers of Edinburgh, with a preference to the Merchant Company.	7 and under 10.	86	Apprentice fee L.10 for 5 years, and on attaining 25 years of age, if unmarried and able to show testimonials of good behaviour, a premium of L.50. Boys preferring a college education receive L.20 per annum for 6 years.	Master, 12 assistants of Merchant Company, 5 of the Town-Council, and minister of the Old Church.	1723
Orphan.	Boys and girls from any part of Scotland.	7 and not above 10.	100	... ...	Variable, and appointed by Trustees.	1727
John Watson's.	Destitute boys and girls.	5 and under 8, leaving at 14.	120	... ...	The Lord Clerk-Register and Depute-Keeper of the Signet, the treasurer of the fund, and 12 commissioners of the Writers to the Signet.	1759
Gillespie's.	Old men and women, and Poor boys.	55 and upwards. 6 to 12, and retained for 3 years.	40 } 200 }	... ...	Master, treasurer, and 12 assistants of Merchant Company, 5 of Town-Council, and ministers of Tolbooth and St Stephen.	1796
Donaldson's.	Poor boys and girls, especially of the names of Donaldson and Marshall, from any part of Scotland (of those already admitted a third are deaf and dumb).	6 to 9, leaving at 14.	300	Such sum of money or other assistance during apprenticeship or otherwise, as governors think advisable.	The Lord Justice-General, Lord Clerk-Register, Lord Advocate, Lord Provost, Lord-lieutenant of county, Principal of the University, senior minister of Established Church, Edinburgh, 2 ministers of St Cuthbert's Parish, preses of College of Physicians, treasurer and secretary of the Bank of Scotland, and 14 other gentlemen, 3 of whom go out annually by rotation, their successors being appointed by the remaining managers.	1828
Cauvin's.	Sons of poor teachers and farmers, whom failing, of printers, booksellers, or agricultural servants.	6 to 8, and retained for 6 years.	26	... ...	The Lord Provost, the Principal of the University and Professor of Humanity, Rector of High School, ministers of Duddingston, Libberton, and Newton, and others.	1825
Stewart's.	Poor sons of honest and industrious parents.	... ...	...	... ...	Trustees.	1814
Chalmers'.	Sick and hurt.	... ...	...	Building not yet erected.	Dean and Faculty of Advocates.	1836
Fettes'.	Young people whose parents have fallen into adverse circumstances.	... ...	...	Do. do.	Trustees.	1836

Edinburgh.

Commercial institutions.

Although not itself an extensive trading or commercial town, Edinburgh may be said to have contributed in an important degree to the vast progress which trade and commerce have made in Scotland, no less than in the other parts of the empire. By means of its banking institutions, capital has been diffused over every district of the country; and thus a beneficial influence has been exerted upon all branches of industry, commercial and agricultural.

Banks.—There are ten banks and branches of banks in Edinburgh, all joint-stock companies. Five are properly Edinburgh institutions, originating and having their principal establishments there. These possess an aggregate capital of L.5,600,000 sterling. Of the other five, two may be considered as partly Edinburgh and partly Glasgow establishments, having head offices and directors in both cities. These have each a capital of one million. The remaining three are branches of Glasgow banks.

The oldest bank in Edinburgh is the Bank of Scotland, which was established in 1695 by an act of the Scottish Parliament. The capital of the company was originally L.1,200,000 Scots (L.100,000 sterling), raised by shares of L.1000 Scots (L.83, 6s. 8d. sterling). This capital is now increased to one million sterling, and the shares have been converted into stock. The establishment is situated in Bank Street, near the head of the Earthen Mound.

The Royal Bank of Scotland was instituted in 1727 by royal charter. Its capital stock was originally L.111,000 sterling. This was raised in 1738 to L.151,000, and by various subsequent additions to two millions. The Royal Bank is in St Andrew Square.

The British Linen Company was erected into a bank in 1746, with a capital of L.100,000, which has now been raised to one million. This bank is also incorporated by royal charter. Its premises, lately rebuilt, are handsome and commodious; they are also in St Andrew Square.

The Commercial Bank of Scotland was established in 1810, and has a capital of L.600,000. It is incorporated, but its charter reserves the liability of its partners. It occupies a splendid new edifice in George Street, on the former site of the Physicians' Hall.

The National Bank of Scotland was instituted in 1825; capital one million. This bank is also incorporated, its charter containing a similar provision with that of the Commercial Bank. The bank is in St Andrew Square.

The other banks in Edinburgh are the Union Bank of Scotland, Parliament Square, an establishment which was originally the private banking-house of Sir William Forbes and Co., and joined the Union Bank in 1843; the Edinburgh and Glasgow Bank, George Street, established 1838; Branch of the Western Bank of Scotland (1832), St Andrew Square; Branch of the Clydesdale Bank (1838), Royal Exchange; and Branch of the City of Glasgow Bank (1839), Hanover Street.

There is also a National Security Savings Bank in Edinburgh, instituted in 1836. It occupies premises in North Bank Street.

The Merchants of Edinburgh form a body, called the Merchant Company, incorporated by a charter of Charles II. in 1681. This company is entrusted with the management of several charitable institutions, and is active in superintending measures connected with the commercial interests of the city. Its business is conducted by a master, treasurer, and twelve assistants, and their hall of meeting is a spacious apartment in Hunter Square.

Literature.—Edinburgh is distinguished as a mart of literature, and its inhabitants enjoy a reputation for cultivated tastes and habits. This character, however, is not of much older date than the latter part of the eighteenth century. Thirty years after Caxton had set up his press at Westminster, Walter Chapman and Andro Myllar, by a royal privilege of James IV., granted in 1507, established here the first printing-press in Scotland. From this only two publications are known to have issued;—one (in 1508), a collection of pamphlets, chiefly metrical romances and ballads, of which an imperfect copy is preserved in the Advocates' Library; and the other (in 1509 and 1510), the Scottish Service Book, including the Legends of the Scottish Saints, commonly called the Breviary of Aberdeen, in two volumes 8vo, printed in red and black letter, a copy of which is preserved in the University Library. The next work was published about the year 1506, and consisted of a black-letter folio volume, entitled "The History and Croniklis of Scotland, compilit and newly correckit be the Reuerend and Noble Clerke, Maister Hector Boece. Translatit laitly be Maister Johne Bellenden. Imprentit in Edinburgh be Thomas Davidson, dwelling fornent the Frere Wynd." The whole works of Sir David Lindsay were also printed by Davidson in 1540. Davidson was succeeded by Lekprevik, Vautrollier, Hart, Young, and others; but the press of Edinburgh did not become distinguished until the appearance of Thomas Ruddiman, the well-known philologist, born in 1674, and Allan Ramsay the poet, born in 1686. The numerous classical works which issued from the press under the editorship or authorship of Ruddiman were then models of typographical accuracy and beauty, while the general excellence of his Rudiments of the Latin tongue, which appeared in 1714 and is well known to every schoolboy in Scotland, is still acknowledged. The long practice he had acquired in superintending the press during the publication of his own works, induced him, in 1715, to establish a printing-press on his own account; and while proprietor of the Caledonian Mercury newspaper, he received the honourable appointment of librarian to the Faculty of Advocates.

Contemporaneously with Ruddiman, Allan Ramsay, the poet and bookseller, was engaged in the publication of several works of his own, among which the *Gentle Shepherd*, a pastoral comedy in the Scottish dialect, which appeared in 1735, then acquired and still retains great popularity. Previously to this, in 1721, Ruddiman had printed, in a handsome quarto volume, a collected edition of his minor poems and ballads, which Ramsay published in the succeeding year at the sign of the Mercury, opposite the head of Niddry's Wynd, and by which he is said to have realized four hundred guineas.

It was thus in the beginning of the eighteenth century that these two men first imparted to Edinburgh that literary character which it still enjoys, and which was the precursor of the era of a new system of publishing commencing with the establishment of the Edinburgh Review in the year 1802, and the publication of such large works as the early editions of the Encyclopædia Britannica. The person to whom Edinburgh is most indebted for an increase of its literary reputation is Sir Walter Scott, whose poetical productions appeared at intervals from 1802 till 1812, and whose novels and tales began to be published in 1814. The principal literary men whose names have generally been associated with Edinburgh, are David Hume (died 1776); Henry Home, Lord Kaimes (1782); Robert Henry (1790); David Dalrymple, Lord Hailes (1792); W. Robertson (1793); Hugh Blair (1800); John Home (1808); Adam Ferguson (1816); Malcolm Laing (1819); John Playfair (1819); Thomas Brown (1820); Dugald Stewart (1828); H. Mackenzie (1831); Sir John Leslie (1832); Sir James Mackintosh (1832); T. M'Crie (1835); Sir Charles Bell (1842); John Abercrombie (1844); Thomas Chalmers (1847); P. F. Tytler (1849); Francis Jeffrey (1850); D. M. Moir (1851); and John Wilson (1854).

The principal newspapers published in Edinburgh are the Scotsman, the Witness, Caledonian Mercury, Edinburgh Evening Courant, Edinburgh Advertiser, Scottish Press, and Evening Post, some of which are published

Edinburgh.

twice, and some thrice a-week. There are two weekly papers, the Guardian and the News; also a paper solely devoted to advertisements, and distributed gratis, on Saturday, called the North British Advertiser.

Civic institutions.

The Corporation.—The ancient civic establishment of Edinburgh was remodelled in 1833 by the act of parliament for reforming the royal burghs of Scotland. The management of the general municipal affairs within the royalty is vested in a town-council, consisting of thirty-one members chosen by the parliamentary electors of the five different wards, and renewed by one-third annually. To these are added one of the deacons of the ancient incorporated trades, elected annually as their convener by his brother deacons and trades' councillors, and the Dean of Guild elected by the guild brethren of the city. The council, thus composed of thirty-three members, elects out of their own number a chief magistrate, with the title of Lord Provost, and four bailies, who together form the magistracy of the city. Besides the ordinary powers of magistrates of royal burghs, the magistrates of Edinburgh are also, by virtue of ancient charters, sheriffs, coroners, and justices of peace, within the city and liberties, and possess and exercise all the powers, privileges, and jurisdictions competent to such officers. The city and liberties form a county of itself, and the Lord Provost is vested with the office of Lord Lieutenant. The magistrates are likewise admirals of Leith and the road thereof, but delegate their powers of holding admiralty courts to the magistrates of the burgh of Leith. The revenue of the Corporation of Edinburgh proper for the period from 2d August 1853 to 1st August 1854 was L.24,000, 14s. By the parliamentary reform act of 1832, Edinburgh and the adjoining districts and suburbs were formed into a parliamentary district, 9½ miles in circumference, which returns two members to parliament. The number of parliamentary electors on the roll in November 1854 was 7713, and the number within the municipal district 4229.

The Dean of Guild Court consists of the Dean of Guild (an office resembling that of the Roman Edile), and five guild councillors, with the dean of the previous year. The powers of this court were formerly far more extensive than they are at present, having relation to causes between merchant and mariner, as well as to those between merchant and merchant. The institution, however, of the Admiralty Court, by the act 1681, cap. 16, superseded its interference with maritime affairs. The Dean of Guild is chosen yearly, and with his council has power to regulate the buildings within the burgh, agreeably to law. He alone is competent to grant authority, by his warrants, or *jedges* as they are called, for pulling down or erecting houses within the burgh and liberties. The provost and bailies have no power to review the decrees of the Dean of Guild, redress being only competent in the Court of Session; as is the case also with the decisions of the bailie court. The public business connected with the civic establishment or corporation is conducted in the Royal Exchange Buildings. The public business of the county, and the sittings of the sheriff and justices, take place in the County Hall, adjacent to the Parliament House, and erected in 1819, at an expense of L.15,000.

The *superiority* of the Canongate jurisdiction, which formerly belonged to the abbot of Holyrood, was purchased by the town of Edinburgh from the Earl of Roxburghe, into whose hands it had fallen, in the year 1636. Since that period the burgh of Canongate has been governed by baron bailies appointed by the town-council from their own body, and by two resident bailies, also appointed by the same authority on the recommendation of the parliamentary electors. In a similar manner bailies are appointed to the subordinate districts of Easter and Wester Portsburgh.

Police.—Till the year 1805 the city was protected only by a feeble body of old men in the garb of soldiers, entitled the City Guard, which constituted the remains of a civic defensive force originally raised in 1514, after the battle of Flodden. In 1805 a regular police establishment was formed, and the city guard was finally dissolved in 1817. The police establishment was remodelled by specific acts of parliament in 1812, 1822, and 1832, and latterly in 1848 and 1854. The establishment consists of 32 general commissioners elected by the inhabitants of the same number of wards, qualified to vote by paying an annual rent of L.10. The body of general commissioners is increased by eight *ex officio* members, the lord provost, four bailies, the sheriff of the county, and his substitutes. Under this body there is an executive police, with a superintendent; and a criminal court is held daily on the plan of that at Bow Street in London. In it a town bailie officiates as magistrate or judge in all cases which occur within the ancient and extended royalty; whilst cases originating in that portion of the city included between the exterior limits of the royalty and the general police boundary fall under the cognizance of the sheriff. Edinburgh is now in all its parts well watched, lighted, and cleaned; and the expenditure for these purposes amounted in the year ending at Whitsunday 1854, to L.38,746, 1s. 5d. An assessment on the inhabitants, of about 1s. 2d. per pound on the rental, the produce of street manure, and the surplus of general fines, supply the revenue of the establishment. The head police-office is a large building in the High Street, with one of its sides to Parliament Square; and the number of the police force is 327.

Edinburgh Police Statistics for 1853.

Persons apprehended by the City Police and remitted to a *higher Court* consisting of the Sheriff and Bailies—285 males, 194 females, and 59 juveniles.

Persons *tried in the Police Court* for thefts, &c., 707 males, and 487 females. Of these there were under 14 years of age, 294 males and 33 females.

	Males.	Females.
Results of these trials:—		
Imprisoned (for periods under 60 days)	210	187
Whipped (males under 14 years of age)	140	
Ordered to find caution	66	40
Dismissed with an admonition	131	98
Fined	5	
Total number convicted	552	325
" " not proven	25	22
" " in which diet was deserted	130	140

Persons *tried in the Police Court for offences and contraventions, assaults, &c.*, 5401 males and 5443 females.

	Males.	Females.
Results of these trials:—		
Imprisoned	345	697
Whipped	43	
Fined	2504	1796
Ordered to find caution	528	577
Dismissed with an admonition	1579	2099
Total number convicted*	4999	5169
" " not proven	98	87
" " diet deserted	296	184
" " remitted as insane	8	3

* Of these there were for contravening cleaning regulations, 2159.

Prisons.—After the removal of the Old Tolbooth in the High Street, an extensive building situated on the Calton Hill, fronting the road which sweeps round that eminence, was provided for the city and county prison. The centre division of the range, called the prison of Edinburgh since the passing of the prison act for Scotland in 1839, was formerly the city bridewell, so called from having been built on the same principle as the St Brideswell prison in London. It was constructed in 1791, in the Panopticon form, after a plan by Robert Adam.

The west wing of the prison was erected in 1817, after a plan by Archibald Elliot—it was this part of the prison which was erected in lieu of the Old Tolbooth; and

Edinburgh. the east wing was erected in 1847, after a plan by Robert Brown. The buildings are in the castellated style of architecture, and have a fine appearance from whatever point they are viewed. The prison contains about 430 cells and rooms, and affords accommodation for both civil and criminal prisoners. The expenses of the establishment are defrayed chiefly by assessments, and partly by the labour of the inmates. A small lock-up-house adjoins the County Hall, and is used for prisoners under examination and before committal for trial. Since the passing of the present police act, prisoners remanded for further examination, and prisoners under sentence of three days' imprisonment from the police court, may be kept in the cells of the new police office in the High Street. The Canongate jail, an old-fashioned plain edifice of the time of James VI., and used for debtors, was discontinued as a prison after the erection of the east wing of the prison of Edinburgh in 1847.

The Poor.—Edinburgh, as regards poor-rates, is divided into three districts, the City parish (or ancient and extended royalty), the parish of St Cuthbert's, and the Canongate, each of which has a house for the reception of paupers, with distinct funds and a separate board of management. A portion of the eastern part of the city is in South Leith parish, for which there is no workhouse. The principal resource for the support of the poor is an assessment. The amount of money collected for this purpose in 1833 was L.13,479, 19s. 4d., whereas in 1814 it was only L.6943, 19s. 10d.

The following table shows the amount of accommodation available in the poor-houses of Edinburgh, and the number of inmates in each house on 1st of July, in each of the years 1850 to 1853, with the population of the parish, according to the census of 1851:—

Poor-houses.	Pop. 1851.	Accommodation.			Number of Inmates 1st July			
		1850.	1851.	1852.	1850.	1851.	1852.	1853.
Canongate of Edinburgh	10,801	163	163	160	107	121	117	100
Edinburgh City Parish	66,608	691	895	909	627	627	549	615
St Cuthbert's Parish......	82,479	686	691	661	554	551	599	619
Totals...	159,888	1540	1749	1730	1288	1299	1265	1334

In the city parishes of Edinburgh and St Cuthbert's, the orphans and deserted children that become chargeable, instead of being collected in the poor-house, are dispersed in the surrounding rural districts, where they are boarded in houses of the working-classes, and regularly visited by an assistant inspector appointed to that duty.

The income from the assessment (for 1853) was as follows:—

City parish	L.21,056	13	8
St Cuthbert's do....................	18,059	6	11½
Canongate do........................	2,946	4	3¾
	L.42,062	4	11¼

The average amount of cost of house inmates in the city parish poor-house for the last year was L.8, 10s., and for children at nurse L.7, 12s.

The number of permanent and outdoor poor and children at nurse, in 1853 was as follows:—

City parish, permanent........................	2000
Do. children at nurse...............	325
St Cuthbert's..	1776
Do. children at nurse...............	498
Canongate...	...
	4599

Besides these public institutions for the relief of the poor, there are numerous other charitable associations of a public and private nature.

Markets.—There are three market-days, Tuesday, Thursday, and Saturday, each week, for the sale of butcher-meat and vegetables; but on Wednesday only are held the markets for the sale of horses, cattle, sheep, corn, and other agricultural produce. The spacious street called the Grassmarket used to be the place where these Wednesday markets were held; but being found to be too small and inconvenient, a place for the cattle and sheep market was procured in the neighbourhood, and fitted up for the purpose in 1844, at the cost of L.8000. In 1849 a spacious corn-market was erected on the south side of the Grassmarket at the cost of L.17,500. It is a handsome building, with a front of three stories, in the Italian style, and a campanile or belfry at the west end. The covered market-place behind is 156 feet 6 in. in length by 97 feet in width, and is lighted from the roof. The butcher meat, fish, and vegetable markets are situate in the centre of the city, and consist of a series of descending open areas, connected by flights of steps from the back of the High Street to Market Street, below the North Bridge. They are well supplied with provisions; but a great part of the business formerly transacted in them is now carried on in private shops throughout the city. A public market for the sale of the same kind of provisions was erected about thirty years ago in Nicolson Street, a second in Old Broughton, and a third, on a large and expensive scale, costing upwards of L.20,000, at Stockbridge; but these speculations of private companies have proved almost complete failures. In 1852 an extensive range of slaughter-houses was erected by the town-council on an area of four acres purchased by them at Lochrin, in the south-west quarter of the city, at the cost of L.22,163; but they have been found already too small for the trade, and will require a speedy enlargement. These slaughter-houses and the corn market were erected from designs by David Cousin, architect, the city's superintendent of public works.

Edinburgh has the privilege of holding two yearly fairs, called the *Trinity* and the *Hallow* fairs; the former on the Monday after Trinity Sunday, and the latter in the first week of November, following the feast of All-Hallows, or All-Saints. The former, however, has long since fallen into disuse; but the latter is still held, and is a well-frequented market for the sale of cattle, horses, and sheep. It is held in such fields as can be hired for the purpose in the vicinity of the city. There is also a great market for sheep and lambs held on the first and second Mondays of April yearly, at the *House of Muir*, about 7 miles south of the city, the privilege of holding which was acquired by the magistrates and council from the Lord Abernethy of Saltoun in 1612.

Supply of Water.—Edinburgh seems to have been anciently supplied with water chiefly from wells within the burgh; but about the year 1680 a supply was brought in by a leaden pipe from the Tod's Well, on the estate of Comiston, a distance of four miles. An addition was subsequently procured from Bonaly; but the supply proving quite inadequate for the wants of the inhabitants, the town-council, being unable to raise money for the purpose themselves, surrendered their rights for L.30,000 to a water company, which was incorporated by act of parliament in 1819. This company expected to derive a sufficient supply of water from the Crawley spring, a feeder of the North Esk in Glencorse parish, and expended nearly L.200,000 in their works for bringing it into town. In the course of years this supply likewise proved utterly inadequate, and the company were forced at last, by public clamour, and the threatened rivalry of new companies, to take measures for increasing the supply. This they have effected by collecting the rain water that falls on the Pentland Hills into great ponds or reservoirs formed in the valleys of the Logan water, and the Bavelaw Burn; and their capital has been fixed by act of parliament (in 1853) at L.322,000. Still the supply is not overabundant, being only about 25 gallons a-day to each per-

Edinburgh.

son in the district supplied, which, besides the city of Edinburgh, includes likewise the towns and villages of Leith, Portobello, Newhaven, and Granton. The company are empowered to levy certain rates upon the rental of the city; but the maximum of their dividends is fixed at $6\frac{1}{4}$ per cent. per annum.

Gas-light.—Edinburgh is lighted with gas supplied by two companies, namely, the Edinburgh Gas-light Company, whose works are situated in the Canongate, and the Edinburgh and Leith Gas-light Company, whose works are situated in Leith.

Places of amusement, and pleasure-grounds.

The Theatre Royal was built in 1768, shortly after the commencement of the New Town, and acquired great reputation under the successive managements of Henry Siddons, and his brother-in-law W. H. Murray. Previously to this period the theatrical performances of the city were exhibited in the Canongate, where a play-house was erected in 1746, in opposition to a rival establishment in the Cowgate. The present house accommodates about 1500 people, and although externally of plain appearance, in internal arrangements it is neat and comfortable; and the company of actors has generally been considered as one of the best out of London. Recently during the winter months it has been used with much success for the representation of operas. It is situated at the east end of Princes Street. The Queen's Theatre and Opera-House has recently been erected on the site of the old Adelphi, at the head of Leith Walk.

The Assembly Rooms, George Street, where public assemblies, balls, and concerts, are held, are plain and unpretending in their external appearance, and were erected in 1787. The Music Hall, a recent addition to the original edifice, forms the largest of the apartments: it is seated for 1486, exclusive of the orchestra, which measures 108 feet long by 91 broad and accommodates 200 people. It contains a large organ, and is well adapted for concerts and public meetings. The ball-room is 92 feet long, 42 feet wide, and 40 feet high.

Princes Street Gardens.—Perhaps the most beautiful feature of Edinburgh in its modern state consists in the highly ornamental pleasure-grounds which occupy the open spaces between the Old and New Towns, as well as between the parallel ranges of Queen Street and Heriot Row. The low grounds to the east and west of the Earthen Mound continued for about fifty years after the commencement of the New Town in a very marshy and unprofitable condition. At length, in 1821, under the authority of an act of parliament, the ground on the west was drained, inclosed, laid out, planted, and highly beautified with walks, and has since been opened to the proprietors or tenants of property in Princes Street, or others, on payment of an annual fee. In 1832–33 the ground on the east was similarly inclosed; but having been recently purchased by the town, it has, under the superintendence of the city architect, been greatly improved and ornamented, and is now open to the public. Since the year 1820 the greater part of the ground north of Queen Street was inclosed and laid out in gardens or promenades in the same tasteful and pleasing style.

The Calton Hill (350 feet above the level of the sea) is the higher portion of one of those heights upon which part of the town is built, and forms one of the principal public parks or promenades. From its position, and the number of monuments with which it is covered, it confers great picturesque beauty on the town, and has been compared to the Acropolis of Athens. The principal access to it is from Waterloo Place, nearly opposite the prison, and convenient and well-made roads for pedestrians are carried over and around the hill in various directions, affording panoramic views of the town and surrounding country.

On the north are the lines of streets of the New Town, constructed of white sandstone, gradually extending with a moderate descent towards the flat ornamental grounds adjacent to the sea. Westwards we have the vista of Princes Street, nearly a mile in length; and on the opposite side of the Princes Street pleasure-grounds the huge unbroken line of tall structures forming the Old Town, terminated by the towers of the Castle. Towards the south the town is seen to spread out in lines of streets and detached houses, till arrested by the Braid and Pentland Hills, or on the east by Arthur's Seat and Salisbury Crags. The view from the Calton Hill in a northerly direction beyond the town is also remarkably fine, comprehending a prospect of the whole Firth of Forth and the hills of Fifeshire.

Arthur's Seat and the Queen's Park (surrounding Holyrood Palace) are now rendered additionally attractive by the formation of the Queen's Drive, an excellent road round the hill, made recently in the most perfect style by the Commissioners of Woods and Forests, and affording the finest views of Edinburgh and its neighbourhood. The hill itself is a noble object, presenting bold pieces of rocky scenery, the principal of which are Salisbury Crags and Samson's Ribs. The summit is 822 feet above the level of the sea.

The Meadows.—In the year 1722 a marshy ground, anciently called the Burrowloch Boroughmuir, in the southern environs of the city, was inclosed, drained, planted with trees, and traversed by extensive broad walks, for the accommodation of the citizens. These public grounds, which receive the appellation of the Meadows, and bear some resemblance to the Green Park in London, are bordered on the south-west side with extensive open downs, called Bruntsfield Links, which are also open to the public, and form a place of agreeable recreation for youth, as well as an excellent golfing ground.

Monuments.

The National Monument occupies a prominent situation on the Calton Hill. It was begun by a body of subscribers in 1822, and was intended to be an exact model of the Parthenon at Athens. Its object was to commemorate those Scotchmen who had fallen in the different engagements by sea and land during the wars consequent on the French revolution; but it has been arrested in its progress for want of funds, and only twelve massive pillars of exquisite workmanship have as yet been completed.

A monument of a singularly elegant description, designed by Mr Playfair, and which is a reproduction, with some variations, of the choragic monument of Lysicrates, was erected in 1830–31 on a prominent situation on the Calton Hill. It is commemorative of the late Dugald Stewart, professor of moral philosophy in the University of Edinburgh. A monumental erection, commemorative of Professor Playfair, is also placed on the Calton Hill, at the corner of the inclosure of the Royal Observatory; and more recently another to the memory of Robert Burns, from the street of the Tripods, has been raised on an isolated eminence fronting the new High School. David Hume's Monument, after the model of an ancient Roman tomb, stands within the old Calton Hill burying-ground.

Lord Melville's Monument, an elegant fluted column, in the centre of St Andrew Square, was finished in 1828. It was raised by subscriptions chiefly among gentlemen connected with the royal navy. On the summit is a colossal figure of the above nobleman, cut in freestone. This beautiful column rises to the height of 136 feet, is modelled after Trajan's pillar at Rome, but without the sculptures, and forms altogether a very prominent and striking object.

The monument to Sir Walter Scott is situated in the East Princes Street Garden, opposite the foot of St David Street. It was designed by George M. Kemp, a young man of humble condition, who died before the structure was completed. The foundation was laid in 1840, and the building completed in 1844, at a cost of L.15,650. A stair conducts to the top of the monument, which is 200 feet high. A marble statue of Scott by Steele, for which the sculptor received L.2000, is placed underneath the princi-

 pal arch, and several sculptural impersonations of characters portrayed in the writings of Sir Walter occupy some of the larger niches.

The equestrian statue of Charles II. (Parliament Square), in vigour of design and general effect, maintains its rank as one of the best specimens of metal statuary in the city. It was cast in Holland, and is composed of lead.

The fine equestrian statue of the Duke of Wellington, by Steele, occupies a prominent position in front of the Register Office. The statue is fully 13 feet in height, and contains about 12 tons of metal. The pedestal, of Aberdeen granite, is 12½ feet high. The different parts were connected by fusion—a novel operation, attended with considerable labour and difficulty. The ceremony of its inauguration took place in 1852. A statue of Burns, by Flaxman, is in the hall of the University Library. The equestrian statue of John Fourth Earl of Hopetoun, in bronze, stands in front of the Royal Bank, St Andrew Square. There are two statues of Queen Victoria; one, by Steele, on the top of the Royal Institution, and another in front of Holyrood Palace, by A. H. Ritchie. In George Street, at the crossing of Hanover Street, stands a pedestal surmounted by a bronze figure of George IV., erected in 1832, in commemoration of the visit of His Majesty to Scotland in 1822. A statue of Pitt, on a similar pedestal, was erected in George Street, at the crossing of Frederick Street, in 1833. Both statues are by Chantrey. There is a bronze statue of Frederick Duke of York on the Castle Hill; and a statue of Watt, in freestone, by Sclater, is placed in front of the School of Arts, Adam Square.

Population. In 1755, shortly before the commencement of the New Town, Edinburgh had a population amounting to 57,195; in 1775 it was computed at 70,430; and in 1791 it had risen to about 80,000. In 1801, by parliamentary census, the amount was 82,560; in 1811 it was 102,987; in 1821 it was 138,235; but in these latter enumerations the population of Leith was included.

Statistics of Population, extracted from Mr Thorburn's Analysis of the Census of 1851.

Population of the Ancient and Extended Royalty.

Divisions and Parishes.	Males.	Females.	Total.	Total, 1841.	Increase in 1851.
I. Old Town.					
1. Greyfriars' (New) Church Parish	1,340	1,382	2,722	2,481	241
2. Greyfriars' (Old) do.	1,445	1 605	3,050	2,580	470
3. High do.	1,581	1,737	3,318	2,785	533
4. Lady Yester's do.	1,075	1,200	2,275	1,800	475
5. New North do.	1,530	1,660	3,190	2,627	563
6. Old do.	2,029	2,208	4,237	2,949	1,288
7. St John's do.	1,486	1,580	3,067	2,140	927
8. Tolbooth do.	1,123	1,194	2,317	2,216	101
9. Trinity College do.	1,518	1,641	3,159	2,314	845
10. Tron do.	1,723	1,799	3,522	2,498	1,024
	14,850	16,007	30,857	24,390	6,467
II. New Town.					
1. Greenside Church Parish	1,613	1,953	3,566	3,105	461
2. St Andrew's do.	2,078	2,724	4,802	4,941	138
3. St George's do.	3,607	5,643	9,250	8,064	1,186
4. St Mary's do.	2,854	5,029	7,883	6,724	1,161
5. St Stephen's do.	2,975	4,832	7,807	6,754	1,225
	13,127	20,181	33,308	29,588	3,720
III. Public Institutions,	1,149	1,294	2,443	2,358	85
Recapitulation.					
1. Old Town	14,850	16,007	30,857	24,390	6,467
2. New Town	13,127	20,181	33,308	29,588	3,720
3. Public Institutions	1,149	1,294	2,443	2,358	85
Total	29,126	37,482	66,608	56,336	10,272

Population of the Parliamentary Burgh.[1]

Divisions of the Parliamentary Burgh.	Families.	Persons.				
		Males.	Females.	Total.	Total 1841.	Increase 1851.
1. The City Proper, or Royal Burgh	12,691	29,126	37,482	66,608	56,336	10,272
2. Part of St Cuthbert's Parish......	16,929	34,943	43,647	78,590	68,390	10,200
3. Canongate Parish.....	2,334	4,851	5,729	10,580	8,922	1,658
4. Edinburgh Castle.....	...	568	149	717	1,022	305
5. Part of South Leith Parish	714	1,548	2,041	3,589	3,229	360
Total....................	32,668	71,036	89,048	160,084	137,899	22,185

Progress of the Population of the Ancient and Extended Royalties, 1801 *to* 1851.

Year.	Old Town.			New Town.			Total.		
	Numbers.	Increase in past 10 Years.		Numbers.	Increase in past 10 Years.		Numbers.	Increase in past 10 Years.	
		Actual.	Rate of, per Cent.		Actual.	Rate of, per Cent.		Actual.	Rate of, per Cent.
1801	20,658	...	...	10,573		...	31,231	...	...
1811	23,355	2,697	13·1	12,841	2,268	21·4	36,196	4,965	15·8
1821	35,920	12,565	53 7	15,848	3,007	23·4	41,768	5,572	12·6
1831	28,196	7,724	21·1	26,796	11,188	68·5	54,992	13,124	34·1
1841	24,390	3,806	13 8	29,588	2,552	11·4	56,336	1,344	2·4
1851	30,857	6,467	26·7	33,308	3,720	12·8	66,608	10,272	17·8
Increase in 50 Years.	...	10,179	49·2	...	22,735	215·0	...	35,367	113

Increase.—The population, which between the census of 1831 and that of 1841 had been almost stationary, has during the last ten years received a very considerable augmentation. The increase is 10,477 or 18 per cent., while, taking the *Old Town* separately, the increase is 6467 or 27 per cent., demonstrating generally the prosperity of the city during the last ten years.

In the absence of extended commercial transactions and manufactures, which have caused such a large accession to the population of Glasgow, and in England to that of the metropolis, Liverpool, Manchester, and other manufacturing towns, the increase in the Old Town may perhaps be ascribed to the construction of the railways communicating with the city, which, since the date of the last census, had, in consideration of the high wages, induced many of the natives of Ireland to leave their own country and settle in Edinburgh. Again, by the operation of the acts for extending the royalty, Leith Street Terrace, the greater part of Leith Street, part of East Register Street, East Broughton Place, and part of Broughton Place, containing collectively a population of about 1200 persons, have, since the census of 1841, been disjoined from St Cuthbert's Parish, and annexed to the extended royalty. Another cause has tended in some degree to augment the population. The census, which in 1851 was taken on the 30th of March, was in 1841 taken on the 6th June, at which time considerable numbers of the population generally retire to the country. Against these "accidental" causes of increase must be placed the dislodgment of the population residing in Canal Street and its immediate neighbourhood, removed since 1841 to make room for the various railway stations.

Old Church Parish is pre-eminent in the department of "Increase." That of the males amounts to 50 per cent. The females show an increase of 32 per cent.: the average of both sexes is 44 per cent. Features of parishes.

[1] For the information of such as may not be resident in Edinburgh, it may be proper to state, that "City," "Royal Burgh," and "Ancient and Extended Royalty," are synonymous terms. "Old Town" and "New Town," again, correspond with "Ancient Royalty" and "Extended Royalty," respectively.

St Mary's Parish exhibits strikingly the disparity of the sexes, which forms so remarkable a feature in the New Town; while the male population numbers 2854, the females amount to 5029, or nearly double. If we exclude the juvenile portion of the population, the results are still more extraordinary; for, while the male population above 15 years of age amounts to 1804, the females of the same class are 3970—being considerably more than double the male population. The solution of this remarkable fact is to be found in the number of female servants in this parish. Of these there are 2254 above 15 years of age—a number considerably above half of the entire adult female population.

Rental.—The gross amount of the rental of dwelling-houses, shops, warehouses, &c., producing above five pounds of rent, within the bounds of police, for the year ending at Whitsunday 1833, was L.406,484. In the year 1853 this sum had risen to L.479,051, and in 1854 to L.484,563.

EDINBURGHSHIRE, or, as it is often called, MID-LOTHIAN, is the seat of the metropolis of Scotland. It is situated between N. Lat., 55. 39. and 50. 59., and Long. W. of Greenwich, 2. 36. and 3. 33. Its boundaries are the Firth of Forth on the N., Linlithgowshire or West-Lothian on the N.W., Lanarkshire S.W., Peebles and Selkirkshire on the S., and Roxburgh, Berwick, and Haddington shires on the E. In form it is very irregular, being narrowest to the Forth, and spreading out towards Lanark and Roxburgh shires. The area comprises 360 square miles, or 230,400 acres; whereof 99,275 acres are under regular cultivation, 26,657½ acres permanent pasture, 831¾ irrigated meadow, 4177¾ called waste, 7321¼ in wood; the remaining area is occupied by towns, villages, sheep-walks, roads, &c.

The surface of this county presents a great variety of scenery. Within the space of a few miles the stately grandeur of the metropolis, the trim elegance of the suburban villa, and the desolate loneliness of a highland glen may be seen. Bounded by the Firth of Forth from Musselburgh to Cramond, the land everywhere rises towards the base of the Pentland Hills, which advance boldly from the S.W. to within five miles of the sea at their eastern extremity. S. and E. of these hills the surface is flat but broken, and again rises to the Lammermoors, the mountains at the head of the Gala, and the Moorfoot-hills. Of the low districts comparatively a small portion is flat. The occasional outbursts of trap, and frequent undulations, diversify its surface, while the woods surrounding the residences of the proprietors beautify and enrich a scene possessing much natural grandeur and loveliness. One cannot travel along a mile or two of road, but some eminence brings into view the ever-changing sea, with the Lomonds, Ochil Hills, and the Grampian Mountains in the distance; while Arthur Seat, the Castle Rock, the Braid, Craiglockhart, and Corstorphine Hills, and the more lofty sweeps of the Pentlands, contrast finely with the rich and beautiful plains around.

Many memorials of the ancient inhabitants of this district have been found, or may still be seen. At Cramond various objects of Roman art have been got; and it is believed that that place was once their principal seaport on the east of Scotland. Along the banks of the Almond, which falls into the sea there, and upwards to where it passes into West-Lothian in Livingston parish, numerous burial places have been discovered; the chief of which is at Old Liston, having the form of a circular mound rising in the centre of a flat field, in the middle of which field stand three large upright stones, like giant guards over the ashes of the dead. Not far off there is another rough pillar; while at the Briggs farm stands the "Cat-Stane," with a Roman inscription upon it. In Ratho parish there is also an upright pillar and an altar stone. Above Comiston and near Morton, a similar upright stone exists, while more of these Standing Stones, as they are called, described in the local traditions as the battle-stones of the Picts, are seen in other situations. On various heights, such as Dalmahoy Hill, are shown what are said to have been the camps of the invaders at the time when the bow and the sling formed the arms of the warriors.

On the North Esk several traces of the early people who dwelt there also exist, but the valley of that stream is more enriched with the remains of a more advanced period of history; of which the chapel of Roslin, founded by the St Clairs in 1446, and Hawthornden, the seat of the poet Drummond, attract many to its banks. Further south Borthwick and Crichton Castles stand as records of the age before gunpowder was known. Dalhousie Castle and Dalkeith Palace keep up the connection between the past and the present, which Craigmillar, associated with the name of Mary Queen of Scots, has long ceased to do. Merchiston Castle, where dwelt Napier the inventor of logarithms, is seen to the S. of the city; while many a modern pile has since been raised between Whitehill and Barnton. On the S.E. brow of the Pentlands, at a place called Rullion Green, the Covenanters gave battle to the king's troops.

Of the several streams rising in the hilly ranges, the Gala flows southwards to the Tweed—in the district which bears its name. The Tyne, rising above Crichton, runs N.E. into Haddingtonshire. There is also the Esk, whereof the southern branch flows from the Moorfoot Hills, the northern from the southern slopes of the Pentlands. The Water of Leith also rises in the north-western side of the same hills. The Almond rises in Lanarkshire, and forms the boundary between West-Lothian for a considerable space. Rising in an elevated district, the course of these streams, though short, affords a large amount of water-power, considering their volume. The only loch of any extent is that at Duddingstone, near Edinburgh. The Edinburgh Water Company have constructed several large reservoirs—the first, called the Compensation Pond, between two hills at Logan House; and several others on the northern side of the Pentlands, at Bonaly and Bavelaw; while the reservoir for the supply of the Union Canal at Cobbinshaw covers several hundred acres.

The natural history of the county affords a wide field for interesting investigation. Hutton first brought the rocks into notice; and since then the fossil fishes in Burdiehouse lime-quarries, and the fossil trees at Craigleith, are conspicuous. Of the various rocks which are found, none can surpass the Craigleith freestone for building purposes; and a vast excavation has been made for the supply of this material for the city. The cost both of quarrying and hewing the rock has caused recourse to be had to cheaper substitutes; and from Redhall and Hailes much stone is taken. This last forms coarse pavement and excellent steps for stairs, and is largely wrought. Many valuable greenstone or whinstone quarries exist: that at Barnton Mount supplies blocks of large size, which have been sent to England for docks, and even to Russia for fortifications. The causeway stones for the streets of Edinburgh are now procured from the whin quarries at Ratho, whence they are conveyed by the Union Canal. Materials of this sort for roads abound in every quarter.

Coal occupies two situations. The extensive deposits in the basin lying between the Pentlands, Inveresk, and Crichton, is the source from which a large supply is taken to the city. As many as 33 seams are enumerated, of various thickness and quality, including gas as well as household coal. The history of the working of these various seams, and its results on the fortunes of their proprietors, or those interested in them, has been of a very chequered nature; large sums having been lost in a fruitless search, or in too sanguine expectations as to the richness of the beds to be reached. Along the northern side of the Pentlands,

from the city to the western extremity, a distance of 18 miles, no coal is wrought; but close on the borders of West Lothian, at Muirhouse-dykes, Wood-Muir, and Longford, a supply is procured for the wants of the district.

Limestone is of frequent occurrence, and is wrought in many situations where coal is not to be had: at Esperston in the south; at Cousland, Crichton, Burdiehouse, and Gilmerton, near Edinburgh; at the Camps in Kirknewton parish; at Muireston and Levenseat still further west. Less is now used for agricultural purposes than formerly, but for smelting iron a large supply is quarried.

Although no blast furnaces have been erected in this county, nor any of those large works which have changed cold barren moorlands into populous districts, and added so largely to the wealth of the country, still ironstone has been wrought for a long period; first to supply the Wilsonton works, and more lately, and now at Muldron in West Calder parish, for the Shotts Company.

Numerous beds of clays are found, and when tile-draining became so prevalent about 1835, many works were erected. The demand having fallen off, they now only are found where a good local demand, fine clay, and plenty of coal are combined; or at Portobello with a large brick trade; at which place and at Edmonstone, fire-clay also is manufactured into the various articles for which it is now used.

To paper-works and corn-mills the water-power of the district is chiefly applied. The quantity of paper made on the Esk and Water of Leith is very great: the process of manufacture is curious and interesting, and forms a striking criterion of the progress of art and civilization. Large quantities of flour are made, and also pot-barley; while much of the oatmeal, which forms the food of the manufacturing districts, is made here. The art of milling is here thoroughly understood, and the article commands the highest price in the market. There are fewer distilleries than formerly. There are carpet-works at Lasswade, gunpowder mills at Stobbs and Roslin, iron-works at Cramond, potteries and salt-pans in Inveresk parish, sailcloth-yarn mills at Balerno.

The climate varies exceedingly; along the low flat eastern portion less rain falls than westwards, while the air is drier. At Inveresk, 90 feet above the sea level, during seven years ending 1853, the average fall was 24·8 inches. In Ratho parish, at 350 feet, 28·8 inches was the fall during the same period. In the earlier editions of this work 25·75 inches is stated as the average fall for the eight years ending 1792 near Edinburgh, and 46°·57 was the mean temperature. At the sea level at Leith 48°·36 is the recent average, while at Bonaly, 1100 feet above the sea, 44°·21 is found to be the mean.

The prevailing winds are from the south-west, north, and north-east. This last, save on the coast side, never rises so high as the south-west, but its effects are far more pernicious on men and animals. In few other counties is the effect of altitude so distinctly traceable, or so sudden. On the shores of the Firth, up the Almond and Esk, and in several of the rich flats, the grain crops ripen fully earlier than in most counties; while a couple of miles nearer the hills, and 200 feet higher, the harvest is ten days later; and still further up at an elevation of 600 feet, another week at least intervenes; and in some spots the crops are as late as any in Scotland. It has often been a subject of remark that the *fiars* prices of grain for a county so placed as this is are lower than others not so favourably situated. The cause is the variety of climate. So long has this been known, that from time immemorial, in fixing these prices, it has been the practice to divide the county into three districts, the Low, the Middle, and the High, examine from each an equal number of witnesses, strike the average from their sales, and take that as the *fiars* price. As the agriculture of these districts is very dissimilar, we can follow no better division than that referred to.

The low district extends from the coast-side inwards by Dalkeith, Slateford, and Ratho. Here are grown those crops which supply the wants of the city. Potatoes, turnip, clover grass, hay, straw, are all carried there, as well as grain; manure is brought back; and cattle are either reared or fattened. Several dairies send milk fresh to town, and their number is increasing. A few fields are pastured, but in general the only grass land is around the houses of the landlords. The farms contain from 50 to 400 acres, and are let on 19 years' leases at rents from L.3 to L.6 per acre, one-half of which is payable at Candlemas, the other at Whitsunday or Lammas, in the year succeeding that on which the crop is grown; and which usually varies with the price of grain. The labour is performed by married men who live in cottages on the farm. Three are required for each 100 acres, and one horse for every 20 or 30 acres, according to situation. Women and boys, some of whom come from the city, do the barn work, weeding and cleaning, and other light labour. The harvest work is chiefly performed by Irish reapers, and some few scythemen. Reaping machines have also been tried, but the heavy tangled crops are too much for them. The land for potatoes is either manured in autumn, or in the drill when planting. From 24 to 34 tons is allowed of horse and cow dung per acre. When the lesser quantity is given, guano also at the rate of from 2 to 6 cwt. accompanies it. But guano is no favourite so near the city. The time of planting is March and April; seed per acre, 10 cwt.· produce, 5 to 8 tons. Wheat succeeds, and is sown in November, either broadcast or in drill. Hunter's and Fenton's are the kinds mostly sown; but Spalding's and Talavera are also grown. Either barley or turnips succeed the wheat. If barley, it has 15 tons of dung ploughed in autumn, or an equivalent of guano in spring, to be followed by turnip. The turnips in either case receive rather less manure than the potatoes, and are all carted off the ground; being sold to cowfeeders, who pay from L.12 to L.20 per acre for them. Barley or spring wheat again succeeds, to be followed by clover grass, which is sold green. Oats follow again, to be succeeded by potatoes or beans. The grain grown in this district is of the finest quality, and commands the highest price for seed corn, for which there is a considerable demand. A small part of this district is naturally dry, and the soil over the whole has been much altered with repeated heavy manurings, and it is now mostly of a free open texture, the heavy clayey portion having become so. Elkington's system of draining was early introduced, and tile-draining more recently has been extensively followed, first at two feet deep, and of late at four, and from 18 to 36 feet apart. Steam-engines for thrashing the crops have been in use since 1830. They are non-condensing, and from four to ten horse power. Fences are chiefly thorn hedges; but stone walls surround the pleasure-grounds of the gentry. The capital required for farming purposes amounts to about L.10 per acre.

The farm buildings are not extensive. They are either slated or tiled. Improvements have taken place in the new cottages, but there is still much to be done in this respect. The *bothy* system is unknown here. The ploughmen are a steady, regular class, hired by the year, partly in money, and partly in meal and potatoes,—the wages for 1854 being about 12s. 6d. per week, the various items being calculated at fiars prices.

There are about 200 acres of irrigated meadows, east and west of the city. Those to the west, from the liquid not being so rich, have never produced such large quantities of grass as those eastwards, where the most of them lie. The old meadows at Lochend Farm extended only to 15 acres; but a large increase has taken place between these and the sea, wherever the water could be raised, either by levels or steam power; and a large barren waste on the sea-coast between Portobello and Leith, now carries luxuriant crops of grass. From four to five cuttings are

yearly obtained. Each acre lets for the season at from L.15 to L.35. The grass is entirely consumed by cows (it having valuable milk-producing properties), and, along with brewers' grains, forms their summer food. Of all the present applications of sewerage-manure water, that by gravitation forms the most profitable; and when it can be applied without detriment to the health of the inhabitants, it is certainly very deserving of being so, for it supplies a large quantity of milk-producing food, in close proximity to the place where it is most required.

The nursery grounds are very extensive, and supply a variety and quantity of plants, shrubs, and forest trees, equal to any in Britain.

In one parish in the vicinity of the town the average produce of wheat per acre for the four years ending 1854 has been estimated at 48 bushels, barley $57\frac{1}{2}$ do., oats $64\frac{1}{2}$ do., turnips 24 tons, potatoes $7\frac{4}{20}$ tons per acre; which may be compared with a similar estimate from a high parish of $25\frac{3}{8}$ bushels wheat, $25\frac{5}{8}$ barley, $20\frac{4}{8}$ oats, $11\frac{4}{20}$ tons turnip, and $2\frac{8}{20}$ tons potatoes: showing the increase which high cultivation, plenty of manure, and fine climate, confers on a soil originally not of the finest quality.

The middle district comprehends the space lying beyond the forementioned line, but does not approach to the hill sides or moorland tract. It covers a larger space than the former, and the same system of farming prevails as in the most improved counties removed from cities. Few potatoes are grown, and turnips are all consumed on the farm with the straw. Save where railways pass, distance prevents town manure being carted; but the canal towards the west takes off a considerable quantity. The rents range between L.1, 10s. and L.3 per acre. The farms are larger, fewer hands are employed, and also fewer horses kept. The crops are not so large, nor the quality of grain so fine. Guano is largely used, in conjunction with farmyard dung. The farm offices are commodious, but in many cases old. The rearing and feeding of cattle is here practised. Byres, boxes, and yards, are all in use. Save the harvest labourers, all the people reside on the farm. Draining with tiles and small stones began about 1830, and was very generally practised, the distance apart of the drains being about 36 feet. Since 1845 deeper drains have been put into the intermediate furrows, with pipes and collars. There are considerably more dairy farms here. A large portion of land is pasture, the best part of which is grazed with sheep, which are sold fat. The soil varies from the free open soil lying on trap, to the stiff, heavyish clays. Most of it is of an intermediate quality; and the system of fallowing having given place to turnip husbandry, in texture it has become much more free, and on part of it the turnips are eaten off with sheep. The cattle fed are chiefly bought for that purpose: they were formerly all of the Angus or Aberdeen horned breeds, but now they are either Irish or English one and two year olds. From the quantity of stock kept, fully L.10 per acre is required as capital, as the high farming system increases the amount of capital required. The leases here are also for nineteen years, and, as a rule, the old tenants have always the first offer of their farms before the expiry of the existing contracts. Many of the properties being of moderate size, the proprietors are as often changed as the tenants. On one estate we know, which has been held by eight different owners during the last fifty years, a tenant has continued o hold the same farm under all of them.

The high district includes all the moorland tracts and hill-sides where corn is grown. As it reaches an elevation of more than 800 feet, almost no wheat is grown, and oats are the chief corn crop. To the S.E. sheep are reared and fed, while to the W. the dairy is most common—indeed, on every farm from 10 to 40 cows are kept. The milk is churned, and butter and milk carted to the city, often 16 or 18 miles: brewers' grains or distillers' refuse being taken back in return. The cows are partly bred on the farm, and are of the Ayrshire breed, or crosses between it and the short-horn. The churns are wrought with horse-power. The rents vary between 15s. and L.2 per acre. The farms are often larger than in the other districts, but of course less valuable. Improvements have proceeded somewhat slowly here; and there is still a large portion of land to drain, which is now being done with drains $3\frac{1}{2}$ or 4 feet deep.

The accommodation both for the tenants, their labourers, and cattle, is somewhat poor. A large space is occupied with the Pentlands, Moorfoot, and other hills; on these both Cheviot and blackfaced sheep are grazed. This last breed predominates on the higher heathy hills, while the Cheviots occupy the lower greener heights. On each holding there are from 30 to 80 scores kept; one shepherd attends to upwards of 30 scores. Lowland farmers hold many of these farms, and are non-resident. Improvements have been going on here also. Many years ago what were called sheep drains were cut; in several places these are giving place to deeper drains, fitted with pipe and collar. Among the hills bordering on the Gala, where the subsoil is dry, guano has been extensively used for raising turnips. These are eaten off with sheep, and a crop of barley raised, or they are at once sown for pasture, by which means the herbage has been doubled. Very great improvements have been effected on many farms along the Gala by inclosures, since the railway passed through that district.

There are two weekly grain markets held in the county —in Edinburgh on Wednesday, and Dalkeith on Thursday. The latter, since the railways have been opened, has fallen from the position it was wont to hold, of the first in Scotland,—Edinburgh now taking that place. There were sold in that market in 1854 of

	Quarters.
Wheat	41,764
Barley	50,967
Oats	47,705
Beans	5,596

Of course, these quantities do not include the whole sales, but only those passing through the market books. The grain is either brought in by carts or by railway, and is paid for immediately after the sale.

There is also a weekly sheep and cattle market on Wednesday, when from 3000 to 6000 sheep, and from 600 to 1000 cattle are offered for sale. On the second Tuesday of November Hallow Fair is held, when from 10,000 to 15,000 cattle are exhibited, and a horse market thereafter. There is a sheep fair also on the first Monday in April for lambing ewes at House of Muir, with a show of about 10,000 head of stock. A cattle and horse fair is held in October in Dalkeith; and two hiring fairs at Mid-Calder, where both cattle and horses are exposed for sale in March and October.

The valuation of Edinburghshire taken in 1649 is L.191,054, 3s. 9d. Scots. In 1811 the real rental of houses and lands, according to the property-tax, was L.677,832, 4s. 7d. In 1849, from the prisons assessment, L.1,389,111 was the valuation; and in 1855, at the previous rate of increase, it will reach one and a half millions sterling. In the county there are 30 parishes, with part of Fala and Kirkliston. Five parishes are included in Edinburgh and Leith, with a population in all, by the census of 1851, of 259,493, including Fala, but not part of Kirkliston. Excluding both of these and the five city parishes, the 25 landward ones contained 64,493 in 1851, all of which are now assessed for the poor, on whom L.15,902, 6s. $8\frac{3}{4}$d. was expended in 1853. A police force also exists in the county, with a superintendent, assistants, and 22 district officers.

Portobello and Granton, since the opening of the railways, may be said to form part of the metropolis. Dalkeith is the largest landward town, or burgh of barony

Musselburgh, Lasswade, Gilmerton, Loanhead, Cramond, Corstorphine, Mid-Calder, Ratho, and Currie, do not exceed the size of large villages.

The Union Canal, which was opened in 1822, runs for 10 miles through the county, and conveys stones, coal, &c., to the city, and manure from it, but no passengers or goods. The Dalkeith Railway was laid in 1836, but merely as a horse-way. Since then the Edinburgh and Glasgow Railway has been constructed, passing through the county for about 10 miles; the Caledonian for 18; the North British, in its various lines, for fully 30 miles; and the Edinburgh, Perth, and Dundee, to Granton and Leith.

There are in the county 423 miles of turnpike roads, from which L.22,210 was collected in 1850 from the five district trusts. The traffic on the various roads has now greatly changed, the most of it consisting of short journeys to the railway stations; and several of the finest roads, such as the one to Queensferry, are now in little use.

There are ten noblemen holding property in the county, the most of whom have residences in it; also nine baronets, and ten families who have held their estates for a very long period. The rest of the land in the county has frequently changed owners.

Edinburghshire sends four members to parliament; two from the city; one from Leith, Portobello, and Musselburgh; and one from the county, the constituency of which amounted to 2133 in 1854.

Agricultural Statistics of the County Crop 1854.

(Total number of imperial acres returned 211,147½.)

Number of acres imperial in tillage.

Wheat	8,128
Barley	11,212¼
Oats	22,852
Bere	50¼
Beans	1,551
Pease	185¼
Vetches	1,080¼
Turnips	14,288½
Potatoes	5,518½
Mangold	77
Carrots	62
Cabbages	89¼
Flax	16
Turnip seed	155
Bare fallow	635¾

Number of acres in grass, roads, and woods.

Grass in rotation of farm	33,373½
Permanent pasture	26,657½
Irrigated meadows	831¾
Sheep walks	69,284¾
Houses, roads, fences	3,598¾
Waste	4,177¾
Woods	7,321¾

Average produce per imperial acre of following crops.

	Bushels.	Pecks.
Wheat	32	1
Barley	40	2
Oats	38	0
Bere or bigg	31	2
Beans	31	1
	Tons.	Cwts.
Turnips	17	4
Potatoes	4	15

Gross produce of following crops.

	Bushels.
Wheat	262,128
Barley	454,116
Oats	868,376
Bere or bigg	1,582
Beans	48,468
	Tons.
Turnips	245,762
Potatoes	26,212

Total number of stock kept, 1854.

Horses	4,582
Milk cows	5,430
Other cattle	7,784
Calves	2,540
Ewes, gimmers, ewe hogs	83,395
Tups, wethers, wether hogs	26,148
Swine	6,403

The above returns are taken from the report furnished to the Board of Trade by the Highland Society. The entire extent of the county is not accounted for, as many of the hill farmers do not know the number of acres they hold. The produce of wheat, as given, may be considered about two bushels per acre above an average, and that of oats and barley slightly above it. The number of farmers is said by the last census (1851) to amount to 534.

EDMONTON, a village in the county of Middlesex, 8 miles north of London, on the London and Cambridge railway. It has an ancient parish church and numerous villas. This is the place referred to in Cowper's humorous poem of John Gilpin.

EDOM. See Idumæa.

EDRISI, or Aldrisi, the most eminent of the geographers who have written in the Arabic language. There is no individual of equal eminence over whose life there hangs a deeper veil of mystery, the various parts of it affording rather subjects of controversy to the learned than of precise information to the biographer. The place, and even the country in which he was born, compose the first subject of disputation. Sionita and Hezronita, who published a Latin translation of his work at Paris, make him a Nubian, and gave to their work the title of *Geographia Nubiensis*, the Nubian Geography. They proceeded upon the expression there used, namely, "the Nile of Egypt, which cuts *our* land." Hartmann was at once led to suspect the correctness of this inference, by observing that Nubia was one of the countries of which Edrisi gives the most meagre and imperfect account; and his suspicions were confirmed by learning that Ockley, on examining two manuscripts in the Bodleian Library, had found in both "that land," instead of "*our* land." It seems now generally agreed, therefore, that there is no reason to suppose him of Nubian origin. Others have assigned him an Egyptian one, which seems more probable, yet rests solely upon the erroneous reading above referred to. In 1663, Bochart stated that he had found in a manuscript of Leo Africanus, that Edrisi was born at Mazara, in Sicily, in 1098. Next year, however, the manuscript was edited by Hottinger, in an appendix to his work entitled *Bibliothecarius Quadripartibus*, when it appeared that the person supposed to be Edrisi was there named Esseriff Essachalli. Esseriff, or Scheriff, is indeed an usual appellation of Edrisi, but it is common to many, and is rather a title than a name. The rest of the name, and the date of birth, are materially different, so that there seems very little reason to doubt that Bochart was here mistaken.

The most positive statement on the subject is that of Casiri, who says (*Bibliotheca Arabico-Hispanica*, ii. 9), that if Edrisi, as appeared probable, were the person designated by the Mohammedan writers under the long appellation of Abu Abdallah Mohamad Ben Mohamad Ben Abdallah Ben Edris, he was born at Septa, or Ceuta, on the coast of Morocco, in the year of the Hegira 493 (A.D. 1099). Casiri not only qualifies his statement with this condition, but he does not state the authorities from which it is derived; so that it rests only upon the confidence reposed in his learning and accuracy. Edrisi was long a mighty name in Northern Africa; but in 919 the dynasty was subverted by Mahedi Abdallah, and the proscribed wrecks of the fa-

mily, according to D'Herbelot, afterwards sought refuge in Sicily. This certainly tends to strengthen the Sicilian origin of our author, though it is not probable that many would seek refuge by concealment in their native country.

If we may trust the information of Casiri, Edrisi pursued his studies at Cordova, and from the accurate description he has given of Spain, it is probable that he had travelled through a great part of that country. Various circumstances prove that he removed to Sicily, and began to compose his great work under the patronage, and indeed at the express desire, of Roger II. king of that island. It was completed about the year of the Hegira 548, A.D. 1153.

It has been a subject of pretty warm controversy among the learned whether Edrisi was a Mohammedan or a Christian. Sionita, who adopts the latter opinion, observes that he calls our Saviour the Lord, and also speaks with profound respect of the holy Virgin, and of various saints. These arguments are strenuously repelled by Hartmann, who lays much stress on the circumstance that Edrisi, amongst his numerous names, bears that of Mohammed; but though this may imply that he was a Mohammedan by birth, it does not authorize us to infer that he may not have become a convert to the opposite faith. Although he writes in a style from which no positive inference can be drawn, yet considering how high religious differences ran in that age, it does not appear very probable that he could have resided in Sicily, or been in such high favour with Roger, without adopting the religion of the monarch and country.

Bochart has fixed the date of his death in the year 1122; but this date clearly proves that he had some quite different person in view; since it appears by the preface to Edrisi's own work that its completion took place in the year 1153. No other notice, nor even conjecture, relative to the time or manner of his death, is to be found in any author.

His work has appeared under various titles. The first and fullest appears to have been, *The going out of a Curious Man to explore the Regions of the Globe, its Provinces, Islands, Cities, and their Dimensions and Situation.* This is sometimes abbreviated. Sionita published it under the name of *Relaxation of the Curious Mind;* but the title of *Nubian Geography,* which he and his companion imposed upon it, is altogether arbitrary.

The work contains a full description of the whole world, as far as it was known to the author, with its countries, cities, and all its features, physical and political. The world is divided into seven *climates,* commencing at the equinoctial line, and extending northwards to the limit at which the earth is supposed to be rendered uninhabitable by cold. Each climate is then divided by perpendicular lines into eleven equal parts, beginning with the western coast of Africa, and ending with the eastern coast of Asia. The whole world is thus formed into 77 equal square compartments, resembling those upon a chess-board, or those formed upon a plane map, by the intersecting lines of latitude and longitude. The geographer begins with the first part of the first climate, including the western part of Central Africa, and proceeds eastward through the different divisions of this climate, till he finds its termination in the Sea of China. He then returns to the first part of the second climate, and so proceeds till he reaches the eleventh part of the seventh climate, which terminates in the north-eastern extremity of Asia. The inconveniences of such an arrangement must be abundantly obvious.

The only valuable unpublished manuscripts of Edrisi which now exist in Europe are two which are preserved in the Bodleian Library. The first, which was brought over from Egypt by Greaves, is written in the Arabic character peculiar to Northern Africa. It is illustrated by a map of the known world, and by 33 other maps, containing each part of a climate, so that there are maps only for the first three climates. The second manuscript, brought by Pococke from Syria, is written in the Arabic character, as used in that country, and bears the date of 906 of the Hegira, or A.D. 1500. It consists of 320 leaves, and is illustrated by one general and 77 particular maps, the last consequently including all the parts of every climate. The general map has been published by Dr Vincent in his *Periplus of the Erythræan Sea.*

There is a manuscript (Cod. DLXXX) in the Royal Library at Paris, which professes to be the production of Edrisi; but D'Herbelot, it appears, has not made use of it as such; and De Guignes expresses positive disbelief on the subject. Hartmann, however, found it to coincide in many particulars with the geography of Edrisi. A copy of our author's work was contained at one time in the library of the Escurial, but it was destroyed by a great fire in 1671.

The geography of Edrisi, in the original Arabic, was printed at Rome in 1592, at the Medicean press, from a manuscript preserved in the grand-ducal library at Florence. Both the paper and printing are exceedingly neat, but the volume swarms with typographical errors, and forms only a clumsy epitome of the original work. The description of Mecca, which is unaccountably omitted, has been supplied by Pococke from his manuscript. Hartmann, D'Herbelot, and Casiri justly remark the imperfections of this edition. In most bibliographical works, this impression has been characterized as one of the rarest of books; but Adler, in a visit to Florence, found in the palace there 1129 copies, which were publicly exposed to sale at a moderate rate.

In 1619, two oriental scholars, Gabriel Sionita and John Hezronita, published at Paris a Latin translation of Edrisi's work, bearing the title of *Geographia Nubiensis;* but it is not executed with all that accuracy which might have been expected, particularly in regard to the proper names. George Hieronymus Velschius, an eminent German scholar, had prepared a copy of the Arabic original, with a Latin translation, which he intended to have illustrated with notes; but death prevented the execution of this design, and his manuscript remains deposited in the library of the university of Jena. Casiri (*Bibliotheca Arabico-Hispanica,* ii. 13) mentions that, at the request of many friends, he had determined to re-edit this work, but he appears never to have executed this intention. The part relating to Africa, preeminent certainly in point of importance, has been very ably edited by Hartmann, who has collected together all the notices relating to each particular country, and has annexed the statements of the countrymen and contemporaries of Edrisi, so that his work forms nearly a complete body of Arabian geography, as far as relates to Africa. (H.M.)

EDUCATION. See NATIONAL EDUCATION, and UNIVERSITIES.

EDULCORATION (low Lat. *edulco,* from *dulcis, sweet*), is used in chemistry to signify the rendering substances more mild, by freeing them from acids and salts, or other soluble impurities, by washing until the water comes off quite pure and insipid.

EDWARD, the name of several kings of England. See ENGLAND.

EDWARDS, GEORGE, fellow of the Royal and Antiquarian Societies, was born at Stratford, a hamlet belonging to Westham in Essex, on the 3d of April 1693. After having spent some time at school, he was put as apprentice to a tradesman in Fenchurch Street. His master, who was eminent both for his piety and skill in the languages, treated him with very great kindness; but about the middle of his apprenticeship an accident happened which totally put a stop to the hopes of young Edwards advancing himself in the way of trade. Dr Nicolas, a person of emi-

nence in the physical world, and a relation of his master's, happened to die. The doctor's books were removed to an apartment occupied by Edwards, who eagerly employed all his leisure hours, both during the day and great part of the night, in perusing those which treated of natural history, sculpture, painting, astronomy, and antiquities. The reading of these books entirely deprived him of any inclination which he might have formerly had for mercantile business, and he resolved to travel into foreign countries. In 1716 he visited most of the principal towns in Holland, and in about a month returned to England. Two years afterwards he took a voyage to Norway, at the invitation of a gentleman who was disposed to be his friend, and who was nephew to the master of the ship in which he embarked. At this time Charles XII. was besieging Frederickshall, an operation which prevented our young naturalist from making such excursions into the country as he would otherwise have done, for the Swedes were very careful to intercept such strangers as could not give a good account of themselves. But notwithstanding all his precaution he was confined by the Danish guard, who supposed him to be a spy employed by the enemy to procure intelligence of their designs. However, by obtaining testimonials of his innocence, a release was granted. In 1718 he returned to England, and next year he visited Paris by the way of Dieppe. During his stay in France he made two journeys of one hundred miles each, the first to Châlons in Champagne, in May 1720, and the second on foot to Orleans and Blois; but an edict happening at that time to be issued for securing vagrants, in order to transport them to America, as the banks of the Mississippi wanted population, our author narrowly escaped a western voyage. On his arrival in England, Mr Edwards closely pursued his favourite study of natural history, applying himself to drawing and colouring such animals as fell under his notice. In this pursuit he paid a strict attention to natural rather than to picturesque beauty. Birds first engaged his particular attention; and having purchased some of the best pictures of them, he was induced to make a few drawings of his own, which were admired by the curious, who encouraged the young naturalist to proceed, by paying a good price for his early labours. Amongst his first patrons and benefactors may be mentioned Mr James Theobalds of Lambeth, a gentleman zealous for the promotion of science. Being thus unexpectedly encouraged, he increased in skill and assiduity, and, by application to his favourite pursuit, procured a decent subsistence and a large acquaintance. However, he remitted his industry in 1731, when, in company with two of his relations, he made an excursion to Holland and Brabant, where he collected several scarce books and prints, and had an opportunity of examining the original pictures of several great masters at Antwerp, Brussels, Utrecht, and other cities. In December 1733, by the recommendation of Sir Hans Sloane, then president of the College of Physicians, he was chosen librarian to that body, and had apartments assigned him in the college. This office was peculiarly agreeable to his taste and inclination, as he had the opportunity of a constant recourse to a valuable library filled with scarce and curious books on the subject of natural history, which he so assiduously studied. By degrees he became one of the most eminent ornithologists in this or in any other country. His merit in this respect is too well known to render it necessary to pronounce any eulogium on his performances; but it may be observed, that he never trusted to others what he could perform himself, and he often found it so difficult to satisfy his own mind, that he frequently made three or four drawings in order to delineate the object in its most lively character, attitude, and representation. In the year 1743, the first volume of the *History of Birds* was published in quarto. As the number of his subscribers exceeded even his most sanguine expectations, a second volume appeared in 1747. The third volume was published in 1750; and in 1751 appeared the fourth volume. This being the last which he intended to publish at that time, he seems to have considered it as the most perfect of his productions in natural history; and therefore devoutly offered it up to the great God of nature, in humble gratitude for all the good things which he had received from Him in this world. Our author, in 1758, continued his labours under a new title, that of *Gleanings of Natural History*. A second volume of the Gleanings was published in 1760. The third part, which formed the seventh and last volume of his works, appeared in 1764. Thus our author, after a long series of years, the most studious application, and the most extensive correspondence in every quarter of the world, concluded a work which contains engravings and descriptions of more than six hundred subjects in natural history not before described or delineated. He likewise added a general index in French and English, which was afterwards perfected with the Linnæan names, by Linnæus himself, who frequently honoured him with his friendship and correspondence. Some time after Mr Edwards had been appointed librarian to the Royal College of Physicians, he was, on St Andrew's Day, in the year 1750, presented by the president and council of the Royal Society with the gold medal, the donation of Sir Godfrey Copley, annually given on that day to the author of any new discovery in art or nature, in consideration of his natural history just then completed. A copy of this medal he had afterwards engraved, and placed under the title in the first volume of his history. He was a few years afterwards elected fellow of the Royal Society and of the Society of Antiquaries, London, and also a member of many of the academies of sciences and learning in different parts of Europe. In return for these honorary distinctions from learned bodies, he presented elegantly-coloured copies of all his works to the Royal College of Physicians, the Royal Society, the Society of Antiquaries, and to the British Museum; and also to the Academy of Sciences at Paris, from which he received a very polite and obliging letter of thanks by their then secretary M. Defouchy. His collection of drawings, which amounted to upwards of nine hundred, were purchased by the Earl of Bute. They contain a great number of British as well as foreign birds, and other animals hitherto not accurately delineated or described. After the publication of the last work, having arrived at his seventieth year, he found his sight beginning to fail, and his hand losing its wonted steadiness. He retired from public employment to a little house which he had purchased at Plaistow, previously to which he disposed of all the copies as well as plates of his works. The conversation of a few select friends, and the perusal of a few select books, were the amusement of the evening of his life; and now and then he made an excursion to some of the principal cities in England, particularly to Bristol, Bath, Exeter, and Norwich. Some years before his death, the alarming depredation of a cancer, which baffled all the efforts of medical skill, deprived him of the sight of one of his eyes; and he also suffered much from the stone, to which at different periods of his life he had been subject; but in the severest paroxysms of pain he was scarcely known to utter a single complaint. Having completed his eightieth year, emaciated with age and sickness, he died, deservedly lamented, on the 23d of July 1773.

Edwards, *Bryan*, the well-known historian of the *West Indies*, was born at Westbury, in Wiltshire, on the 21st of May 1743. His father had a small paternal estate;

but as this did not exceed L.100 per annum, he found it insufficient for the maintenance of a numerous family, and endeavoured to improve his circumstances by dealing in corn and malt. This hazardous trade proved, as it often does, only a means of more deeply involving his affairs; and he died in 1756, leaving a widow and six children in a very distressed situation. Mrs Edwards, however, had two opulent brothers in the West Indies, the eldest of whom, Zachary Bayly, possessing a princely fortune, and being of a very amiable and generous disposition, undertook the support and education of young Edwards. He had already been placed by his father at the school of Mr Foot, a dissenting clergyman at Bristol, where he had been taught the elementary branches of education; but, for some reason which he never was able to divine, that person was strictly prohibited from initiating him in any branches of classical learning. He gave a species of instruction, however, not usual in schools, and from which his pupil probably derived the greatest benefit. He was accustomed to make the boys write letters, or rather essays, on various subjects, such as the beauty and dignity of truth, the obligations to a religious life, the benefits of good education, and the like, giving them, where it appeared necessary, an outline of the arguments which might be employed on the subject. When the papers were given in, he made such observations as appeared proper, insisting at least that they should be correct in point of grammar and orthography. These exercises gave occasion to display the superior talents of Edwards, whose powers of elegant composition already began to appear. He soon became the favourite of his master, who liberally praised these youthful performances, and often transmitted them for the gratification of his parents. They were entirely satisfied; but when the care of his education devolved on his uncle, the agent employed by him at Bristol was much surprised to find an entire deficiency in classical knowledge, and, imputing the blame to the master, removed him immediately to a French boarding school in the same city. It is not said that he acquired here any great portion of Greek and Latin, but he became master of the French language, and having access to an extensive circulating library, cultivated a taste for reading which adhered to him throughout the whole of his future life.

In 1759, another uncle, the younger brother of him under whose care he had hitherto been, arrived in England. He, too, was possessed of an ample fortune, became member of parliament, first for Abingdon, and afterwards for his native town, and set up a splendid establishment in London. He appeared quite disposed to befriend young Edwards, and even took the latter to reside with him; but the nephew observes, that, after enumerating his external advantages, he had nothing else to say in favour of his uncle. What the bad qualities were which drew forth so unfavourable a sentence we are not informed; but in a few months they separated, and Edwards went out to his other uncle. In this friend he seems to have found every thing he could desire; the most enlightened mind, the sweetest temper, and the most generous disposition. To this was added a truly paternal regard for himself, which was returned with all the warmth of filial affection. His uncle, finding him possessed of literary talents, but deficient in classical acquirements, engaged a Mr Teale, a clergyman, and formerly master of a free grammar-school, to reside in his house, and give him the instruction of which he stood in need. This choice proved most acceptable to Edwards; he found in Mr Teale a man of extensive information, and one, too, possessing considerable taste in poetry. He viewed him, therefore, as a companion rather than as a teacher; but this relation between the tutor and pupil, however agreeable to both, was not favourable for instilling the dry principles of grammar and prosody. A much larger proportion of their time was spent in tasting the beauties of Dryden and Pope, and in laughing at the comic sallies of Molière. Mr Edwards, upon the whole, acquired, during this period, small Latin and less Greek; but he continued to practise composition, both in prose and verse; and the two companions sent occasional pieces to the colonial newspapers.

The time was now coming when Mr Edwards' talents were to be exercised in a wider sphere. His uncle dying, bequeathed to him his property; and in 1773 he became heir to the much larger estate of Mr Hume, also of Jamaica. His wealth and talents united, now entitled him to take a lead in the political concerns of the island. In 1784 he published *Thoughts on the Proceedings of Government respecting the Trade of the West India Islands with the United States of America.* This was followed by a speech delivered at a free conference between the Council and Assembly at Jamaica, held on the 25th of November 1789, on the subject of Mr Wilberforce's propositions in the House of Commons concerning the slave trade. It was in 1793, however, that he published his great work, on which he had been many years engaged, entitled *History, Civil and Commercial, of the British Colonies in the West Indies*, 2 vols. 4to. He begins the work by giving a view of the original inhabitants of the West Indies, their manners, institutions, and the means by which they have been so entirely exterminated. This was followed by a sketch of the revolutions through which these islands have passed since the first European invasion. He gives next a geographical and statistical description of each particular island. He treats finally, at great length, of the government, the social state, and above all the commerce, of this remarkable region. In the course of the discussion, he enters fully into its relations with the African coast and the negro slave trade. Mr Edwards, as a great and long-resident proprietor, was almost inevitably led to be a supporter of this traffic. He reasons, however, in a liberal and candid manner on the question, and does not even attempt to deny the extent of the evils with which it was accompanied. He only insists that these evils have been overrated; and that Great Britain, by renouncing it whilst it was still prosecuted by the other nations of Europe, would ruin her own colonies, without doing any thing to improve the condition of the Africans. In 1796 he published, in one volume quarto, a *History of St Domingo*, an island which had excited a deep interest, in consequence of the insurrection of the slaves, and the consequent establishment of an independent negro government. In 1801 a new edition of both these works was published, in three vols. 8vo, under the general title of *History of the West Indies.* A fifth edition issued from the press in the year 1819. When Park returned from his celebrated journey, Mr Edwards, from his oral information, drew up a report of it, which was submitted to the African Society, and published in their *Transactions.* Mr Park afterwards incorporated the greater part of this into the general narrative of his *Travels*, in preparing which he availed himself much of the assistance and suggestions of Mr Edwards. It has been currently said that this narrative was entirely written by Mr Edwards; but as this assertion has been pointedly contradicted by Park, who has elsewhere shown respectable talents for composition, it can only be understood in the limited sense which has now been stated. It appears, however, that Mr Park was induced, by Mr Edwards' influence, to give rather a more favourable view of the trade in slaves than reflection afterwards led him to sanction.

Mr Edwards, after his removal to England, took up his residence at Polygon, near Southampton; and in 1796 he

became member of parliament for the borough of Grampound, which he continued to represent till his death, which took place on the 15th of July 1800. He left a short narrative of his life, which was prefixed to the edition of his history published in 1801. (H.M.)

EDWARDS, *Jonathan*, a celebrated American metaphysician and divine, was born on the 5th of October 1703, at Windsor, in the province of Connecticut. His family had originally emigrated from England in the reign of Queen Elizabeth. His father, Mr Timothy Edwards, was a clergyman of great piety and respectability, and by his mother he was grandson of Mr Solomon Stoddard, a noted and zealous divine of Northampton. Jonathan was accordingly reared in the bosom of Puritanism, and all his ideas were early imbued with the cast of thought which was native to the stock from which he had sprung. There was something indeed not a little singular in the prevailing character of religion in America in those days. A conversion seems to have been a regular era in a man's life, which could be fixed down to a date, as much as his coming of age or his being married. A very curious document remains of Jonathan's conversion, the whole steps and progress of which he has detailed for the behoof of his children; and it is a document which, even amidst all its frequent weakness and extravagance, impresses us with a high sense of the genius and of the worth of this remarkable man. We cannot avoid giving our readers a little insight into it, especially as it contains some passages of deep feeling and sensibility, which form a striking contrast to the controversial hardness of his other writings. It is full of bursts of tenderness; and even whilst the subjects of his earliest meditations were the same dark doctrines, in their most tremendous form, which he afterwards defended so ably by the help of his mature reason, amidst all the gloom which naturally surrounds them, they seem to have left upon his mind no sentiments but those of gentleness and charity. At the same time, this document affords us a distinct proof that such doctrines take their origin, in a great measure, in peculiar circumstances of society, or of the individual mind; and since they were quite as fully impressed upon Edwards before he was capable of any profound reasoning concerning them, as afterwards, the presumption is, that his early prepossessions came strongly in aid of his later conclusions.

It was in the midst of these youthful musings that he acquired a full and firm persuasion of tenets which we will own scarcely seem to us to be either so lovely, or of so good report, as the more natural sentiments of his unconverted state, which he gave up in exchange for them. "I had a variety," says he "of concerns and exercises about my soul from my childhood; but had two more remarkable seasons of awakening before I met with that change by which I was brought to those new dispositions, and that new sense of things, that I have since had. The first time was when I was a boy, some years before I went to college, at a time of remarkable awakening in my father's congregation. I was then very much affected for many months, and concerned about the things of religion." This state of mind, however, appears to have passed off; but, in his last year at college, he was visited by a severe sickness, which made him form many wise and holy resolutions, which he was afterwards for the most part enabled to keep. So far it was well; but now follows the grand proof of his conversion. "From my childhood up," he says, "my mind had been wont to be full of objections against the doctrine of God's sovereignty in choosing whom he would to eternal life, and rejecting whom he pleased, leaving them eternally to perish, and be everlastingly tormented in hell. It used to appear like a horrible doctrine to me. But I remember very well when I seemed to be convinced and fully satisfied as to this sovereignty of God, and his justice in thus eternally disposing of men according to his sovereign pleasure. But I never could give an account how or by what means I was thus convinced, not in the least imagining in the time of it, nor a long time after, that there was any extraordinary influence of God's Spirit in it, but only that now I saw farther, and my reason apprehended the justice and reasonableness of it. However, my mind rested in it, and it put an end to all those cavils and objections that had till then abode with me all the preceding part of my life. And there has been a wonderful alteration in my mind with respect to God's sovereignty from that day to this, so that I scarce ever have found so much as the rising of an objection against God's sovereignty in the most absolute sense, in showing mercy to whom he will show mercy, and hardening and eternally damning whom he will. God's absolute sovereignty and justice, with respect to salvation and damnation, is what my mind seems to rest assured of as much as of any thing that I see with my eyes." This doctrine continued throughout Mr Edwards' life in peculiar favour with him; and he employs the whole resources of his dialectics to support it, with a full conviction that he was thereby glorifying God, and performing an important service to mankind.

In this document of Mr Edwards' early opinions, we have said that, amidst all the horrors of his creed, there are many intimations of the natural fineness and sensibility of his spirit. The following passages are remarkably beautiful, and have about them a tone of pastoral or rather scriptural poetry. "Not long after I first began to experience these things, I gave an account to my father of some things that had passed in my mind. I was pretty much affected by the discourse we had together; and when the discourse was ended, I walked abroad alone in a solitary place in my father's pasture for contemplation. And as I was walking there, and looked up on the sky and clouds, there came into my mind so sweet a sense of the glorious majesty and grace of God that I know not how to express it....God's excellency, his wisdom, his purity and love, seemed to appear in every thing; in the sun, moon, and stars; in the clouds and blue sky; in the grass, flowers, trees; in the water and all nature, which used greatly to fix my mind. I often used to sit and view the moon for a long time, and so in the day time spent much time in viewing the clouds and sky, to behold the sweet glory of God in these things; in the mean time singing forth with a loud voice my contemplations of the Creator and Redeemer...I used to be a person uncommonly terrified with thunder; and it used to strike me with terror when I saw a thunder-storm rising; but now, on the contrary, it rejoiced me. I felt God at the first appearance of a thunder-storm, and used to take an opportunity at such times to fix myself to view the clouds, and see the lightnings play, and hear the majestic and awful voice of God's thunder." These confessions have let us already into the inside of Edwards' mind, and there is no need to return upon them whilst we pursue the account of his studies, life, and writings. There is a poetry and grandeur in some of his passages of this sort which show a moral sublimity of genius in the midst of enthusiastic reveries, often, in inferior minds, more productive of dark and disorderly sentiments than of sound and elevated piety. When he comes, however, to reason on his theological or philosophical tenets, he is no longer either an enthusiast or a poet; for he then proceeds with all the pertinacity and ingenuity of a hard-headed dialectician, determined neither to tolerate nor employ any weapon but stern argument.

He went young to Yale College, and as early as his thirteenth year had read Locke *On the Human Under*

standing with great delight and profit. He had a great taste for natural philosophy, but the moral and divine sciences were his chief object; and after a long residence at college, during which time he prepared himself assiduously for the ministry, he was in due form licensed to preach. In August 1722 he was invited to preach to the English Presbyterians at New York, where he continued with approbation above eight months; but as this society was too small to maintain a preacher, he returned in the year 1723 to his father's house at Connecticut, where, for some time, he applied to his studies with much industry and perseverance; and this severe application became habitual to him, although he was of a delicate constitution. In the spring of 1724, having taken his master's degree, he was appointed tutor of Yale College, being then in his twenty-first year; an office which, notwithstanding his youth, he filled for two years with great success and reputation. In September 1726 he received an invitation from the people of Northampton in Connecticut, to become assistant to his mother's father, Mr Stoddard, to whom he was ordained colleague in his twenty-fourth year, and continued as pastor of this congregation till the year 1750. During this time he married, had many children, and wrote several pious and useful treatises, chiefly suggested by the events of the times, such as his *Faithful Narrative of the Surprising Work of God, in the Conversion of many Hundred Souls in Northampton* (for these, as his biographer[1] tells us, were remarkable times for the out-pouring of God's Spirit); but particularly a sensible and useful treatise on *Religious Affections*, in which he endeavoured to restrain the extravagance and fanaticism into which, under these strong impressions, the religion of his flock was but too apt to degenerate. He was a most faithful and conscientious minister, but at last fell under the displeasure of his people, from no other cause except his anxiety for their spiritual interests. They appear, indeed, to have been a very stiff-necked generation, full of absurd whimsical vagaries on the subject of religion, but at the same time evincing little of its spirit in their lives and conversations. They had all a voice in the election and continuance of their clergyman, and they were very ready to seize any opportunity to show their power. Mr Edwards discovered that some licentious books had got among the youth of his congregation, a fact as to which he wished some investigation to take place; and this was the first point upon which his people flew off from him. There arose afterwards another point about the administration of the holy communion. His grandfather Mr Stoddard had, it seems, a notion that the administration of the sacrament was a moment which the Divine Spirit was much disposed to seize for the conversion of sinners; and that, therefore, the most notorious sinners were almost without scruple to be admitted to that holy ordinance, in the hope that this conversion would fall upon them. The result of this precious notion was, that the utmost licentiousness, mingled as it was with wild religious fancies floating in every brain, began to prevail amongst the people. When Mr Edwards, on his grandfather's death, obtained the entire charge, he endeavoured to make a change in this particular; but the outcry against him was loud and overbearing. Even his brethren of the clergy tamely gave way to a clamour which they condemned; and this excellent, able, and pious clergyman was thus driven away by the misguided flock, for whom he had laboured assiduously during twenty-four years; and at an advanced period of life, with a wife and a large family, he was thrown upon the world and the care of providence.

His next position was at Stockbridge, in the western part of Massachusetts Bay, where he was put at the head of a mission for converting the Indians. He was not enabled to do much as a missionary; but here he had a great deal of leisure, which he employed in writing his principal works. It was now he completed his chief treatise on the subject of free will; a work concerning the rapid execution of which we have the following information in Sir Henry Moncreiff Wellwood's able and interesting *Life of Dr Erskine*. "It was not till the month of July 1752, that he appears to have resumed his studies on the subject of free will; for on the 7th of that month he writes Dr Erskine, that 'he hoped soon to be at leisure to resume his design;' and gives him another sketch of the plan of his book, in which, though there be nothing new, there is more detail than in that which he had formerly sent him. Whatever opinion," continues this able writer, "may be held with regard to Mr Edwards' argument, it must appear astonishing to those who are capable of appreciating the difficulty of his subject, that, in nine months from the date of this letter, on the 14th of April 1753, he could write Dr Erskine, that he had almost finished the first draught of what he originally intended; though he was under the necessity of delaying the publication till he knew the result of proposals which he had circulated for printing his book by subscription. His book was published in 1754, and, though he had made some progress in preparing his materials before he left Northampton, was certainly written, and nearly completed, within the time ascertained by the two letters referred to, and must be admitted to convey a very striking idea, both of his mental resources and of his literary ardour."

In 1757, on the death of Mr Aaron Burr, Mr Edwards was chosen president of New Jersey College. He had only been here, however, a very short time, when he was carried off on the 22d of March 1758, in the fifty-fifth year of his age, by the small-pox. This disease was at that time raging in the neighbourhood. Mr Edwards, who had never had it, proposed to be inoculated, which his physicians approved of. He had the disease favourably, but a secondary fever set in, and by reason of a number of pustules in his throat, the obstruction became such that he could not swallow the necessary medicines, and the fatal result was what we have stated. The character of Mr Edwards is that of a very primitive, self-mortified, simple, and amiable man, and affords a strong proof of the power of genuine Christian piety upon the heart, in spite of the most gloomy and repulsive tenets. He was solely occupied with his professional duties and his theological studies, insomuch that, as is mentioned with inimitable simplicity by the author of his life, "he was less acquainted with most of his temporal affairs than many of his neighbours, and seldom knew when and by whom his forage for winter was gathered in, or how many milk-kine he had; whence his table was furnished," or by what means his wants were provided for. Mrs Edwards, however, a most valuable and sensible woman, fully supplied his defects in these particulars. We must quote another passage from this piece of biography, which is equal in simplicity, though by no means in any thing else, to some of the exquisite biographies of Isaac Walton. After being informed that he did not permit dancing, against which

[1] This primitive piece of biography, from which all our quotations are taken, is prefixed to a volume of sermons published after Mr Edwards' death. Its author is not mentioned. The edition from which we quote is printed at Edinburgh, by Alexander Jardine, 1799.

Edwards, Jonathan.

amusement, indeed, he wrote a sermon, we are told that "he allowed not his children to be from home after nine o'clock at night, when they went abroad to see their friends and companions; neither were they allowed to sit up much after that time, in his own house, when any came to make them a visit. If any gentleman desired acquaintance with his daughters, after handsomely introducing himself, by properly consulting the parents, he was allowed all proper opportunity for it, and a room and fire, if needed; but must not intrude on the proper hours of rest and sleep, nor the religion and order of the family."

Mr Edwards comes nearer Bishop Butler as a philosophical divine than any other theologian with whom we are acquainted. His style, like Butler's, is very much that of a man thinking aloud. In both these authors the train of thinking in their own minds is more clearly exhibited to us than perhaps by any other writer, whilst they show us with great truth and distinctness what their notions are, and how they came by them, with very little concern about the form of expression in which they are brought out. Butler, however, had a larger mind than Edwards, and was by no means so much of a mere dialectician. If, therefore, he be less acute than the American, he is more comprehensive, and gives fairer play to every opposing argument. We do not mean here to enter into any of Edwards' speculations. Both on the subject of original sin, and on the freedom of the will, he seems to us to unite a great deal too closely the views which originated, as we have seen, in no small degree, amidst his early reveries, with the infallible discoveries of divine revelation. Our notion is, that in all discussions on such subjects which have hitherto appeared, the speculatists have forgotten how little a part either of the history or the nature of man we are in fact acquainted with; and how ready we ever are, in laying the foundations of our theories, to place a tortoise beneath the elephant. The whole difficulty, for instance, on the freedom of the will, turns upon a puzzle in the idea of cause and effect. Perhaps this idea is far from being precise in our minds (Mr Edwards uses it very loosely in his speculations); yet we do not scruple, in our reasonings upon it, to draw the most positive inferences from the assumptions with which we set out. We suspect, indeed, that the true and accurate notion of causation always involves the idea of volition; and, on that supposition, to ask for the cause of volition itself is absurd. It may be very true that we cannot will to do any thing without previous thought or motive; neither can we think without previous existence. But is our existence the cause of our thinking? Just as much as our thinking is the cause of our willing. We are far, however, from wishing to add our own crude conceptions to those which have been piled up on this subject from the beginning of time to the present hour, without, we believe, doing the slightest service to the cause of moral and religious truth, or accomplishing any thing, in short, beyond affording an exercise for ingenuity, and too often a handle for uncharitable rancour and presumptuous absurdity. Mr Edwards, with all his great powers, has accordingly, we apprehend, done but little good to the world, we mean as a philosopher; for he did much good in his own day, whilst he was living the life of a zealous and faithful Christian minister. But it is "thus we play the fools with the time; and the spirits of the wise sit in the clouds and mock us." Exalted above all the folly of human wisdom, the spirit of this truly good and pious man is now, it may be, disposed to regard with some such sentiment many of his own most severe and laborious speculations, which were carried on in the serious belief, that if "the knots of Calvinism were trimmed off, or its doctrines, in the whole length and breadth of them, were not rigidly maintained, a man could nowhere set his foot down with consistency and safety, short of Deism, or even Atheism itself, or rather universal Scepticism."

Eecloo ‖ Eger.

Edwards' works consist of several volumes of sermons, printed at various times, and often reprinted in this country as well as in America. Besides these, he wrote, 1. *A Treatise concerning Religious Affections*, 1746, 8vo; 2. *An Account of the Life of the Reverend David Brainerd*, 1749, 8vo; 3. *An Inquiry into the Qualifications for full Communion in the Visible Church*, 1749, intended as a vindication of his principles in the matter which occasioned his dismission from Northampton; 4. *A careful and strict Inquiry into the Modern Notion of that Freedom of Will which is supposed to be essential to Moral Agency*, 1754; 5. *The Great Christian Doctrine of Original Sin defended, containing a Reply to the Objections of Dr John Taylor*, 1758; 6. *A History of Redemption*; 7. *Miscellaneous Observations on Important Theological Subjects*, London, 1793; 8. *Remarks on Important Theological Controversies*, ibid. 1796. Some of these were posthumous, as were a few other tracts of less importance written by him. (R. M.)

EECLOO, a town of Belgium, province of East Flanders, situated on the high road between Ghent and Bruges, 12 miles N.E. of the former. Pop. (1851), 8884. The town is generally well-built, and has an ancient convent, a town-hall, prison, several churches, and numerous schools Manufactures—woollen and cotton goods, soap, tobacco, chocolate, and hats; besides distilleries, tanneries, salt refineries, and oil mills. A large weekly market for grain, cattle, &c. is held here.

EEL. See Ichthyology.

EFFENDI, a Turkish word signifying *master*, frequently subjoined as a title of respect to the names of persons, particularly to those of ecclesiastics and learned men. The grand chancellor of the empire is called *Reis Effendi*, abbreviated from *Reis-al-Kottâb*, which signifies "the chief of secretaries or writers."

EFFERVESCENCE. When an acid is added to a carbonate, the phenomena of bubbles, vapours, and small jets of liquid, attended with a hissing noise, are occasioned by the disengagement of gas; and this species of intestine motion is termed effervescence. Sometimes also effervescence is accompanied with a great degree of heat, from the decomposition of some substances and the formation of new compounds.

EFFIGY (*effigies*), the portrait, image, or representation of a person. It also denotes the impression of a coin, representing the head of the prince who struck the coin. To *hang*, or *burn in effigy*, is to burn or hang an image or picture of the person intended to be executed or degraded. In France, this was formerly done in the case of any criminal who could not be apprehended—his image or picture being hung on a gibbet, below which was written his sentence of condemnation.

EFFLORESCENCE, in *Chemistry*, the formation of a kind of mealy powder on the surface of certain bodies. It is occasioned either by decomposition or by drying. The efflorescence which happens to cobalt and martial pyrites is of the former kind; and that observed on the crystals of soda, Glauber's salt, &c., is of the latter kind. An efflorescence is sometimes also a species of crystallization, such as the beautiful vegetations which shoot up from different saline substances. See Crystallization.

The term is used in botany to denote the time of flowering.

EFFLUVIUM, a term used to express the minute particles which exhale from most, if not all, terrestrial bodies, in the form of sensible vapours.

EGER, (Boh. *Cheb*), a frontier town of Bohemia, capital of a cognominal circle, situated on a rocky eminence on

the right bank of the Eger, 94 miles west of Prague. Pop. about 10,000. It was formerly strongly fortified, but its walls are now almost destroyed, and the ditches have been filled up. There are several handsome buildings in the town, including a fine parish church, and a spacious town-hall. At the east end of the market-place is the burgomaster's house, in a bed-room of which Wallenstein was assassinated in 1634. Situated in an angle of the fortifications, on a rock, are the ruins of the imperial castle, containing an ancient square tower built of massive blocks of volcanic tuff, and regarded by some as a work of the Romans. The double chapel is an interesting specimen of Gothic architecture;—the lower story which existed in 1213 is supported by granite pillars, with ancient capitals; the upper story rests on four slender marble columns with pointed arches, and singularly carved capitals bearing gnostic and other symbols. Adjoining the chapel is the castle-hall where the friends of Wallenstein were treacherously murdered previous to his own assassination. Eger has manufactures of cotton and woollen stuffs, chintz, leather, soap, &c. An avenue nearly three miles in length, leads from this town to Tranzensbad, or Tranzensbrann, celebrated for its mineral springs.

EGERIA, or ÆGERIA, in *Roman Mythology*, a nymph of Aricia in Italy, from whom Numa is said to have received instructions respecting the laws and regulations which he introduced at Rome. According to the legend, they had frequent interviews by night in the Lucus Camenarum—a grove near the Porta Capena, in the valley now called La Caparella. When Numa died, the disconsolate Egeria retired to the grove of Aricia, on the borders of the Lacus Nemorensis (Nemi); and by her tears and lamentations so frequently interrupted the worship of Diana, that the goddess, in commiseration, transformed her into a fountain. Egeria was regarded as a prophetic divinity; and, as presiding over childbirth, she was invoked by pregnant women. Hence by some she has been identified with Lucina (Liv., i. 19.; Ovid, *Met.* xv. 431, &c.; Virg., *Æneid*, vii. 761), &c.

EGG, in *Physiology*, a body formed in certain females, in which is contained an embryo or fœtus of the same species, under a cortical surface or shell. The exterior part of an egg is a shell, which in a hen, for instance, is a white, thin, and friable cortex, including all the other parts. The shell becomes more brittle by being exposed to a dry heat. It is lined everywhere with a very thin but pretty tough membrane, which dividing at or very near the obtuse end of the egg, forms a small bag, where only air is contained. In new-laid eggs this follicle appears very little, but becomes larger when the egg is kept. Within this are contained the albumen or white, and the vitellus or yolk; each of which has its different virtues. The albumen is a viscous, white liquor in the egg, different in its consistence in its different parts. It is observed, that there are two distinct albumens, each of which is inclosed in its proper membrane. Of these, one is very thin and liquid, the other is more dense and viscous, and of a somewhat whiter colour, but, in old and stale eggs, after some days' incubation, inclining to a yellow. As this second albumen covers the yolk on all sides, so it is itself surrounded by the other external liquid. The albumen of a fecundated egg is as sweet and free from corruption during the whole time of incubation as it is in new laid eggs; and so is also the vitellus. The eggs of hens consist of two liquors separated one from another, and distinguished by two branches of umbilical veins, one of which goes to the vitellus, and the other to the albumen. When the vitellus grows warm with incubation, it becomes more humid, resembling melting wax or fat; and hence it occupies more space. For as the fœtus increases, the albumen insensibly wastes away and condenses: the vitellus, on the contrary, seems to lose little or nothing of its bulk when the fœtus is perfected, and only appears more liquid and humid when the abdomen of the fœtus begins to be formed. The chick in the egg is first nourished by the albumen, and, when this is consumed, by the vitellus, as with milk. If we compare the *chalazæ* to the extremities of an axis passing through the vitellus, which is of a spherical form, this sphere will be composed of two unequal portions, its axis not passing through its centre; consequently, since it is heavier than the white, its smaller portion must always be uppermost in all positions of the egg. The yellowish-white round spot, called *cicatricula*, is placed on the middle of the smaller portion of the yolk; and therefore, according to what has been said above, must always appear on the superior part of the vitellus. Not long before the exclusion of the chick, the whole yolk is taken into its abdomen; and the shell, at the obtuse end of the egg, frequently appears cracked some time before the exclusion of the chick. The chick is sometimes observed to perforate the shell with its beak. After exclusion, the yolk is gradually wasted, being conveyed into the intestines by a small duct.

Eggs differ very much, according to the birds which lay them, as to their colour, form, size, age, and the different ways of dressing them. Those most used in food are hens' eggs. As to the preservation of eggs, it is observed that the egg is always quite full when it is first laid by the hen; but from that time it gradually becomes less and less so, till its decay; and, however compact and close its shell may appear, it is nevertheless perforated with a multitude of small holes, though too minute to be discerned by the naked eye, the effect of which is a daily decrease of matter within the egg, from the time of its being laid. This perspiration is much quicker in hot weather than in cold. To preserve the egg fresh there needs no more than to preserve it full, and stop its transpiration; the method of doing which is, by stopping up those pores with matter which is not soluble in watery fluids; and on this principle it is that all kinds of varnish, prepared with spirit of wine, will preserve eggs fresh for a long time, if it be carefully rubbed all over the shell. Butter, or mutton fat, is also good for this purpose.

EGHAM, a village of Surrey, 18 miles W. of London, on the Thames, and connected with Staines on the opposite side of the river by an iron bridge. In the vicinity is Runnymede, famous in English history as the scene of the conference between King John and his barons, which ended in the signing of the Magna Charta, A.D. 1215; and Cooper's Hill, celebrated by Denham and Pope.

EGINHARD. See ÆGINHARD.

EGNATIA, or GNATIA, a city of Peucetia, a province of Apulia, situated on the coast, the inhabitants of which are ridiculed by Horace for exciting the wonder of the ignorant multitude by burning incense on an altar without the process of ignition. This city gave name to the Via Egnatia, which passed from Brundusium through Egnatia to Canusium. Its ruins are found at the *Torre d'Agnazzo*, where the inhabitants still pretend to show the temple alluded to by Horace.

EGREMONT, a small market-town of England, county of Cumberland, on the Ehen, 2½ miles from the coast. The parish church, St Mary's, is an ancient edifice. The ruins of Egremont castle stand on an eminence near the town. Large quantities of iron ore are excavated in the neighbourhood. Market-day Saturday. Pop. of parish 2049.

EGLANTINE, a name of the sweet-briar, *Rosa rubiginosa*, so frequently alluded to by our old poets. Warton justly observes—that Milton in the *Allegro* has applied the word improperly to the *honeysuckle*.

> Then to come, in spite of sorrow,
> And at my window bid good-morrow,
> Through the sweet-briar or the vine,
> Or the twisted eglantine.

EGRET. See index to ORNITHOLOGY

EGYPT.

SECTION I.

PHYSICAL GEOGRAPHY, PRODUCTIONS, AND INHABITANTS.

Egypt.

Egypt, a country situate at the north-eastern extremity of Africa, between N. Lat. 31. 37. and 24. 1., and E. Long. 27. 13. and 34. 12.;[1] bounded on the N. by the Mediterranean Sea, on the S. by Nubia, on the E. by Palestine, Arabia, and the Red Sea, and on the W. by the Great Desert.

Names of Egypt.

In the hieroglyphic inscriptions the proper name of Egypt is Kem, and it was therefore thus called by its ancient inhabitants. The pronunciation of this name cannot be regarded as perfectly certain, since the first consonant may perhaps be "ch,"[2] and the vowel is not expressed. The Coptic form is χημι or χαμη in the Memphite dialect, and κημε or κημη in the Theban. The name signifies, both in Egyptian[3] and in Coptic, "black," and is said to have been given to the country by reason of the blackness of its cultivable soil.[4] The other names of Egypt in its ancient language appear to be appellations of a poetical character.

Egypt is usually called in the Hebrew Scriptures מִצְרַיִם *Mizraim.* In the enumeration of the descendants of Noah, we find Mizraim among the sons of Ham,[5] and it has been hence concluded this is the name of an individual as well as of Egypt. In the Old Testament, however, men are called the fathers of tribes and of cities;[6] and the name Mizraim, although used as a singular, being dual in form, is manifestly applicable to a country naturally divided into two regions, and so divided by its ancient inhabitants. This name in the singular form מָצוֹר, *Mazor,* is sometimes given to Egypt in the Bible. The latter is the same as the Arabic name مصر *Misr,* pronounced in the vulgar dialect *Masr,* and signifying "red mud." By red (أحمر *ahmar*), the Arabs mean both red and reddish brown; and the Egyptian Kem signifies either a dark colour generally, or particularly (and this is more probable) that of the tail of the crocodile, the first hieroglyphic of the group (which is read Kem), which varies, in different individuals, from a slaty to a reddish brown.[7] The ordinary Hebrew and Arabic name of Egypt is therefore of the same signification as the hieroglyphic one. We also find Egypt called in the Old Testament "the land of Ham," חָם,[8] and mention is made therein of "the tabernacles of Ham."[9] This may refer to the patriarch or to the Egyptian name; and as the patriarch's name signifies in Hebrew "hot" or "warm," and we find in Arabic, a sister language, a cognate word حمأ *hama,* fetid black mud,[10] the two may be regarded as identical with each other and with Mazor. Since the name of the patriarch is so appropriate to Egypt, it is most reasonable to suppose that it was given him prophetically as the progenitor of the sun-burnt inhabitants of this and neighbouring lands; and it must be borne in mind, that both Noah and Japhet, and probably Shem also, were so named. Besides the biblical names of Egypt above mentioned, there is also רַהַב *Rahab,* signifying "the Proud."

The Arabic name of Egypt, Misr, is given to that country by its modern inhabitants. It first occurs, as far as is known, in the Kur-án, as in the following passage, "And Pharaoh proclaimed among his people, saying, O my people, doth not the government of Misr belong to me?"[11] where Misr signifies Egypt.[12]

The name of Egypt, written Misr, is stated by Colonel Rawlinson to be found in the cuneiform inscriptions of Assyria.

The etymology of the common Greek name of Egypt, Αἴγυπτος, whence ours is derived, has occasioned much discussion. The most probable derivation is αἶα "land," and Γυπτος a proper name. This "Guptos" seems equivalent to Coptos, the Coptic κεβτω, κεπτο, κεπτω, κεϥτ, and Arabic قفط, *Kuft,* a town in Upper Egypt, radically the same as the name of the Egyptian Christians, Copts. In hieroglyphics Coptos is called Kebt-hor,[13] which is clearly the same as the biblical Caphtor; and since Kebt-hor is identical with Coptos, Caphtor may be with "Guptos." In the enumeration of the sons of Mizraim we find the Caphtorim,[14] and elsewhere the country called Caphtor is mentioned. In the book of Jeremiah, אִי כַפְתּוֹר "Iy-Caphtor"[15] that is, "the island" or "coast" (whether bordering on a sea or river) "of Caphtor" is spoken of; and this expression seems to be the very origin of Αἴγυπτος. A historical inquiry, for which there is not space in the present article, lends additional weight to the probability of this etymology.[16]

Geographical position.

By the Greeks and their contemporaries Egypt was generally held to be a country of Asia, though some assigned it to Libya,[17] that is, Africa. The reason of this difference

---

[1] These limits are those of the northern coast.

[2] Certain letters of the Egyptain alphabet had a double pronunciation, either in the language generally, according to their position, or in different dialects. That rendered "k" is probably one of these, and sometimes held a middle place between the simple "h" and the rough "kh," being a "ch" (χ) or "hh."

[3] Champollion, *Dictionnaire Egyptienne,* s. v.

[4] Plutarch, *De Iside et Osiride,* c. 33, p. 364.

[5] Gen. x. 6.

[6] See Gen. x. 15, *et seqq.*, where it is said that "Canaan begat Sidon, his first-born [not necessarily the city so called], and Heth, and the Jebusite, and the Amorite," as well as other tribes. In 1 Chron. we find mention of "Shobal the father of Kirjath-jearim, Salma the father of Beth-lehem, Hareph the father of Beth-gader" (ii. 50, 51); and a little farther occur these words, "The sons of Salma, Beth-lehem, and the Netophathites" (*Id.* 54.)

[7] Comp. Horapollo Nilous Σκότος δὲ λέγοντες, κροκοδείλου οὐρὰν ζωγραφοῦσιν· ἐπειδὴ οὐκ ἄλλως εἰς ἀφανισμὸν καὶ ἀπώλειαν φέρει ὁ κροκόδειλος οὗ ἐὰν λάβηται ζώου, εἰ μὴ τῇ οὐρᾷ τῇ ἑαυτοῦ διαπληκτίσας ἄτοπον [or ἄτονον] παρασκευάσει. ἐν τούτῳ γὰρ τῷ μέρει ἡ τοῦ κροκοδείλου ἰσχὺς καὶ ἀνδρεία ὑπάρχει. *Ed. Cory.*, l. i., c. lxx., p. 87. It is to be observed that the facts stated by Horapollo are usually much more reliable than his explanations of them, or those of his translator Philip, to whom we may ascribe much of the contents of the work. In selecting symbols the ancient Egyptians seem to have chosen those representing as obviously as possible the idea which they were desirous to embody, but the philosophical interpreters of their system sought to explain those symbols in an abstruse manner.

[8] Ps. cv. 23, 27; cvi. 22.

[9] Ps. lxxviii. 51.

[10] *Black mud,* according to the lexicon called the Siháh (MS.); or *black fetid mud,* according to the Kámoos.

[11] *Kur-án,* c. xliii. 50.

[12] The same name is applied in Arabic to several of the successive capitals of Egypt. See below, section iii.

[13] MS. notes of Sir Gardner Wilkinson, who believes that Mr Harris of Alexandria first ascertained the true reading.

[14] Gen. x. 14; 1 Chron. i. 12.

[15] Jer. xlvii. 4.

[16] The Bible relates that the Philistines came out of Caphtor, and as well as the Egyptian monuments, shows that the Philistines and Cretans were most probably kindred peoples, and thus the name Αἴγυπτος, if the same as "Iy-Caphtor," would be traceable to the maritime Greeks, who were at all times connected with Egypt.

[17] "Egypt, according to some, is of Asia, and according to others, of Libya."—Scholiast on *Apollonius Rhodius* (iv. 1571).

Egypt.

seems to have been twofold, partly because Egypt was socially Asiatic but by position African, and partly because the Nile, which intersects the country, was fixed upon as the boundary of Asia and Libya, so that half Egypt, or at least some part of it, would have been assigned to each of these continents. From this cause arose the opinion of the Ionians, which Herodotus mentions,[1] that what others have called Egypt, except the Delta, was half an Arabian country and half a Libyan; so that the Delta, their Egypt, should have been, as the historian remarks, reckoned a fourth division of the world by the Ionians, since they assigned it to neither Asia nor Libya.

Extent.

In ancient times Egypt was held to be the country overflowed by the Nile north of the First Cataract, and the Arabian and Libyan deserts and mountains which border that tract on the east and west were not considered part of it. Thus Herodotus relates that " they of the city of Marea and of Apis, who inhabit the parts of Egypt bordering on Libya, thinking themselves to be Libyans and not Egyptians, and being discontented at the usage concerning victims, desiring not to abstain from [eating the flesh of] cows, sent to [the oracle of] Ammon, saying that nothing was common to them and to the Egyptians, for they dwelt without the Delta, and did not speak the same language with them, and that they wished it might be allowed to them to eat all things: but the god did not permit them to do thus, saying, that Egypt was that [tract] which the Nile passing over waters, and the Egyptians those who, dwelling below the city Elephantine, drink of this river. Thus these things were replied by the oracle to them. Now the Nile reaches, when it swells, not alone the Delta, but also some part of the tract which is said to be Libyan, and of that which [is said to be] Arabian, even for a two days' journey on both sides, and [sometimes] yet more than this or less."[2] No more accurate description could be given of the Egypt of the ancients than this reply of the oracle of Jupiter Ammon. By the modern inhabitants, and by the Arabs, Egypt Proper is the same tract, but they differ from the ancients in calling the deserts those of Egypt, instead of assigning them to the adjoining countries. Modern European geographers, however (the Turks excepted), understand Egypt to comprehend the Eastern Desert to the Red Sea, and the Western as far as a little beyond the neighbouring oases, excepting that of Seewah, anciently that of Jupiter Ammon. The country watered by the Nile north of the First Cataract, and the deserts which bound it, have been always distinct naturally and politically, inhabited by two or more different races, a settled people, and a nomad, often at war with one another; and it has been easier to distinguish these tracts than to determine how much of either desert should be assigned to the inundated tract as part of Egypt, so that the ancient definition of that country seems by far the more reasonable of the two. That of the modern geographers is, however, now so generally received, that it is unadvisable to attempt to disturb it.

The political advantages of the situation of Egypt, and of its natural strength, as well as resources, can scarcely be overestimated. It lies in the very route of the trade between the East and the West. Not only has the commerce of Arabia and India in almost all ages passed through it, but its great river and caravans of camels have brought from Central Africa ivory and gold and negroes, since the patriarchal times. It has natural harbours on the coast of the Red Sea and that of the Mediterranean, the selection and improvement of the most important of which has been regarded as the wisest act of Alexander the Great, and certainly was that by which he most benefited posterity, if indeed he did so directly by any other.[3] The plain of Lower Egypt is hard to approach by land, and by reason of its intersection by the branches of the Nile and by canals, as well as the possibility of sometimes laying great portions of it under water, difficult to subdue, while the narrow valley of the Sa'eed, or Upper Egypt (otherwise called Middle and Upper) is made almost impregnable by the mountains and deserts which closely hem it in. The whole country is rendered independent of neighbouring lands by its extreme fertility, which makes its defence the easier. The ancient wealth and power of Egypt need therefore occasion us no wonder, and while we trace the causes of their decay, these natural advantages of position raise a hope for the future.

Superficies.

In the great French work on Egypt, there is an excellent memoir on the superficies of that country by Col. Jacotin,[4] which is both fuller and from a higher authority than anything else on the same subject: from this memoir the following remarks are taken:—M. Jacotin observes that Egypt, according to the maps of the best geographers, particularly of D'Anville, is situate between the meridians 26. 30., and 32. 20. E. Long. (that is from the meridian of London, or rather Greenwich, 28. 50. and 34. 40. E. Long.), and the parallels 24. 1. 25., and 31. 37. 0. N. Lat. The surface contained within these limits may be computed to be 20,000 square leagues, or 115,200 square geographical miles.[5] This must be considered as a very approximative calculation, since the limits of Egypt, when the deserts are included, are necessarily extremely vague. The space which the Nile does or can water and fertilize, including its bed, north of the First Cataract, is only 9582·3936 square miles, or about a twelfth of the whole superficies, and of this but 5626·5984 square miles, inclusive of the islands of the river, are either in a state of cultivation, or fit for cultivation. The space actually under cultivation was found by M. Estève, according to M. Jacotin, to be 5469·8688 square miles; but the latter gentleman calculates that anciently 2735·0784 square miles more may have been cultivable, whereof much might still be reclaimed. His most important results are contained in the following table, which he gives in various measures of space, of which the square leagues of 25 to the degree of latitude are only here retained, while a column is added with the same sums in square geographical miles.

Nature of the Surface.

	Square Leagues of 25 to the Degree.	Square Geographical Miles.
1. Towns, villages, &c.	21·93	126·3168
2. Cultivated land, and land fit for cultivation	965·85	5563·2960
3. Uncultivated land which might be cultivated	224·87	1295·2512
4. Islands in the river	10·99	63·3024
5. Canals, with their banks, dikes, roads, &c.	36·19	208·4544
6. Ruins and rubbish, of ancient towns and monuments	4·89	28·1664
7. The river when at its height	47·71	274·8096
8. The lakes, ponds, and marshes, during the inundation	283·00	1630·0800
9. Sandy tracts, sea-shore, and hills, within the part of Egypt which can be inundated by the river, and distinct from the deserts	68·18	392·7168
Total	1663·61	9582·3936

In addition to these various kinds of surface, M. Jacotin estimates the desert tract between the limits of the fertile

[1] Herod., ii., 15, 16.

[2] *Id.*, ii., 18, 19.

[3] The Emperor Napoleon I., who was not the man to underrate military glory, held this opinion: "'Alexandre,' a dit Napoléon, 's'est plus illustré en fondant Alexandrie et en méditant d'y transporter le siège de son empire, que par ses plus éclatantes victoires. Cette ville devait être la capitale du monde. Elle est située entre l'Asie et l'Afrique, à portée des Indes et de l'Europe. Son port est le seul mouillage de cinq cents lieues de côtes qui s'étendent depuis Tunis, ou l'ancienne Carthage, jusqu'à Alexandrette; il est à l'une des anciennes embouchures du Nil. Toutes les escadres de l'univers pourraient y mouiller, et, dans le vieux port, elles sont à l'abri des vents et de toute attaque.'"—Clot-Bey, *Aperçu Général*, tom. i., p. 188.

[4] *Description de l'Egypte*, 2de edit. tom. 18, ii., p. 101, *et seqq.*

[5] The square miles mentioned in these remarks are always geographical, whether this is specified or not.

Egypt.

soil and the foot of the mountains on either side of the Nile as equal to about 52 square leagues, or 299·52 square miles.

Mr Lane calculated the extent of the cultivated land in Egypt to be equal to 5500 square geographical miles, or rather more than one square degree and a half. "He made this calculation," says Mrs Poole, "from a list of all the towns and villages in Egypt, and the extent of cultivated land belonging to each. This list is appended to De Sacy's 'Abd Allatif.' It was made in the year of the Flight 777 (A.D. 1375-6); and may be rather underrated than the reverse. The estimate of M. Mengin shows that in 1821 the extent of the cultivated land was much less; but since that period, considerable tracts of waste land have been rendered fertile."[1] The near agreement of Mr Lane's calculation with those of M. Estève and Col. Jacotin, affords satisfactory evidence of the accuracy of the writer last mentioned. Mrs Poole's work was published in 1844, since which time the extent of the cultivable land can have varied but little.

Ancient divisions.

In the hieroglyphic inscriptions mention is made of "the two regions" of Egypt, and the kings of the whole land wear the crowns of Upper and Lower Egypt, although the country had been divided into more than two monarchies; all which shows that among its ancient inhabitants, in the earliest times, the natural division obtained. The upper country, or Upper Egypt, commenced above Memphis, comprising the narrow valley as far as the First Cataract; while the lower country, or Lower Egypt, was the plain containing the Delta, the cultivable land on each side thereof, and the few miles of territory which intervened between the point of the Delta and the southern part of Memphis. Near Memphis the mountains begin to recede, and the valley to open into the plain; and the commencement of the Delta was not anciently so far north of that city as it is at present north of its site. For the lesser divisions of Egypt under the Pharaohs, we must depend upon the statements of ancient writers, since satisfactory evidence has not been adduced on this matter from the hieroglyphic inscriptions. The first step, however, has recently been taken by Mr A. C. Harris of Alexandria, who has collected and published the hieroglyphical standards representing districts (whether nomes or toparchies), and ascertained that these standards have a geographical import.[2]

Diodorus Siculus relates that a king Sesôstris, whom he calls Sesoôsis, first divided Egypt into nomes, 36 in number;[3] and Strabo says that such was the ancient number of these provinces.[4] It will be seen, however, that the name Sesôstris was applied by the Greeks to more than one king, without any distinction; so that, if we admit that Diodorus is accurate, we cannot determine to which of the Pharaohs this relates; nor, since certain of these kings who were thus confounded reigned at distant periods, can we ascertain approximatively the time when nomes were instituted. It is not therefore possible to come to any certain conclusion as to the period before that of the Greek geographers. The following is a list of the more important nomes from Ptolemy, Pliny, Strabo, and the coins. In consequence of the changes that were occasioned by the increase in their number, and the confusion that is caused by different names having been applied to the same nome, no complete list could be given without large comments as to the disputed points. In the Delta and the rest of Lower Egypt, were the Mareôtic nome, the Alexandrian, the Metêlite, the Cabasite, the Saïte, the Prosôpite, the Sebennyte (which was separated latterly into two nomes), the Xoïte, the Athribite, the Mendesian, the Busirite, the Leontopolite, the Tanite, the Sethrôïte, the Arabian, the Bubastite, and the Heliopolite. The nomes of the Heptanomis were the Memphite, the Heracleopolite, the Arsinoïte, or Crocodilopolite, the Aphroditopolite, the Oxyrhynchite, the Cynopolite, the Hermopolite, and the Antinoïte. Of the Thebaïs the chief nomes were the Lycopolite, the Hypsêlite, the Aphroditopolite, the Antæopolite, the Panopolite, the Thinite, the Diospolite, the Tentyrite, the Coptite, the Theban, the Hermônthite, the Apollinopolite, and the Ombite. The Oasis of Jupiter Ammon forms a separate nome in Pliny's list, and the other two oases, the "Great" and "Little," were included in the Antinoïte nome, according to Ptolemy. Strabo assigns ten nomes to the Delta, the same number to the Thebaïs, and sixteen to the intermediate space; but it is not clear that he refers to his own times, and the text seems inaccurate, and the number sixteen should rather be assigned to the nomes of the Delta. Ptolemy enumerates 44 nomes, and Pliny 46. Subsequently, however, they increased to about 58 or 56, 35 or 33 in Lower Egypt, 8 in the Heptanomis, and 15 in the Thebaïs.[5]

The whole country in the time of the earlier Cæsars was divided into the Delta, Heptanomis, and Thebaïs. The first of these comprehended nothing beyond its natural limits, excepting certain portions of land to the east and west; the second, called Heptanomis, because it originally comprised seven nomes, commenced at the point of the Delta and extended southwards to the Thebaïca Phylace; and the third, the Thebaïs, reached thence to the First Cataract. About the close of the fourth century Lower Egypt was further divided into four provinces, Augustamnica Prima and Secunda, and Ægyptus Prima and Secunda, and the Heptanomis was called Arcadia from the Emperor Arcadius, while Upper Egypt was divided into Upper and Lower Thebaïs.

Modern divisions.

The following is a list of the modern divisions and provinces:—El-Akâleem El-Bahreeyeh, or the northern provinces, comprehending the Gharbeeyeh, the province of Er-Rasheed, or Rosetta, the Boheyreh, the province of El-Mansooreh, the Manoofeeyeh, the province of Ed-Dimyât, or Damietta, the Sharkeeyeh, the Kalyoobeeyeh, and the province of El-Geezeh. El-Akâleem El-Wustâneeyeh, or the middle provinces, containing the province of Atfeeh, the Feiyoom, the province of Benee-Suweyf, and that of El-Minyeh. El-Akâleem El-Kibleeyeh, or the southern provinces, having three divisions, the province of Asyoot, that of Girgeh, and that of Kinè. This is the manner in which the country was officially divided at the time of the French invasion, and the same division popularly obtains at the present day. Under the Memlook Sultâns of the Bahree Dynasty, we find Egypt divided into somewhat smaller provinces, whereof the less important were afterwards merged in those adjoining them, and the later system was thus formed. By Mohammad 'Alee Páshá a new division was organized into mudeerliks, or districts governed by a mudeer, of which Lower Egypt, including a small portion of Middle Egypt, contained four, and Middle and Upper Egypt three.[6] In consequence of these circumstances it will be easily understood that much confusion prevails respecting the modern divisions of the country.

General appearance.

The general appearance of Egypt is remarkably uniform. The Delta is a level plain richly cultivated, and varied alone by the lofty dark-brown mounds of ancient cities, and the

[1] *Englishwoman in Egypt*, vol. i., p. 85. M. Jomard in the *Description de l'Egypte* (ix., p. 110), calculates the land mentioned in the list given by De Sacy, to be 952·1 square leagues, or 5592·96 square miles. Mr Lane has preferred giving a round sum, for the reason doubtless that accuracy is not to be expected in a list of the kind.

[2] "Hieroglyphical Standards representing places in Egypt supposed to be its Nomes and Toparchies, collected by A. C. Harris of Alexandria, M.R.S.L., London."

[3] Lib. i., 54.

[4] Lib. xvii., 5.

[5] Wilkinson's *Modern Egypt and Thebes*, vol. i., p. 420–1; and ii. 3, 4, 5. Becker's *Handbuch der Römischen Alterthümer*, continued by Marquardt, vol. iii. pt. 1, p. 213. See also Eckhel *Doctrina Numorum Veterum*, vol. iv., p. 99, *et seqq.*

[6] See Mengin, *Histoire Sommaire*, 237, *et seqq.*

Egypt.

villages in groves of palm-trees, standing on mounds often if not always ancient. We sometimes see groves of palm-trees besides those around the villages, but other trees are, except in some parts, rare. In Upper Egypt the valley is in as rich a state of cultivation, but very narrow and bounded by mountains of no great height, which hem it into a confined space. The mountains seem like cliffs from the river, but are rarely very steep. They constitute the edge of the desert on either side of the valley, which appears as though it had been cut through a rocky table-land, for they rarely take the form of peaks. Sometimes they approach the river in bold promontories, and at others are divided by a valley with the bed of a torrent that flows only at very distant intervals. The features of the country therefore vary very little, nor is there great difference in the colour. The bright green of the fields, however, the reddish-brown or dull green colour of the great river, the tints of the bare yellow rocks, and the deep blue of the sky, always form a pleasant view, and often one of great beauty.

Climate and meteorology.

The climate of Egypt, being remarkably equable, is healthy[1] to those who can bear great heat, and who avoid the unwholesome tracts of the country. Europeans, exclusive of the Turks, generally hold a contrary opinion to this; but it should be remembered that Alexandria, where most of them reside, is situate on a salt marsh, and that those born in cold climates are generally found to be unfit to support great heat, more especially if they persist in a mode of life which, though not prejudicial in a cold climate, is the surest means of destroying the constitution in a hot one. The English physician at Cairo, Dr Abbott, who has resided in Egypt several years, but is also acquainted with many other countries, considers that the climate is the finest in the world; and he does not stand alone in thinking thus.

The atmosphere is remarkably dry and clear, except on the sea-coast; and even the humidity, which is the inevitable consequence of the spreading of the inundation, is scarcely felt except in its usually rendering the heat more oppressive. Sometimes a white fog very dense and cold rises from the river in the morning, but it is of rare occurrence and short duration. The heat is extreme during a great part of the year, but it is chiefly felt when accompanied by the hot winds of spring, and the sultry calm of autumn, after the Nile has overspread the lands. The winter is often comparatively severe in its cold, especially as the domestic architecture is calculated to protect rather from heat than cold. "The general height of the thermometer in the depth of winter in Lower Egypt, in the afternoon and in the shade, is from 50° to 60°: in the hottest season it is from 90° to 100°; and about ten degrees higher in the southern parts of Upper Egypt."[2]

On the coast of the Mediterranean rain is frequent, but in other parts of Egypt very unusual. At Cairo there is generally one heavy storm in the winter, and a shower or two besides, while at Thebes a storm occurs but once in about four years, and light rain almost as rarely.

The wind most frequently blows from the north-west, north, or north-east, but particularly from the first direction. The proportionate prevalence of these winds to those from all the other quarters, in the year, is about 8 to 3; but to those from the south, south-east, and south-west, about 6 to 1.[3] The northerly winds are the famous Etesian winds of the ancients, which enable boats constantly to ascend the Nile against its strong and rapid current. They also cool the temperature during the summer months. The southerly winds are often very violent,[4] and in the spring and summer, especially in April and May, hot sand-winds sometimes blow from the south, greatly raising the temperature, and causing especial suffering to Europeans. The famous Simoom, properly called Samoom, is a much more violent hot sand-wind, which is more usual in the desert than in the cultivated tracts, but in either, occurring only at long intervals. It is a kind of hurricane, most painful to experience, and injurious in its effects.[5] The Zóba'ah is a common but remarkable phenomenon. It is a very lofty whirlwind of sand resembling a pillar, which moves with great velocity, and when crossing the Nile frequently capsizes any boat which may be in its way, and of which the main sheet is tied, through the carelessness of the boatmen, instead of being held. Mr Lane measured some with a sextant and found them to be between five and seven hundred feet in height, and one to have an altitude of seven hundred and fifty feet.[6]

One of the most interesting phenomena of Egypt is the mirage, which is frequently witnessed both in the desert and in the waste tracts of uncultivated soil near the Mediterranean; and it is often so truthful in its appearance that one finds it difficult to recognise the illusion.

Diseases.

Notwithstanding the fineness of the climate, the stranger who visits Egypt is struck by the signs which he sees everywhere of the prevalence of many serious diseases, while he may be a witness of calamitous visits of the plague or the cholera. Yet he should remember the poverty of the great mass of the inhabitants, and their insufficient food, the ignorance of the native medical practitioners, the false system of many of the foreigners established in the country, and the reluctance of the natives to take medical advice. Ophthalmia is frequently followed by blindness if not treated, and dysentery, without the aid of physic, still oftener terminates fatally; so that there is no reason to wonder at one's frequently meeting blind persons, and hearing of deaths from dysentery.

The plague may be regarded as the most remarkable disease of Egypt. Plagues are recorded by Manetho to have occurred in the reigns of two of the most ancient kings,[7] and this malady is evidently alluded to in the Bible as peculiarly Egyptian.[8] It has not, however, broken out since the year 1843, when there was a plague of a comparatively insignificant character so far as the mortality was concerned. In 1835 there was a plague of extreme severity, by which there died of the inhabitants of Cairo a number equal to the whole adult male population.[9] There having been no outbreak since 1843, whereas ordinarily there would have been several before the present year (1855), has been attributed to the sanitary measures of the Egyptian government. That government doubtless deserves great credit for its exertions in this matter; but all such efforts would have as yet produced but little result were it not for the constant extreme dryness of the climate, and the powerful heat of the sun during a great part of the year.

The plague is not confined to Egypt, but appears on the east and south coasts of the Mediterranean, and part of the north coast, and sometimes pursues a similar course to the cholera in advancing steadily from place to place. In Egypt it usually first appears at Alexandria in the winter or spring, and if the earliest cases occur towards the close of the year, one may be sure of a plague of great severity and long continuance. At first the cases are generally few, but they gradually increase, and in the hottest weather attain their maximum. The disease is not long in travelling from Alexandria to Cairo, but it rarely ascends much higher

1 Lane's *Modern Egyptians*, Introduction.
2 *Id.*, *ibid.*
3 Clot-Bey's *Aperçu Général sur l'Egypte*, tom. i., p. 39.
4 In Stephens's *Incidents of Travel in Egypt*, &c., chap. iv., there is an excellent description of the effects of a gale from the south. Any one who has witnessed the scene which that author describes on the Nile, will be struck by the truthfulness of the picture which he draws.
5 *Englishwoman in Egypt*, vol. i., pp. 96, 97.
6 *Id.*, *loc. cit.* *Modern Egyptians*, chap. x.
7 Cory's *Ancient Fragments*, 2d edit., p. 96.
8 Zech. xiv. 18.
9 *Modern Egyptians*, Introduction.

Egypt.

up the river, and has seldom been known at Thebes in modern times. Many medical writers have denied the contagious character of the plague; in particular, Clot-Bey, a French physician, who was long chief medical officer of the Egyptian government, and who published a treatise on this disease;[1] yet it is impossible to deny the positive evidence of the senses, showing not only that the plague is contagious, but that it is so in the highest degree. The efficacy of quarantine is alone a strong argument in favour of those who believe in its contagious character; but the distinct fact, for example, of persons having taken the disease after wearing the clothes of those who had died of it, in circumstances the most conclusive, can hardly be rejected.

Dysentery is an extremely common malady, and causes very considerable mortality. It may usually be traced to a careless course of diet, and especially to the eating of crude vegetables, and unripe or unwholesome food, and the drinking brackish water. Mr Lane (in the *Modern Egyptians*) has made public a mode of treatment which has been attended with extraordinary success.[2]

Asiatic cholera has visited Egypt in its westward course on the occasions in which it has appeared in Europe, excepting the last visitation; and it is remarkable that after each of the two former occasions, the epidemic appeared a second time, but with far less destructive results. At each of these times the mortality was considerable, nearly 200,000 having perished in all Egypt, according to the government reports, which were probably below the truth, in 1848.

Among the diseases most dreaded by the European residents, or, to use the expression of the natives, the Franks, is the liver-complaint. Those, however, who are moderate in the use of intoxicating drinks, or who abstain from them altogether, either escape this disease, or suffer from it in a comparatively mild form. Hæmorrhoids and herniæ are among the most ordinary maladies.

Cutaneous disorders have been esteemed from ancient times among the curses of Egypt. Leprosy is well known but not common, unlike elephantiasis, which in more than one form has numerous victims. Smallpox was formerly very severe, but its virulence has been checked by the use of vaccination. There are various other diseases of lesser importance, the most remarkable being the so-called guinea-worm, which, however, is perhaps not indigenous.

Of the diseases of the eye, ophthalmia is the most formidable from its prevalence and malignant character; yet perhaps no malady is more amenable to treatment if promptly commenced. Where the predisposition exists, a slight cause, such as the irritation caused by a grain of dust or sand, is sufficient to produce an inflammation, which, if allowed to increase, inflicts a lasting injury if it do not produce blindness. For this disease also Mr Lane has published a very efficacious mode of treatment.[3]

Clot-Bey affirms that pulmonary consumption is extremely rare among the native inhabitants;[4] yet another physician of ability has asserted, though not in print, that he had met with not a few cases in a short practice. The opinion of the former is corroborated *primâ facie*, by the circumstance that the Romans sent their consumptive patients to Egypt, and that modern European physicians have adopted the same course; yet the ill success of this change argues unfavourably for the climate of Egypt for persons thus afflicted. Its effect is not that of the climate of Madeira, and the patient rarely improves. A residence in the desert, however, a mile or two from Cairo, under canvas, would probably have a beneficial result in cases of incipient consumption. Asthma and bronchitis are among the common disorders.

The occurrence of coup-de-soleil is not unusual, but it is rarely attended with fatal results. Madness is common, but it generally assumes the milder form of idiocy. Maniacs alone are confined: idiots are regarded with much respect as saints, and it is probable that some persons feign idiocy to become objects of popular veneration, supported by alms given ungrudgingly. One of the Memlook Sultáns, Kaláoon, after the example of Saláh-ed-Deen or Saladin,[5] founded a madhouse or máristán at Cairo, which yet remains,[6] but in a grievously neglected state. Of late it has been found necessary to remove the patients thence to a modern hospital.

Nervous affections are uncommon, probably owing to the calm life which the inhabitants lead. Rheumatism is of more usual occurrence; but gout is, according to Clot-Bey, unknown.[7] It is very remarkable that hydrophobia is also unknown in Egypt. Although ownerless dogs are very numerous in Cairo and the smaller towns, and the heat of summer is so great, there is no recorded instance of rabies; yet Clot-Bey is probably in error when he says that it has not been observed at any period in that country,[8] for the formularies of the Coptic church contain a prayer to be used for a person afflicted with hydrophobia,[9] and such a prayer is not likely to have been derived from a foreign source.[10]

Geology.

In considering the geology of Egypt, its deserts claim our first notice. By a desert is generally understood a wide plain of shifting sand; but this is usually an erroneous description of such a tract, and especially inapplicable to the deserts which border the valley of the Nile. These are raised mountain regions, the surface of which is often covered with sand, débris, and pebbles, intersected by valleys, and diversified, in the case of the western desert, by some oases.

On both sides of the Nile the mountains are limestone, until a little above Thebes, where the sandstone commences. At the First Cataract red granite and other primitive rocks burst through the sandstone beneath the bed of the Nile, and for a considerable space on the east, obstructing the course of the river by numerous small islands and rocks, and thus forming the rapids. In several places, chiefly on the eastern side, bold promontories or steep mountains approach the river, and sometimes reach it. They are always utterly devoid of vegetation, and, except the granite, generally of a yellowish or reddish colour, though in some places they are greyish. Near the cataracts the sandstone mountains are partially covered with a bright yellow sand in drifts. The mountains on both sides near the river are usually about 300 feet in height, and rarely much loftier. The highest point on the western bank at Thebes is four times that altitude. If one leaves the river and ascends the mountains, he finds a great rocky tract before him, the only easy paths through which are along valleys often very winding. The eastern desert gradually rises until about midway between the Nile and the Red Sea, where primitive rocks burst through the later formation, and the loftiest of them, a granite mountain called Gebel-Ghâreb (*cir.* Lat. 28.) at-

---

1 Clot-Bey, *De la Peste*, Paris.
2 *Modern Egyptians*, App. E.
3 *Id.*, *ibid.*
4 Clot-Bey, *Aperçu Général*, tom. ii., p. 372.
5 Abulfedæ *Annales Muslemici*, ed. Reiske, Hafn., 1789–1794, tom. iv., pp. 30, 31.
6 *Englishwoman in Egypt*, vol. i., p. 166.
7 Clot-Bey, *Aperçu Général*, tom. ii., p. 377.
8 *Id.*, tom. ii., p. 378.
9 This is stated on the authority of the Rev. J. R. T. Lieder of Cairo, who has been long engaged in endeavouring to educate the Copts, and has succeeded in removing many of their prejudices, especially against Protestants. While occupied in this labour, he has collected a valuable amount of information respecting the ancient and remarkable church to which this remnant of the old inhabitants of Egypt belong.
10 For an account of the diseases of Egypt, see Clot-Bey's two works *Aperçu Général* and *De la Peste*, and *Desc. de l'Egypte*, tom. xiii., p. 29 *et seqq.*

Egypt.

tains the height of about 6000 feet. In this portion of the desert are porphyry, breccia, and basalt rocks, which were much prized by the ancient inhabitants for purposes of architecture and sculpture. The western desert is of a lower elevation, and is principally remarkable for its oases, which are deep valleys containing alluvial soil, but they are little productive except in dates. Their beauty and fertility has been much, though naturally, exaggerated. Notwithstanding the inequalities of their surface, it is evident that these deserts gradually rise towards the Red Sea, attaining their greatest height in the peninsula of Sinai, which is but a continuation of the same tract.

The most remarkable geological change which has been observed to have taken place in Egypt, and which is still in operation, is the depression of the northern shore and the corresponding elevation of the southern part of the isthmus of Suez. The consequence of this change of level has been the ruin of places on the shore of the Mediterranean, and the extension of the salt-marshes, and at the same time the drying up of a considerable part of the northernmost portion of the Gulf of Suez. It is very interesting to find this latter result predicted in the Scriptures at a time when it could not have been humanly foreseen. Thus Isaiah prophesied, "The waters shall fail from the sea, and the river shall be wasted and dried up;"[1] and, in another place, "The Lord shall utterly destroy the tongue of the Egyptain sea; and with his mighty wind shall he shake his hand over the river, and shall smite it in the seven streams, and make [men] go over dryshod" [Heb., *in shoes*]. In the latter passage,[2] "the river" may mean Euphrates, and instead of "in the seven streams," we may read "into seven streams;"[3] but the former passage, as well as another,[4] are sufficient to show that a diminution of the streams of the Nile was also prophesied, which likewise has been remarkably fulfilled. The bed of the Red Sea may be traced for a course of several miles north of Suez, which now stands at the head of its western gulf; and places considerably north of that town were on the coast within the historical period. Indeed, the change appears to have occurred chiefly, if not wholly, during that time.

The form of the plain and valley inclosed by the deserts and mountains is remarkably regular. In Lower Egypt the cultivable land little exceeds the limits of the ancient Delta, but considerably those of the space between the two remaining branches of the Nile. The northern coast is protected by shoals and a low range of sand-hills. To the south of these are extensive salt-marshes and lakes, or waste tracts, and then the cultivable land commences. The form of the valley, or Upper Egypt, may be more accurately described. For the first 70 miles above Cairo, by the course of the river, the valley is nearly north and south, until it takes a westerly direction, which it maintains for about the same distance. It then bends in an easterly course for a few miles, and again runs north and south for a longer distance, until, about 60 miles higher than the point where it turned towards the east, it again takes that direction, which is first E.S.E., then S.E., then due E., and at last a little to the N. of E. After this easterly course of near 200 miles, the valley becomes N. and S. for about 30 miles; it then turns to the W. for about 20 miles, and to the E. for about 50, when it again assumes a southerly direction for the remaining 60 miles below the First Cataract, the boundary of the country. The mountains and desert on the western side throughout Upper Egypt (or Middle and Upper), that is above Cairo, are generally further from the river than those on the eastern, which frequently reach to the water's edge. The difference is most remarkable as far as the town of Farshoot, which is by the course of the river about 350 miles above Cairo, and about 70 miles below Thebes. Near Farshoot commences a continuous series of canals, which flow parallel to the Nile, and near the Libyan chain, until they terminate in Lower Egypt, not far north of Cairo. South of Farshoot, the western mountains gradually approach the Nile; until, halfway between Thebes and the First Cataract, the cultivable soil is equally narrow on each bank; for, with the exception of a tract about 70 miles in length, commencing a little above Farshoot, and terminating a little above Thebes, the mountains and deserts on the eastern bank are very near the river throughout Upper Egypt. The greatest breadth of the cultivable land, all of which is not now cultivated, on the western bank seldom exceeds about 8 or 10 miles, and on the eastern bank, about 3 miles, but it is usually much narrower.

There is in Upper Egypt one striking deviation from the uniform character of the country. About 70 miles above Cairo, by the course of the Nile, an opening in the Libyan range leads to a kind of oasis, the Feiyoom, a fertile tract, lying in a hollow of the desert, and having at its further extremity a considerable lake of brackish water.

Names of Nile.

In the hieroglyphic inscriptions, the Nile receives the name of Hapimou, or the "abyss of waters,"[5] under which it was worshipped as a god. This divinity is represented as a stout man having woman's breasts, and sometimes painted red, but at others blue, to indicate the river at the season of its rise and during the rest of the year, or High and Low Nile.[6] The names of the Nile in Coptic are *φιαρο* or "the river," which was probably likewise an ancient Egyptain name, and its variations, and *πιαυτης*. Other supposed Coptic names rest upon doubtful authority.

We find in the Bible three names of the Nile. It is frequently called נְהַר מִצְרַיִם, or "the river of Egypt."[7] The appellation יְאוֹר, or יְאֹר, and its plural, is similar to this, and is probably of Egyptian origin. The Nile also receives the name of נַחַל, or נַחַל מִצְרַיִם—that is, if the word נַחַל be a proper name—Nahal, and Nahal-Mizraim; or, if it bear its ordinary Hebrew signification, "the brook," and "the brook of Egypt." Hence a difference of opinion has obtained respecting this name, some maintaining that it was a name of the Nile, while others concluded that it applied to a mountain torrent, which is usually dry, on the border of Egypt and Palestine, sometimes called the river of Egypt. In parallel passages, however, "the river of Egypt" and "the Nahal of Egypt" are used synonymously,[8] and almost certainly, also, the latter and the name Shihor, which is undoubtedly a name of the Nile.[9] It becomes a question, then, whether Nahal is to be taken in its ordinary Hebrew signification, or as a proper name of the river, and the origin of the Greek Νεῖλος. That it usually signifies a brook when applied to a stream cannot be denied, but its proper and first meaning is a valley, and thence a mountain-torrent. The Arabs, in like manner, have often used the word "wâdee," properly signifying "a valley," to designate rivers, because mountain-torrents in the valleys of Arabia are the streams to which the natives are accustomed: hence the names of several Spanish rivers commence with this word, as the Guadalquivir, a corruption of the Arab name, El-Wâdee el-Kebeer, or "the great river." It is not unreasonable, therefore, to suppose Nahal not to be a proper name. On the other hand, it may be argued that it is scarcely likely that two such similar appellations as Nehar-Mizraim and Nahal-Mizraim would be employed to designate the same stream, particularly as they ordinarily

1 Is. xix. 5.
2 Is. xi. 15.
3 Gesenii *Lexicon*, s. v. נָהָר
4 Ez. xxx. 12.
5 Bunsen's *Egypt's Place*, vol. i., p. 499.
6 *Ancient Egyptians*, second series, vol. ii., p. 56 *et seqq*. Pl. 56, 57.
7 Gen. xv. 18, &c.
8 Gen. xv. 18; Num. xxxiv. 5.
9 Josh. xiii. 3.

bear different significations; that the Arabs have the parallel appellation, Neel-Misr, or the Nile of Egypt; and that Nahal bears a resemblance to Νεῖλος which can hardly be accidental. The name שִׁיחוֹר, *Shihor*, which occurs in the Bible, as already noticed, is derived from שָׁחַר, "to be black," and signifies turbid and black.

The proper name of this river in Greek is Νεῖλος, by which it is known among the Arabs, who call it النِّيل *En-Neel*, the Nile, or نِيل مِصْر *Neel-Misr*, the Nile of Egypt. A famous Arab lexicographer gives the following explanation of this word:—"النِّيلُ is the river (lit. the inundation) of Egypt: Es-Saghânee says—'But as to the نِيل [indigo] with which one dyes, it is an Indian word Arabicised.'"[1] As the Hebrew word Shihor signifies black or turbid—and, with that signification, properly applies to the river during the inundation—it is very remarkable to find a name properly signifying the Nile during the inundation, to be the same as that of the dye indigo. It should be remembered also that the Low Nile was painted blue by the ancient Egyptians. The river is turbid and reddish throughout the year, and turns green about the time when the signs of rising commence, but not long afterwards becomes red and particularly turbid. Not to extend these remarks further, and to show more clearly the connection between the different names of the Nile mentioned above and others, a comparative list is here appended.

Hebrew.	Arabic.	Greek.	Latin.
Nahar-Mizraim		Αἴγυπτος ποταμὸς	
Nahal-Mizraim	Neel-Misr		
Nahal	Neel	Νεῖλος	Nilus
Shihor		Μέλας	Melo
	Bahr (Sea)	Ὠκεανὸς ?	

The Gihon, which is mentioned as one of the four rivers which arose in Eden, has been supposed by early commentators, as well as by certain modern critics, to be identical with the Nile. This opinion, however, is irreconcilable with the position of the other rivers, two of which are indubitably the Tigris and the Euphrates, and the third, probably the Phasis.

Source. The present article is not the place in which to examine the various opinions which have obtained respecting the source of the Nile. It is enough to say, that the interesting discoveries by Dr Krapf and Mr Rebmann, the missionaries stationed at Mombas, leave no room to doubt that the Bahr el-Abyad, or White Nile, flows from snowy mountains south of the equator. These must be the Mountain or Mountains of the Moon spoken of by Ptolemy and the Arabian geographers, and so called, according to Aristotle, from their whiteness.[2] The Arabs generally have placed the source of the river considerably south of the equator; and the errors of our modern European geographers must be ascribed to the Greeks. For further details, see the article NILE.

Change in level. A remarkable change has been ascertained to have occurred in the level of the Nile above Gebel-es-Silsileh (the ancient Silsilis, more than 80 miles south of Thebes), and throughout a considerable portion of Nubia. Indications of this change were first observed by Dr Lepsius, who discovered hieroglyphic inscriptions on rocks at Semneh, not far above the Second Cataract, showing that the river attained a much higher level about 2000 years before the Christian era than it does now. Sir Gardner Wilkinson pursued the inquiry in a paper read before the Royal Society of Literature, and published in their Transactions,[3] wherein he argues that the cause of this alteration must have been the bursting through of a barrier at Silsilis, where the low mountains confine the river to a narrow channel. There must have been at this place, therefore, an ancient fall of far more importance than the First Cataract, and those above it throughout Nubia; and from it may have arisen the accounts in classic writers of the greatness of the cataracts of the Nile, which are wholly inapplicable to the present First Cataract. This change seems to have been already complete about the beginning of the fourteenth century before our era, and we cannot tell if it had not been effected considerably earlier. All that is known for certain is, that it took place after the middle of the twentieth century B.C., and before the later date first mentioned. Its result has been to place the cultivable soil of a great portion of Nubia beyond the reach of the inundation, so that it is irrigated alone by water-wheels.

Water and deposits. The water of the Nile differs considerably in appearance and purity at various seasons of the year. A little after midsummer it becomes very turbid, and not long afterwards it assumes a green colour for more than a fortnight, owing to the quantity of vegetable matter which it brings down from its upper course. It then resumes its turbid character for the period of the rise, and retains it, though in a less degree, for the remaining portion of the year, until the following midsummer. The water is extremely sweet, particularly if drunk in its turbid state, and is easily filtered through porous jars manufactured in the country. Too careful a filtration destroys its peculiar flavour, and diminishes its excellence. It is very wholesome, except during the short period at which it is green; and the inhabitants of Egypt hold it in such high esteem, that they say, that he who has once drunk of the water of the Nile must return to drink of it again. Its turbid appearance, particularly during the rise and inundation, is owing to the presence of large quantities of earthy matter, which are annually deposited. The deposit, or mud of the Nile, has been thus analysed by M. Regnault.[4] The specimen was dry, and taken from a canal which conducted the waters of the inundation. He obtained the following results:

Water	·11
Carbon	·09
Oxide of iron	·06
Silica	·04
Carbonate of magnesia	·04
Carbonate of lime	·18
Alumen	·48
	1·00

M. Regnault remarks that the quantities of silica and alumen vary according to the places whence the mud is taken. "On the banks of the Nile the mud contains much sand; and, when it is carried by the waters of the inundation to distant tracts, it loses on the way a quantity of sand proportionate to its distance from the river; so that, when this distance is very considerable, one finds the argillaceous matter almost pure: thus the soil of Egypt presents argillaceous matter in those different states of purity which the arts require."[5]

Rise and inundation The Nile shows the first signs of rising in Egypt about the time of the summer solstice. At Khartoom, where the White River and the Blue River join, the commencement of the increase is observed early in April.[6] The slowness of the rise at first causes this difference. Usually the regular increase does not commence in Egypt until some days after

[1] The Misbâh of El-Feiyoomee.

[2] The incidental allusion in Aristotle is very valuable, if referring to these mountains, since it has been suggested that the mention in Ptolemy is an interpolation, because it was supposed to be unsupported by any other ancient writer. May not the story Herodotus tells of the source of the Nile from two mountains be an incorrect version of a true statement? (ii. 28).

[3] *Transactions of Royal Society of Literature*, vol. iv., new series.

[4] *Description de l'Egypte*, tom. xx., p. 163.

[5] *Description de l'Egypte*, tom. xx., pp. 163-4.

[6] Clot-Bey, tom i., pp. 36, 37.

the summer solstice, and the inundation begins about two months after that solstice. The river attains its greatest height at, or not long after, the autumnal equinox, and then, falling more slowly than it had risen, sinks to its lowest point at the end of nine months, when it remains stationary for a few days, until it begins again to increase. The inundation continues rather longer than it naturally would do, because the waters are retained for some time upon the lands by closing the mouths of the canals.[1] The river's banks being a little higher than the rest of the cultivable soil, the water is conveyed by canals or cuttings, and does not pour over the banks.

The inundations vary considerably, and, by either failing or rising to too great a height, cause much damage and distress. In the great French Description of Egypt, there is a table of sixty-six inundations, whereof eleven were very high, thirty good, sixteen feeble, and nine insufficient. This table was taken from the official records of the Nilometer on the Island of Er-Rōdah, near Cairo, and comprehends the inundations of the years A.H. 1150–1215, that is, A.D. 1737–1800.[2]

The Nile rises about 40 feet at the First Cataract, about 36 at Thebes, about 25 at Cairo, and about 4 at the Rosetta and Damietta mouths of the Nile, during a good inundation.[3] When it is said, however, that the river has attained to a certain height in feet or cubits, the height at the Nilometer of Er-Rōdah above-mentioned is meant; and by ancient writers, that of the river at Memphis, which was situated on the western bank, a little higher than Er-Rōdah. If the river do not attain a greater height than 18 or 20 feet, the rise is scanty; if only 2 or 4 feet more, insufficient; if it attain to 24 feet, or a greater height, not exceeding 27 feet, the inundation is good; but a higher rise must be characterized as a destructive flood.[4] Sometimes the inundation has failed altogether; as for seven years (A.H. 457) in the reign of the Fátimee Khaleefeh El-Mustansir bi-llāh, when there was a seven-years famine;[5] and low inundations always cause dearths. Excessive inundations, on the other hand, produce, or at least foster, the plague and murrain; so that a variation of a few feet is productive of the most serious consequences.

Current and volume of water.

The current, when at the lowest, has been estimated at about 2 feet a second, or a mile and a third in the hour, and at about 3 miles an hour during its height. The volume of water which the Nile pours into the Mediterranean in 24 hours, is as follows, according to M. Linant, an engineer in the employ of the Egyptian government:[6]—

		Cubic Mètres.
During the Low Nile,	by the Rosetta Branch,	79,532,551,728
	by the Damietta Branch,	71,033,840,640
		150,566,392,368
During the High Nile,	by the Rosetta Branch,	478,317,838,960
	by the Damietta Branch,	227,196,828,480
		705,514,667,440

Increase of soil by deposit.

Although the water is so abundantly charged with alluvium throughout the year, and especially during the inundation, the annual deposit by the river, except under extraordinary circumstances, is very much smaller than would be conjectured by any one unacquainted with researches into subjects of this nature. Various opinions have obtained as to the exact deposit left in a century on the land, but the inquirers have not usually differed in their results above an inch. If, however, we compare the quantity of deposit on certain very ancient structures, whereof we know the date, we shall find that the amount has materially differed in various places. Such differences are the natural results of irregularities in the river's course, of the strength or weakness of the current at particular places, of the nature of the country, and many other disturbing causes, from which we might have expected even greater variations. The ordinary average rate of the increase of the soil of Egypt may however be stated as about four inches and a half in a century.[7]

The cultivable land of Egypt must be regarded as wholly the deposit of the Nile, but it is vain to attempt a calculation of the period at which this process commenced, since we cannot conclude that the same ratio has always obtained, and we must suppose that the causes then in operation were very different from those which now regulate the phenomenon.

Cultivable soil.

From the table of the superficies of Egypt, it will be seen that the cultivable soil occupies only 5626 square miles, and that which might be cultivated only 1295 square miles, altogether 6921 square miles, or somewhat more than two-thirds of the whole space included between the deserts; but the quantity actually under cultivation does not exceed 5469 or 5500 square miles, or six-elevenths of the entire surface. This was not always so, and the deficiency of the population is the principal cause that near one-half of the soil which might possibly be brought into a state of culture is left uncultivated.

Throughout Egypt the cultivable soil does not present any very great difference, being always the deposit of the river; it contains, however, more sand near the river than at a distance from it. Towards the Mediterranean, its quality is injured by the salt with which the air is impregnated, and therefore it is not so favourable to vegetation. This, however, does not usually extend far south of the sea or the salt-marshes which intervene for the most part between it and the land. In Lower Egypt we find the greater portion of the neglected tracts principally to the E. and W. of the modern Delta, and in its northern portion. In Upper Egypt the narrowness of the valley, and the more numerous population, preserve the country in a better state of cultivation, and the soil is somewhat richer. The largest uncultivated tracts lie on the western bank, where the valley is broadest, and in places where the great canal running parallel to the Nile has fallen into a neglected condition. It may not be uninteresting to endeavour to trace the causes which have produced this change in Egypt.

Ancient prosperity of Egypt, and its decline.

Although some of the accounts of classic writers may be deemed exaggerated when they speak of the population and prosperity of Egypt in ancient times, we cannot accuse them of errors, except in the numbers of cities and villages, and of the inhabitants of the country; for the monuments show us how rich was Egypt under native rulers, and indicate to what causes this condition may reasonably be assigned. From the time at which the Great Pyramid was built, to the Persian invasion, a period of not much less than 2000 years, the population of Egypt and its extent of cultivated land far exceeded what they are in the present day. The country does not seem to have been over-populated; and many causes conduced to prevent this, such as the serious wars in which the Pharaohs engaged, the formation of colonies, and the like. The conquest by Cambyses, and the subsequent long and desolating struggle with the Persians, inflicted a severe blow on the interests of the country. Under the Macedonians it recovered much of its former prosperity; and when the Romans held Egypt, it was one of their most productive provinces, and the granary

[1] See the table in *Description de l'Egypte*, tom. xviii., i., p. 630, *et seqq.* *Horæ Ægyptiacæ*, pp. 4, 5.
[2] *Description de l'Egypte*, tom. xviii., i., p. 626, *et seqq.*
[3] *Englishwoman in Egypt*, vol. i., p. 89. *Description de l'Egypte*, tom. xviii., i., pp. 576–7.
[4] *Description de l'Egypte*, tom. xviii., i., p. 616.
[5] See below, section ii.
[6] Clot-Bey, tom. i., p. 41.
[7] This is Mr Lane's calculation. M. Girard, in the *Description de l'Egypte*, makes it "very nearly" 126 millimetres, that is in English inches 4·96071954. For a remarkable instance of rapid deposit see the *Englishwoman in Egypt*, vol. i., p. 132.

Egypt. of the empire. During the period of their rule, or for nearly seven centuries, various causes contributed to the decline of the population, but they were all of a political character. The chief of these were the contests of rival emperors, the occasional attempts of the natives to regain their independence, the incursions of savage tribes whom the Romans often had not power enough to repulse, notwithstanding that Egypt was in part protected by German mercenaries, until they had inflicted much loss on the inhabitants; and lastly, the religious struggles, first the persecutions of the Christians by the idolaters, and then the differences of Christian sects. After the Muslim conquest, this decay continued almost uninterruptedly until the accession of the Fâtimees; but from that time until the Turkish invasion, although foreign wars certainly diminished the population, the kings of that and the succeeding independent dynasties generally governed the country with a regard for its best interests, and cannot be accused of the tyranny and misrule of which the Turkish pâshâs have been guilty To them must be attributed the present miserable condition of Egypt. The great evil then is an insufficient population, and their consequent inability to cultivate the whole of the land fit for culture.

Physical causes have been assigned to account for what is in the main simply traceable to political ones. The geological change producing the elevation of the tract north of the head of the Gulf of Suez, and the depression of the north coast of Egypt has considerably diminished the cultivable soil in the Delta, by increasing the salt lakes and marshes which occupy its southern portion. There is, however, no greater fallacy than to suppose that the sands of the deserts have done injury by encroaching on the alluvial tracts, and that once fertile regions are buried beneath them. In some places they have undoubtedly encroached upon the valley or plain; but the deposit of the Nile has been constantly, and in almost every part of the country, encroaching upon the deserts, and thus diminishing their extent. It is neglect which might easily be remedied, that has permitted the sands thus to cover the soil where there have been no labourers to cultivate it. Above Gebel-es-Silsileh (Silsilis), in Upper Egypt, the change in the level of the Nile has placed fertile tracts almost wholly beyond the reach of the inundation, and thus made agriculture very laborious, but this is only for the space of about 40 miles in Egypt, where the extent of cultivated soil must always have been small on account of the narrowness of the valley. The failure of five of the seven branches of the Nile is partly to be charged to the neglect of the inhabitants, since all might have been maintained as constantly running canals; and the decay of the great canal which runs parallel to the Nile throughout the chief part of Upper Egypt is traceable to the same cause.

Projects for restoring its prosperity.

Various projects have been undertaken of late to better the condition of Egypt. The most promising of these was the construction of a barrage across both branches of the Nile at the point of the Delta, in order to regulate the inundation, and thus to render the country more fertile and easy of cultivation. This great engineering work was commenced under the government of Mohammad 'Alee, and continued under that of Ibraheem Pâshâ. Abbâs Pâshâ ordered it to cease; but it is said that Sa'eed Pâshâ, the present governor (Jan. 1855), intends to complete it. There is no doubt that, if successful, this barrage would produce the most happy results; but many other changes must take place before we can hope that Egypt will begin to recover anything of its ancient prosperity. A better government, and the placing the commerce of the country in native hands, would do much to effect this desirable result; but as far as we can judge, such a reform is unlikely. The pashalic will cease at the expiration of the present treaty with the Porte to be hereditary, and the governors will have no desire but to extract as much wealth as they can from their unfortunate province. The destiny of Egypt may indeed be different, but this is not the place in which to discuss the Oriental Question.

Agriculture under the Pharaohs.

Under the Pharaohs Egypt was an agricultural country, and both commerce and manufactures were comparatively unimportant. They judged rightly, that the main energies of the people should be expended in turning to the best account a soil of unexcelled richness, annually watered and renewed by the river. From the sculptures and paintings of the tombs, we form a clear idea of the agriculture of the ancient Egyptians, while the Scriptures and the classical writers give us information respecting the tenure of land, and the laws affecting the cultivators.

From the representations on the walls of the tombs, we learn what especial attention the great proprietors of land paid to the processes of agriculture. We see them constantly overseeing the labourers, and thus watching the interests of their lands; and this indicates one of the causes of the national prosperity of those times. The Egyptians were especially anxious to have a sufficient supply of water, both to draw the waters of the Nile upon those tracts which were not above their level at different periods, and to raise them by manual labour to the higher portions of the land. To effect the former object, they displayed great mechanical skill, as well as in the construction of dams and dikes, to retain the waters upon the lands; but for the latter they seem to have been contented with the rudest contrivances. Indeed, we know of but two methods that were employed in raising water, the use of the simple machine called in the present day the shâdoof, and buckets carried by men. The shâdoof is still employed, and is of the same form as that used by the ancient Egyptians. It consists of a pole resting upon a beam placed across two columns of brick or mud, and having at one extremity a weight, and at the other a rude bowl-shaped bucket suspended by a stick.[1] A man stands beneath it, and pulling down the bucket to the water, raises it again, assisted by the weight.

Immediately after the water of the inundation had subsided, the land was ploughed or broken up by the hoe, and sown, the seed being sometimes trodden in by goats driven over the field for the purpose.[2] Wheat being the most important of the field produce, we find the various agricultural processes connected with it frequently represented. Besides the ploughing and sowing, the harvest is depicted, the reapers cutting the wheat just below the ear, the ears being carried in nets or baskets by men or on asses to the thrashing-floor, where they were thrashed by oxen or cows.[3] Sometimes the wheat was bound in sheaves.[4] The same or similar processes with reference to other kinds of grain are pourtrayed in the tombs, wherein we find also curious representations of the vineyards and gardens. The vineyard was not the least valuable part of an estate when Egypt was famous for its wines in the days of the Greeks and Romans; and it is evident that wine must have been highly prized in earlier times from several kinds being enumerated in the inscriptions, and from its always being seen at the feasts. Besides the vine, other fruit-trees were cultivated, and especially the palm-tree. These will be afterwards mentioned in speaking of the productions of Egypt, which are now, for the most part, the same as in early times. The gardens were often extensive, and laid out with great formality (partly the result of their being watered in the same manner as the fields generally), and containing tanks for fish as well as for purposes of inundation.[5] The Egyptians paid great atten-

[1] For the ancient form of the shâdoof, see *Ancient Egyptians*, vol. ii., p. 4; and for the modern, *Modern Egyptians*, chap. xiv.
[2] Wilkinson's *Ancient Egyptians*, vol. iv., p. 38. [3] *Id.*, p. 86, 87, 90, 94. [4] *Id.*, p. 93. [5] Lepsius's *Denkmäler*, abth. iii., bl. 95.

Egypt.

tion to preserving fish, and the product of the fisheries of one great artificial lake, that of Mœris, formed an important branch of the revenue. There were also tracts left to reeds, which, if not planted, were at least carefully maintained, on account of their value for manufactures, and as covers for wild-fowl.

The agricultural labourers, like the herdsmen, were regarded as a degraded class, and seem not to have possessed land of their own, except in very early times. Indeed, it is stated in the Bible that Joseph purchased the whole of the land of the Egyptians for Pharaoh, and gave the people seed to sow it, claiming a fifth of the produce as the king's right. The land of the priests alone was not purchased.[1] Diodorus Siculus relates that anciently the land was the property of the priests, of the king, and of the military class,[2] and the monuments leave little room to doubt that such was generally the case. The two accounts are reconciled by supposing that the military class soon regained their land.

Modern agriculture.

The agriculture of the modern Egyptians differs little from that of the ancient inhabitants. In one respect it is the converse of the old culture, for while the ancients excelled in the management of dikes and dams, and neglected the raising of water except by a simple and rude machine, or the still simpler method of carrying it in buckets, the moderns, while they have paid less attention to the great canals, and the means by which they were regulated, have employed far more ingenious means of artificial irrigation. The deficiency of population has partly caused the decay of many of the canals, and the neglect of many of the dams and dikes, and has at the same time necessitated the economizing of human labour, for which that of oxen has been substituted in a great measure.

Of the machines the most common is the shâdoof, already described, but there are also two kinds of water-wheels. The more usual of these is that called the sâkiyeh, which is composed of a horizontal wheel turned by oxen, and connected with a vertical wheel which is on the same axis as another around which are earthen pots in which the water is raised and poured into a trough. The tâboot is a similar machine, which differs from the sâkiyeh principally in having a hollow wheel instead of the wheel with pots, in the jaunts or fellies of which the water is conveyed. Sometimes a katweh is employed, which is a bucket like that of the shâdoof, having four cords by which two men dip it into the river or canal and raise the water.[3]

"The 'rei' lands (or those which are naturally inundated) are, with some exceptions, cultivated but once during the year. After the waters have retired, about the end of October or beginning of November, they are sown with wheat, barley, lentils, beans, lupins, chick-peas, &c. This is called the 'shitawee' (or winter) season. But the 'sharâkee' lands (or those which are too high to be subject to the natural inundation), and some parts of the rei, by artificial irrigation are made to produce three crops every year; though not *all* the sharâkee lands are thus cultivated. The lands artificially irrigated produce, first, their shitawee crops, being sown at the same period as the rei lands, generally with wheat or barley. Secondly, in what is called the 'seyfee,' or in the southern part of Egypt the 'keydee' or 'geydee' (that is, the summer) season, commencing about the vernal equinox, or a little later, they are sown with millet ('durah seyfee'), or with indigo or cotton, &c. Thirdly, in the 'demeereh' season, or period of the rise of the Nile, commencing about or soon after the summer solstice, they are sown with millet again, or with maize ('durah shâmee'), &c., and thus crowned with a third harvest. Sugar is cultivated throughout a large portion of Upper Egypt; and rice in the low lands near the Mediterranean."[4] The culture of cotton was introduced by Mohammad 'Alee with a view to promote his manufacturing schemes, and the Turkish grandees have found it a source of temporary profit. The necessity, however, of constructing dams to exclude the Nile water from the cotton-growing fields has rendered the inundations destructive, and the speculation seems on the whole to have injured the welfare of Egypt.

The agricultural implements of the modern Egyptians are rude in construction, and similar to those anciently employed in the country. One of these, however, was not known to the earlier inhabitants. This is the nórag, a machine "in the form of a chair, which moves upon small iron wheels or thin circular plates, generally eleven, fixed to three thick axle-trees, four to the foremost, the same number to the hindmost, and three to the intermediate axle-tree. This machine is drawn in a circle by a pair of cows or bulls over the corn." It is employed to separate the grain of wheat, barley, &c., and to cut the straw, which is used for fodder.[5] The ancient Egyptians, as before remarked, generally cut the wheat near the ear.

An Egyptian garden is in some respects a miniature of Egypt. It is intersected by numerous small channels which are filled by one or more water-wheels. By these channels the water is spread over the garden, divided by them into many square compartments, edged with ridges of earth. This system of course makes it very difficult to keep a garden in good order, and no great variety of flowers is cultivated.

Though Mohammad 'Alee Páshá was very desirous to encourage European manufactures, he did not sufficiently endeavour to apply modern science to the improvement of the native agriculture. Ibraheem Páshá, however, who succeeded him, always maintained that the country should be agricultural rather than manufacturing, and introduced important improvements during his father's government. In particular, he watered large tracts by means of powerful engines, and his estates were always noted for the excellence of their culture. But the shortness of his rule did not permit him to extend these plans, and they ill suited the oriental apathy of Abbás Páshá. Whether the present governor will adopt a wiser policy than his predecessor cannot yet be perceived, but his abolition of certain government monopolies augurs well for the future. The first popular acts of a new ruler do not, however, always indicate the course he will pursue.

Tenure of land.

Before the time of Mohammad 'Alee a kind of feudal system prevailed, and much of the land was possessed by small proprietors under the protection of the great emeers. By the massacre of the Memlooks, the páshá destroyed feudalism, and by arbitrarily seizing almost all the landed property, rendered private tenure of land a most rare condition. He allotted to those whom he thus unjustly dispossessed annual pensions for life, as the only compensation for an act of tyranny to which even the history of Egypt scarcely affords a parallel.[6] But this cruelty was carried still farther, and those whose lands were not confiscated, through fear yielded them up, so to speak, voluntarily, and buried their title-deeds, which are yet so concealed. A system of government which suffers the supreme authority to overlook such acts, and subordinate governors to perpetrate them, in defiance of the Muslim code and Arab jurisprudence, demands the most thorough and searching reform.

Lakes of Egypt.

Egypt has always been famous for its lakes, which have either aided commerce or supplied the inhabitants of the country with fish and wild fowl, or with some valuable production, or assisted in regulating the effects of the inundation. All have enriched the land in some one of these

1 Gen. xlvii. 18–26.
2 Lib. i., ch. 73.
3 *Modern Egyptians*, ch. xiv.
4 *Id.*, ch. xiv.
5 *Modern Egyptians*, ch. xiv.
6 *Id.*, ch. iv.

Egypt.

ways, and thus they have been important sources of its natural wealth.

Lake Mareotis.

Commencing our examination at the north-western extremity of Egypt, we first observe the lake now called Boheyret-Maryoot,[1] and anciently Lake Mareotis. This is an extensive salt marsh rather than a lake, excepting during the inundation, when its contents are augmented by filtration. Its shape is that of an irregular right-angled triangle, whereof the hypotenuse extends from east to west for a space of about forty miles. At its eastern extremity the lake is of little breadth, and separated by only a narrow strip of land from the sea. It scarcely widens for about half its length, and then suddenly becomes very broad to the south of Alexandria. Not far beyond that city its shore changes in direction, and the distance from the sea for the first time becomes greater. The eastern side, which is the shortest, has a south-easterly direction, and the lake is here of considerable breadth. Anciently Lake Mareotis was navigable, and thus contributed to the commercial importance of Alexandria. The country around was cultivated, and produced the famous Mareotic wine. The relations of various travellers show that it was still a lake during the fifteenth and sixteenth, and as late as towards the close of the seventeenth century after the Christian era; and one of these writers, Villamont (in 1590), mentions that in his time the fisheries produced a considerable sum.[2] When, however, the French army conquered and occupied Egypt (1798–1801) they found its basin to be "a sandy plain, of which the lower portion retained the rain-water, which remained there for a great part of winter." It probably had dried up towards the close of the seventeenth century or beginning of the eighteenth.[3] On the 4th of April 1801 the English army, which was co-operating with that of the Grand Vezeer against the French garrison of Alexandria, cut the dikes of the canal of that city, and thus admitted the waters of the Lake of Aboo-Keer into the ancient bed of Lake Mareotis, in order to cut off the water supply of the besieged.[4] The basin of the lake being, however, partially inhabited, some loss of life and property was the result of this act, which has been much called in question, and not without reason. The unhealthiness of Alexandria is also traceable to the formation of this marsh. The precedent thus set has been twice imitated, first by the Turks in 1803, and a second time by the English army under General Fraser in 1807.[5] At the present day the lake or marsh is unprofitable, and its shores are uncultivated and uninhabited, the whole wearing the most dreary and melancholy aspect.

Lake of Aboo-Keer.

To the north of Lake Mareotis is situate that of Aboo-Keer, called by the modern Egyptians Boheyret-Aboo-Keer. It is simply the northernmost portion of the former lake, from which it is separated by the Mahmoodeeyeh Canal (which here occupies the site of the older Canal of Alexandria), and the embankments or dikes which form its banks. It is very small, nowhere measuring ten miles across; and extremely shallow, usually not exceeding three feet in depth. The water is salt, being chiefly derived from the sea, from which it is separated by a narrow strip of land on the western side, and on the eastern by a similar strip of far less breadth, the shore of the ever memorable Bay of Aboo-Keer.

Lake of Atkoo.

To the east of the lake of Aboo-Keer is that of Atkoo, or Boheyret-Atkoo. It spreads when full nearly to the town of Rosetta, and is separated from the sea by a narrow neck of land on which stands the large village of Atkoo. Its extent varies according to the quantity of water which it receives from the inundation.[6]

Lake of El-Burullus.

The great lake of El-Burullus commences a little to the eastward of the Rosetta branch of the Nile, and stretches to somewhat beyond where the canal which was anciently the Sebennytic branch enters it, and passing through it reaches the sea. Like the other northern lakes, it is separated from the Mediterranean by a narrow strip of land, and its shore on that side is similar in direction to the coast of Egypt. For two-thirds of its extent from its western end it takes a north-easterly direction, and then turns towards the south-east. Its southern shore is extremely irregular, and not far from it are most of the numerous islands which diversify its surface. The greatest extent of the lake, measured in a line from the eastern to the western extremity, exceeds forty miles, and it is throughout very shallow.[7] It is chiefly known for its water-melons, which are yellow within instead of being red or pink, and come into season after those grown on the banks of the Nile.

Lake of El-Menzeleh.

The easternmost of the lakes of Egypt is Boheyret-el-Menzeleh, which greatly exceeds the others in size. It extends from very near the Damietta branch of the Nile to the mouth of the old Tanitic branch, which is now called the canal of El-Mo'izz, and passes through this lake to the sea. It also receives the waters of the canals which were once the Mendesian and Pelusiac branches. The northern shore is separated from the sea by an extremely narrow strip of land, and slopes from the west in a south-easterly direction, and the southern shore is very irregular, although its distance from the northern generally does not vary much. At its south-eastern extremity is a long marshy creek extending into the desert. Its average length is about forty miles, and its average breadth about fifteen. Its depth is greater than that of the other lakes, and the water is salt, though mixed with fresh, and therefore not pure sea-water. Upon the surface are numerous islands, and the whole lake abounds in reeds of various kinds. It supports a considerable population of rude fishermen, who dwell in villages on the shore and islands, and live upon the fish of the lake. This fishery was a government monopoly, and probably is so still unless Sa'eed Páshá has abolished it with the other monopolies. The reeds are cover for water-fowl of various kinds which the traveller sees in great numbers, and wild boars are found in the marshes to the south.[8]

Lake Serbonis.

The Lake Serbonis, so well known in ancient times as having swallowed up those passing over its marshes concealed by shifting sands, is now dry, and little danger is to be feared by those who cross it. It cannot indeed be any longer included in the list of the lakes of Egypt.

Bitter Lakes.

Besides the lakes above mentioned are those called the Bitter Lakes, which should rather be termed marshes, occupying part of the ancient bed of the Red Sea between Suez and Lake Menzeleh, and the Natron Lakes. The latter are very small, and situate in a valley of the western desert, not very far from the river; this valley will be noticed in a future place.

Natron Lakes.

Lake of El-Karn.

In Upper Egypt there is but one lake of sufficient importance to claim a separate notice. It is the Birket-el-Karn or Lake of El-Karn, at the extremity of the Feiyoom, which is, as already mentioned, an oasis on the western side of the river, to which an opening in the mountains leads. It is about 35 miles long, and its widest part a little exceeds 7 miles, according to Sir Gardner Wilkinson, while in several places it is considerably narrower. About the middle is a single island. The depth is not great, and the same author,

[1] "Boheyreh" (pronounced "Boheyret" when followed by a genitive), signifies "a little sea," being the diminutive of "bahr" a "sea," and is applied to large lakes, smaller ones receiving the appellation "birkeh." The distinction is however not always maintained, and the great lake of the Feiyoom is called Birket-el-Karn, although from its size it should be called a boheyreh.

[2] *Description de l'Egypte*, tom. xvi., p. 201. [3] *Id.*, pp. 200, 201. [4] *Id.*, 201, 202. [5] See section ii.

[6] *Description de l'Egypte*, tom. xvi., p. 204. [7] *Id.*, p. 205. [8] *Modern Egypt and Thebes*, vol. i., p. 446.

Egypt.

who "sounded in several places," "found what is considered the deepest part to be only $28\frac{1}{2}$ feet."[1] Its level is considerably below that of the Nile, as the bank of the river at Benee-Suweyf, which is at the entrance of the valley leading to the Feiyoom, is upwards of a hundred feet higher than the water of the lake.[2] The shores are barren or uncultivated; the northern is desert and bounded by sandy mountains; the southern was in ancient times partly cultivated. The water is brackish and unwholesome, though the fishermen, of whom there are a few, drink it habitually.

Lake Mœris.

The famous Lake Mœris lay between the Feiyoom and the Nile, and not far from the river. It was an artificial work executed by an ancient Pharaoh, whose name it bore, and may rather be described as having been a broad canal than a lake. The irrigation of neighbouring tracts was regulated by Lake Mœris, and its fisheries, as before mentioned, formed an important part of the revenue. Subsequently to the subjugation of Egypt by the Romans its dikes were neglected, and by degrees it became ruined. Until lately its position and extent were considered doubtful, but M. Linant's excellent memoir, published by the Egyptian Society of Cairo, has established these points most satisfactorily from the remains of its basin, which are yet traceable.

Canals of Egypt.

Mahmoodeeyeh Canal.

The canals of Egypt deserve especial attention from their great importance in extending the beneficial influence of the inundation. In Lower Egypt we find, beginning from the east, first the Mahmoodeeyeh Canal, which connects Alexandria with the Rosetta branch of the Nile, taking a similar direction to that of the ancient canal which it has succeeded. It was dug by the orders of Mohammad 'Alee, and although not quite 50 miles in length, and not 100 feet broad, about 12,000 labourers are said to have died in ten months while the work was in progress.[3] This is well known to be a tolerably accurate statement of the losses experienced by the unfortunate workmen, and is only one of the many instances which the history of our own times affords of that reckless disregard of human life, which is one of the worst traits of Turkish character, and strikingly distinguishes the cruel 'Osmánlee from the humane Arab.[4]

Canal of Manoof.

Between the Rosetta and Damietta branches of the Nile are several canals, some of which are of importance, particularly the short canal of Manoof connecting the two branches not far from the point of the Delta. To the east of the Damietta branch are others, whereof the most remarkable occupy the beds of the Tanitic and Pelusiac branches, which have been cleared to a sufficient extent to form canals. The former of these, which lies to the westward of the other, is called the Canal of El-Mo'izz, the first Fátimee khaleefeh who ruled in Egypt, having been dug by his orders, and the latter bears the name of the Canal of Abu-l-Munegga, a Jew who executed this work, under the Khaleefeh El-'Amir, in order to water the province called the Sharkeeyeh. The last-mentioned canal is connected with the remains of that which anciently joined the Nile and the Red Sea. Of this important work the greater part has been destroyed through neglect, but it might be restored without a very great expenditure. It was of the Pharaonic times—having been commenced according to ancient writers by Sesôstris[5] or by Neco II.; most probably by the former, since Rameses II., who is generally intended by the Sesôstris of the Greeks, has left a record of his reign in its vicinity.[6] It was continued by Darius Hystaspis, and at length finished by Ptolemy Philadelphus. The reopening of this canal, or the cutting of another from the Mediterranean to the Red Sea, has been proposed in our own times, but both projects have given way to that of a railway, which is now in course of construction. A ship canal joining the Mediterranean and the Red Sea is now (January 1855), however, contemplated, but it is generally believed that it will not be carried out.

Canal of El-Mo'izz.

Canal of Abu-l-Munegga.

Canal of the Red Sea.

Bahr-Yoosuf.

The extent and character of the great canal called the Bahr-Yoosuf or River of Joseph, which runs parallel with the Nile on its western side, from a little below Cairo to near Farshoot, a distance by the river of about 350 miles, render it the most important work of the kind in Egypt. It is a continuous series of canals rather than one canal. Although the Joseph whence it takes its name is the celebrated Saláh-ed-deen, the Saladin of our historians, yet it is related that he merely repaired it, and it is not doubted to be of a much earlier period. Most probably it was executed under the Pharaohs; and there would seem some reason in the Arab tradition that it was the work of the patriarch Joseph, were it not for the circumstance that such a story would naturally arise from its name. In the present day it is not navigable except during the season of the inundation, and at other times is dry in various places. To restore it would not be a work of extreme difficulty, and would greatly benefit the commerce and agriculture of the country, perhaps more than any other undertaking of the kind.

Botany.

Egypt differs from most other countries in having neither woods nor forests. Besides the palm groves, we rarely see even a grove of trees, except in Lower Egypt. The largest common trees are acacias, sycamore-fig-trees, and mulberry-trees, all of which are frequently planted on each side of the great roads near Cairo; and the most beautiful trees are the date-palm and the banana. The beauty of the palm is, however, in a great measure owing to art; for its lowest branches are annually cut, which causes it to grow high, and renders its head of elegant form. On this account the ancient Egyptians adopted a palm branch as the symbol of the year.[7] When wild, this tree has a far inferior appearance, being low, and having long ragged branches reaching to the ground; and its dates are small and poor in flavour. The Theban palm is a very different tree, having two great branches, each of which divides into two other branches, a subdivision which continues still farther. The weeping-willow, myrtle, elm, and cypress, are found in the gardens and plantations, with various trees bearing the fruits to be next mentioned; and the tamarisk is to be seen everywhere.

The more common of the fruits are dates of various kinds; which are sold half-ripe, ripe, dried, and pressed in their fresh moist state in mats or skins. Many different sorts are enumerated as known in Egypt. The dependencies,

[1] *Modern Egypt and Thebes*, vol. ii., pp. 344–5. [2] *Id.*, p. 346. [3] *Englishwoman in Egypt*, vol. i., pp. 47–8.

[4] Writers on the East have not generally been careful to distinguish the Turkish and Arab national character, and the former has thus had the advantage of the virtues of the latter, which has received in return the stigma of the other's vices. The remarkable characteristics of Arab character are high honour, generous hospitality, and humanity; coupled with much deceit in small matters not considered points of honour, carelessness as to religion, though not irreligion, and a love of plunder. The Turkish character is as strongly marked by treachery, often of the blackest kind; little hospitality, particularly to strangers; cruelty and disregard of human life; bigotry as to their religion, which is now giving way to deism; and the same love of plunder which is so common among the Arabs, as well as darker vices unknown to them, which have rendered the Turkish name a bye-word in the East, as well as in the West. The conquests of the Arabs were not marked by desolation; their rule has preserved and even improved the philosophy of Greece, which was welcome at the court of Baghdád when unknown in Europe: architecture among them attained an excellence scarcely rivalled elsewhere in modern times. The rule of the Turks is traced by ruined cities, and whole provinces laid waste; literature has forsaken its most famous seats, Constantinople, Athens, Alexandria, and Antioch; the arts have decayed. Until they held Egypt and Mesopotamia, these were the richest countries of the world, now they are half deserts. All these are facts which can be proved.

[5] Aristot. *Meteor.* i. 14; Str. i. and xvii.; Plin. *Hist. Nat.*, vi. 29; Herod. ii. 158; Diod. i. 33.

[6] *Materia Hieroglyphica*, appendix No. 4. [7] *Horæ Ægyptiacæ*, p. 9–11.

Egypt.

however, and not Egypt, produce the finest of these dates. The hotter and drier climates of the Oases and Lower Nubia best suit the date-palm; and the pressed dates of Seewah, the ancient Oasis of Jupiter Ammon, are among the most esteemed. The dates of Mount Sinai are generally poor, but the good monks of the convent of St Catherine make of them an excellent conserve, taking out the stones and placing almonds in their stead, and then pressing them together and packing them in gazelle-skins. The grape is a common fruit, but wine is not made from it on account of the prohibition of Mohammed. The Feiyoom is celebrated for its grapes, and chiefly supplies the market of Cairo. The most common kind of grape is the white, of which there is a small kind far superior to the ordinary sort. The black grapes are large, but comparatively tasteless. The vines are trailed on trelliswork, and form agreeable avenues in the gardens of Cairo; but little attention is paid to their culture, the common fault of Egyptian agriculture and gardening, resulting from the generosity of nature and the indolence of the inhabitants.

The best known fruits, besides dates and grapes, are figs, sycamore-figs, and pomegranates, apricots and peaches, oranges and citrons, lemons and limes, bananas, which are believed to be of the fruits of Paradise (being always in season), different kinds of melons (including some of aromatic flavour, and the refreshing water-melon), mulberries, and Indian figs, or prickly pears, the fruit of the lote-tree, and olives. Many of these are excellent, especially the figs and melons. The trees and plants which produce most of them are chiefly confined to the gardens. The cactus bearing the Indian fig is extremely common, and forms the hedges of gardens and plantations.

The general plan of an Egyptian garden has been already described. Although seldom in good order, such a garden is often picturesque; having a few date-palms and bananas, and perhaps overlooked by a house of the old style of architecture. No great variety of flowers is cultivated. Among the more usual are the rose (which has ever been a favourite among the Arabs), the jasmine, narcissus, lily, oleander, chrysanthemum, convolvulus, geranium, dahlia, basil, the hinnè plant (or Egyptian privet, which is said to be a flower of Paradise), the helianthus, and the violet.

The vegetables, &c. are very common and of various kinds, so that we cannot wonder that the Children of Israel longed for them in the desert. The principal are beans, peas, vetches, lentils (whereof a pottage is made, which is the common food of the Nile boatmen), lupins, chick-peas, the lubia (*Dolichos lubia*), fenugreek, mallows, the bamiyeh (*Hibiscus esculentus*), spinach, purslain, melookheeyeh (*Corchorus olitorius*), leeks, onions, garlic, celery, parsley, chicory, cress, radishes, carrots, turnips, colocasium, lettuce, cabbage, fennel, gourds and cucumbers (both of several kinds), the tomata, the egg-fruit or badingân (black and white), caraway, coriander, cumin, aniseed, and red pepper.

The chief field-produce is wheat (which is more grown than any other kind of corn), barley, several sorts of millet, maize, rice, oats, clover, peas, the sugar-cane, roses, two species of the tobacco-plant, and cotton. The sugar-cane is extensively cultivated, and excellent sugar is manufactured from it. There are fields of roses in the Feiyoom, which supply the market with rose-water. The tobacco produced in Egypt is coarse and strong compared with that which is used by the middle and upper classes, and imported from Syria and Turkey. That of Syria is considered the best. Of textile plants, the principal are hemp, cotton, and flax; and of plants used for dyeing, bastard saffron, madder, woad, and the indigo plant. The intoxicating hasheesh—which some smoke in a kind of water-pipe formed of a cocoa-nut, two tubes, and a bowl, seldom used for any other narcotic—is not, as has been erroneously supposed, opium, but hemp. The effect is most baneful. The leaves of the hinnè plant, already mentioned, are used to tinge of a bright red colour the palms of the hands, the soles of the feet, and the nails of both hands and feet, of women and children, the hair of old ladies, and the tails of horses. Indigo is very extensively employed to dye the shirts of the natives of the poorer classes, and is, when very dark, the colour of mourning; therefore, women at funerals, and generally after a death, smear themselves with it. Oil is extracted from the seeds of the cotton plant, hemp, colewort, the poppy, the castor-oil plant, sesame, and flax. The high coarse grass called halfeh (*Poa cynosuroïdes*) grows in great quantity in waste places and among ancient ruins.

Many kinds of reeds are found in Egypt, though, if we compare the representations in the tombs of the ancient Egyptians with what we see in the present day, it is evident that they were anciently much more common. That they should be wasted away, was prophesied by Isaiah (xix. 6, 7). The famous byblus or papyrus, from which paper was manufactured in old times, appears to be nearly, if not quite extinct, since Sir Gardner Wilkinson has never seen it.[1] M. Delile, in his excellent account of the Egyptian flora, merely mentions it by name in his list as the *Cyperus papyrus*, called in Arabic *berdy*, and found at Damietta,[2] but gives no figure of it. The lotus, so prized for its flowers by the ancient inhabitants, is still found in Egypt, though it is not common. The French naturalist above mentioned enumerates three species which formerly grew in that country—one with white flowers, another with blue, and a third with rose-coloured, the last of which is now extinct there.

Zoology.

The zoology of Egypt is not of remarkable interest, although it contains some very curious points. The absence of jungle and of forests, and the little shelter thus afforded to beasts of prey, as well as other wild animals, partly causes this; and we observe few birds of beautiful plumage for the same reason. Such an open country is rather fitted for birds which will not be so easily remarked as would be the brilliant ones of the forests of India and Brazil.

One of the most characteristic of the beasts is the camel, which is more at home in the dry climate of Egypt than elsewhere out of its native deserts. It has been remarked, however, that the camel, like his master the Arab, degenerates when removed into a city or a cultivated tract—that the former commonly becomes mangy, and the latter experiences a physical and moral degradation. The Egyptian camel is of the one-humped kind, which has been erroneously called the dromedary, whereas the dromedary is merely a swift camel standing in the same relation to the ordinary camel that our saddle-horse does to our cart-horse. Camel's flesh is for the most part eaten only by the peasants and the Arabs of the desert; by the Copts it is considered unlawful food.

It is very remarkable that no representation of the camel has been found in the sculptures and paintings of the Egyptian monuments, among the very numerous figures of the animals of Egypt both tame and wild, and of those brought from foreign lands as presents. It does not appear to have been introduced into other African countries, until after the Christian era;[3] but it must have been known to the Egyptians, although it is by no means certain that it was one of their domestic beasts. Two passages in the Bible which speak of camels in the possession of Pharaohs,[4] refer to the time at which the foreign tribes called Shepherds were in Egypt; and it is almost certain that those

[1] *Modern-Egypt and Thebes*, vol. i., p. 441.

[2] "*Cyperus papyrus*, Linn.—Arab. *berdy*, Damiatæ." *Description de l'Egypte*, tom. xix., p. 71. Other Cyperi are described at pp. 125–6, and 130–2 of the same volume.

[3] Comp. Desmoulins, Mem. lu à l'Institut, 28 Juin 1823.

[4] Gen. xii. 16; Ex. ix. 3.

very Pharaohs were of the Shepherd races. Perhaps the camel was peculiarly the animal of one or all of those races, and therefore omitted in the representations of the monuments as an ill-omened and hateful beast.

To modern Egypt the camel is very valuable, since the traffic with Syria, Arabia, Western Africa, and Ethiopia, is mainly carried on by caravans. But the ancient Egyptians appear to have derived their wealth more from tributary presents than from commerce, to have allowed their land commerce to be much in the hands of foreign merchants, like those who brought Joseph into Egypt, and to have left even their sea commerce partly at least in foreign hands.

In old times the horses of Egypt were famous, and the armies of the Pharaohs were noted for their war chariots. From Egypt Solomon, and in his time all the kings of the Hittites and the kings of Syria, had horses and chariots.[1] And long after, when first the kingdom of Israel and then that of Judah endeavoured to throw off the yoke of the great kings of the East and made alliance with Egypt, they put their trust in Pharaoh's horses.[2] In the representations of battles fought by the kings of the Eighteenth and Nineteenth Dynasties we see no Egyptian cavalry, but only chariots, called *cavalry* in the inscriptions. At later times they may have had cavalry, properly speaking, of their own, and perhaps at all times among the mercenary or auxiliary forces.

In the present day the horses of Egypt are of a very indifferent breed, and the best that one sees in that country have been brought from Arabia and Syria, but these are seldom of great excellence. It is indeed surprising to find so few really good horses in a country bordering on Arabia; and not many years ago this was still more remarkable, though not during the existence of the Memlooks. The finest Arabs, however, are kept in the background by their possessors, partly for fear of the "evil eye," and partly, in the case of all but the highest personages, to avoid their forcible seizure by those of greater rank and power.

The Egyptian ass holds a middle place between that of Great Britain and the wild ass, which is more swift of foot than the horse. It is tall and handsome, docile, and having excellent paces, particularly a quick and easy amble. Thus it is well suited to the narrow streets of the metropolis, and of the other towns of Egypt, and is therefore commonly used for riding by persons of the middle and lower classes. Although asses are generally much cheaper than horses, the price of a fine ass exceeds that of an ordinary saddle-horse. The mules are handsome, but noted for vice, and what is very remarkable, for not being sure-footed.

The neat cattle are short-horned, rather small, and, as of old, very beautiful, speaking artistically. They are exceedingly quiet in disposition, and much valued for agricultural labour by the people, who therefore very rarely slaughter them for meat, and then only for the Franks. Buffaloes of an uncouth appearance and of a dark slaty colour, strikingly contrasting with the neat cattle, abound in Egypt. When voyaging on the Nile, one often sees them standing or lying in the river by herds. They are perfectly mild, and the little children of the villagers often ride them to or from the river. They are sometimes slaughtered, but their flesh is tough and coarse. Sheep (of which the greater number are "black") and goats are abundant in Egypt, and the flesh of the former is the ordinary butcher's meat. Swine are very rarely kept, and then almost wholly for the Franks; the Copts generally abstain from eating their meat. It appears that the ancient Egyptians, though they were not forbidden this flesh, in like manner rarely eat it, perhaps because it is so extremely unwholesome in a hot climate.

The Muslims consider dogs unclean, and therefore those of Cairo and most of the towns are half-wild and without masters, living upon offal, and upon food thrown to them by charitable persons. In the villages, however, and particularly in the Thebaïs, their case is better, for they are kept as guards to protect live-stock from thieves, and from hyenas and other wild animals, which come down from the mountains and deserts by night in quest of prey. The common dog of Egypt is generally of a sandy colour and strong, though not remarkable for courage; but in Upper Egypt, about Thebes, there is a fierce breed of dogs with wiry hair, generally black, and much esteemed for courage by their masters. Cats are as numerous in Cairo as dogs, and many of them are as homeless. They are, however, regarded with favour by the natives, who assign as their reason that the prophet Mohammad was fond of cats. This may perhaps be regarded as a relic of the veneration in which they were held by the ancient Egyptians. By them the cat was considered one of the sacred animals, and more highly reverenced than was perhaps any other. It was the emblem of the goddess Pasht, whom the Greeks called Bubastis. Diodorus Siculus relates an anecdote which shows to what an extent the veneration for this animal was carried. He tell us, that when he was in Egypt he was an eye-witness of the popular vengeance on a Roman who had accidentally killed a cat. Although the people were most anxious to conciliate the Romans, and were in great fear of them, neither this fear nor the interference of the king, prevented the unintentional culprit losing his life through their rage.[3] It is not a little curious, that there is at Cairo a royal foundation for the support of destitute cats. The author of this charity was the famous Memlook Sultán, Edh-Dháhir Beybars, whose humane intentions have of late years been sadly neglected by the trustees.

The wolf, fox, jackal, and hyena, chiefly inhabit the deserts and waste places of Egypt, and lurk in the ancient tombs and deserted quarries. The wild cat is also found in that country, though it is not common. The weasel abounds in Cairo, and is proverbial for its mischievous and revengeful disposition, and rats and mice are not among the least of the plagues. The ichneumon, jerboa, hare, and hyrax, are likewise natives of Egypt or its deserts, and the tame rabbit is kept for food.

The beasts of the chase which inhabit the deserts on either side of the Nile are antelopes of various kinds, and the wild ass esteemed by the Arabs and Persians to be the prince of game. It is found in the southern part of the Eastern Desert. The most beautiful of the antelopes is the gazelle, which is often tamed and kept in the large courts of the houses of Cairo. In Lower Egypt, principally in the desolate marshes near the Mediterranean, the wild boar is found and occasionally hunted. It is however a timid and rare animal, so that the sport is not, like the boar-hunting of other countries, exciting and dangerous.

From the representations in the tombs of the ancient Egyptians we see that in old times the hippopotamus was one of the wild beasts of the country. It has now retreated above the First Cataract, the southern boundary of Egypt, and is rarely observed below the Second Cataract. The crocodile has retreated in the same manner, and instead of being found throughout the Nile in Egypt, is rarely seen by one who is ascending the river, until he is many miles south of Cairo. The name of the island of Elephantine, situate a little to the north of the First Cataract, bearing the same signification in hieroglyphics as in Greek, makes it probable that at some remote period elephants were found in Upper Egypt, though now they are not seen north of Abyssinia.

In exploring the tombs and dark parts of the temples the traveller is annoyed by crowds of bats, which extinguish his candle, fly into his face, and cling to his clothes, some-

[1] 1 Kings x. 28, 29.

[2] Isaiah xxxi. 1.

[3] Lib. i., cap. 83.

Egypt.

times rendering examination impossible without a lantern. One species is very large, but the common one is small.

Birds of prey are numerous in Egypt, and of many kinds. Of the most remarkable are three species of large naked-necked vultures, the Arabian (*Vultur monachus*), the sociable (*Otogyps auricularis*, G. R. Gray—*Vultur nubicus*, Ham. Smith), and the fulvous (*Gyps vulgaris*, Sav.); as well as the smaller species called the aquiline vulture (*Nephron percnopterus*). The aquiline vulture has a feathered neck, and when standing is by no means a handsome bird, but it is much to be admired when on the wing from the contrast of the black and white of its plumage, and the steady manner in which it soars in circles. Perhaps the bearded vulture breeds in the most lofty parts of the desolate mountains of the desert between the Nile and the Red Sea; for when the French army was in Egypt, one of these birds was killed. It was of extraordinary size, for M. Larrey states that it measured more than fourteen Parisian feet, that is, more than fifteen English, from point to point of its expanded wings. Several species of eagles and falcons, two kinds of hawks, the common buzzard, and the moor-harrier, live in Egypt, or visit that country, according as they are migratory, erratic, or sedentary.

The common kite abounds at Cairo, and is one of the chief scavengers of the city; the others being the crow, the aquiline vulture, the half-wild dog, and the cat. The ruins and tombs of Egypt, and the modern houses, scarcely ever in perfect repair, shelter owls of various kinds.

The Spanish sparrow, which differs little from that of Britain, the water-wagtail, linnets, and larks, are among the birds of Egypt. The kind of kingfisher which is commonly seen on the Nile, perched on some eminence, and darting suddenly to seize a fish, is very inferior in its plumage, which is speckled, black and white, to the common kingfisher, which is also occasionally seen. The beautiful hoopoe is among the least rare birds, and there are also three species of bee-eaters. The hoopoe may be often seen in Cairo, where it is not only unmolested, but regarded with a sort of reverence, as the bird of Solomon; for the Muslims believe that there existed friendship between it and the wise king of Israel. Crows of the kind which we call the Royston crow are very numerous at Cairo. Birds of the swallow tribe, the woodpecker and the cuckoo, are also known in Egypt.

In the metropolis, in the towns and villages, and in the fields, no bird is more common than the pigeon, tame or wild. Pigeon-fancying is a favourite amusement of all classes at Cairo, and in the villages the pigeon-houses are often loftier than the huts upon which they are raised. Wild turtle-doves build in the courts of the houses of the capital. These courts often serve for the purpose of poultry-yards, in which fowls wander about without any care being taken of them, except that food is occasionally thrown to them. They are consequently meagre, and produce very small eggs. Turkeys, ducks, and geese are kept in the same manner.

Quails migrate to Egypt in great numbers, and sand-grouse, called by the natives kata, from their cry, are common in the deserts. There also the Arabs, like the ancient Egyptians, hunt the ostrich. A kind of red-legged partridge is likewise found in Egypt.

The islands of the Nile, the sand-banks which appear when the river is low, some of the lakes and marshes, the sheets of water caused by the inundation, and the mountains near the river, are the favourite resorts of many kinds of wading and of web-footed birds.

Of the waders the most interesting would be the sacred ibis of the ancient Egyptians, if that bird be really found in Egypt at the present day. But it does not appear certain that but one species was anciently held sacred; nor, if we admit that but one was revered, does it seem clear that this is the *Ibis religiosa* of Cuvier which is now known in Egypt.

The Egyptian plover is famous on account of the story, which modern observation has confirmed, related by Herodotus respecting it and the crocodile.

Among the most common waders are the spur-winged plover, the snow-white egret, which has been erroneously called the ibis, and the pelican. The cormorant, too, is often seen, as are wild geese and ducks, both of several kinds.

Of the many reptiles the crocodile deservedly occupies the first place. It is seldom observed in the present day far north of Asyoot, the capital of Upper Egypt. Several crocodiles are generally seen basking in the sun in the heat of the day on a sand-bank: at the approach of a boat they quickly plunge into the stream. They rarely attack a human being, but it is unwise to bathe in the river at places where they are reputed to be fierce, and to bathe at any distance from a boat in the part of Upper Egypt where they are found. It is said that the crocodile's common mode of attacking a person on shore who is near the river's edge, is to approach stealthily and sweep him into the stream by a blow of his tail, the great weapon of all the lizard-tribe. The smaller saurians are found in great numbers: of these a species of chameleon may be particularized.

Serpents and snakes are among the most common reptiles, and of various kinds, including the deadly cerastes and cobra di capello. The house snakes, however, which are so numerous at Cairo, are perfectly harmless.

Fishes abound in the Nile and in the Lake Menzeleh. The modern inhabitants of the country are partial to fish as food, but they say that only those fishes which have scales are wholesome. The fishes of the Nile are generally insipid in comparison to those of the sea; though a few of them, particularly the bultee (*Labrus niloticus*, Linn.), the kishr (*Perca nilotica*), and the binnee (*Cyprinus bynni*, Arted.), are of a delicate flavour.

One of the commonest insects is the dangerous scorpion. Its sting is very painful, and if no remedy is applied, sometimes fatal, particularly if a person is stung in the heel.[1] Large spiders are abundant, including more than one species of *solpuga*, incorrectly called tarantulas by the Europeans, and believed by the natives to be very venomous, but this is most likely an error. Egypt has ever been famous for what may be termed insect-plagues, but not to the extent that has been asserted by some modern travellers. Caution will enable one partially to escape the attacks of fleas and bugs, and altogether to avoid the more dreaded insect which is usually spoken of with them. Beetles of various kinds are found, including that which was anciently held sacred—the scarabæus. Locusts are seldom seen at all, and very rarely in large numbers. When, however, such is the case, they commit great havoc in the fields and gardens, reminding the beholder of the description of the plague of locusts which preceded the Exodus. Sometimes they merely cross the valley of Upper Egypt, and leave the mark of their passage in desolated fields, entirely stripped of verdure; and at other times they spread themselves for days, or even weeks, over the cultivated lands, committing far more extensive mischief. On an occasion of this sort, the government offered rewards for locusts killed and brought to the officials by the villagers.

Bees are kept in Egypt, and their honey is much prized by the inhabitants, who usually eat it in the clarified state. It is inferior to that of England, and also to the famous Greek honey. Butterflies and moths of many kinds are observed in the fields. There are plantations of mulberry-trees in the eastern part of Lower Egypt, for the rearing of silk-

[1] A little ipecacuanha, made into a paste with water and applied externally to the place stung, has produced, in the many instances in which the writer has seen it used, almost instant relief.

Egypt.

worms. The manufacture of silks was a government monopoly, but has probably lately ceased to be so. The silks of Egypt are generally inferior to those of Syria and other eastern countries, though some have been produced of great excellence. Among the other insects may be mentioned the common fly, rightly deserving a place among the plagues of Egypt, as does also the mosquito, which, however, is not found throughout the country.

Ancient inhabitants.

In the following remarks on the ancient Egyptians great assistance has been derived from the valuable work of Sir Gardner Wilkinson on their manners and customs, which has made us better acquainted with them than we are with any other people of antiquity. From the representations of their monuments, and from the mummies which have been unrolled, we are enabled to form an accurate idea of the personal characteristics of the ancient Egyptians. In consequence of a misconception of a passage in Herodotus (ii. 104), and confused notions respecting the inhabitants of Africa, it has been often supposed that the Egyptians were very nearly allied to the negro race. A careful examination of the most distinct data in our possession has, however, produced a far different result; and it is now acknowledged that they were more related to the Caucasian than to the negro type. It has also been shown that most of the modern inhabitants have preserved many of the characteristics of their ancient predecessors, and that it is, therefore, erroneous to suppose that the former are chiefly of Arab origin, although the intermixture of Arab as well as other blood has so much changed the national type, that it would not be safe to describe the earlier people from the appearance of the present. Nevertheless, one is often struck, among the remains of ancient monuments, by the similarity of an early representation to some one of the natives standing by, priding himself upon an Arab origin, and repudiating the stigma that he is of the race of Pharaoh.[1]

Personal characteristics.

Judging, then, from the monuments and mummies, the countenance of the ancient Egyptians was oval, and narrower in the case of the men than of the women. The forehead was small and somewhat retiring, but well-shaped; the eyes large, long, and generally black; the nose rather long, and with a slight bridge; the mouth expressive, with rather full lips, and white and regular teeth; the chin small and round, and the cheek-bones a little prominent. The hair was long, full, crisp, and somewhat harsh, and almost always of a black colour. The men had black beards, but they wore them in so artificial a mode that one cannot judge whether they were full or not. The skin of the men was of a dark brown, that of the women varied from olive to pink flesh-colour in different persons. The colour of the women was natural, and the darker hue of the men the result of exposure to the sun, and the scantiness of their clothing explains why their faces were not darker than the rest of their bodies.

Dress.

The dress of the ancient Egyptians did not much vary at different periods. At the time of the building of the Great Pyramid it was, however, simpler than under the rule of the Eighteenth and Nineteenth Dynasties, about a thousand years later. As the period last mentioned is that of which most sculptured and painted monuments remain, it will be best to describe what was then the dress of the inhabitants, and this description will apply, in its main particulars, to the preceding and subsequent times of their ancient history.

The men of all classes either had shaven heads, with skull-caps, or wore their own hair, or wigs, very full, and in numerous plaits or curls, falling to the shoulders, but sometimes much shorter and in the form of a bag; there is, indeed, reason to suppose that the practice of shaving the head was universal, except among the soldiers.[2] All the hair of the face was also shaven, except in the cases of kings and great persons, who had a small formal beard beneath the chin.

The king was distinguished from his subjects by the richness of his apparel. His head-dress was sometimes his own hair, or the wig, alone, in various forms, but not much differing in length; and at others he wore the high crowns of Upper and Lower Egypt—the former being a kind of conical helmet, and the latter, a short cap with a tall point behind, worn outside the other. He is also occasionally represented with another form of high cap.[3] The king often had the figure of an asp, the emblem of royalty, tied just above his forehead. His beard was about three inches long, and one inch broad and deep, and formally plaited.

The simplest royal dress was a kilt, usually reaching nearly to the knees, rather full in front, having a girdle above, from which hung before a broad band, richly ornamented, and peculiar to the king, like the lion's tail (natural or artificial) which was attached to it behind, and reached nearly to the ground. Sometimes a large and full shirt was worn over the kilt, descending almost to the ankles, and having wide sleeves reaching to the elbow: this outer dress is occasionally simply a skirt. Both these dresses were usually of white linen, and the upper dress was apparently very fine and transparent. Sandals were worn on the feet, and the ornaments were armlets, bracelets, both flat and broad, and deep necklaces, besides those above mentioned.[4]

The ordinary costume of men of the upper and middle classes was the same as that of the king—the short kilt, with sometimes the long shirt or skirt of fine linen above it, tied in various forms. Their beards were very short, scarcely exceeding an inch in length, and of a formal square shape, and they wore the full hair or wig, or a skull-cap.[5] They generally went barefooted, but sometimes used sandals. The priest was occasionally clad in a leopard's skin, either tied or thrown over the shoulder, or worn as a shirt, the fore-legs forming sleeves.[6] Military personages are often represented with helmets, and sometimes with short coats or corslets of plate-mail.[7] The royal princes were distinguished by a side-lock of curiously-plaited hair.[8]

The men of the lower class wore the kilt and girdle alone,[9] or, especially when engaged in laborious work, went altogether naked. They shaved the head and face, and had no head-covering but the skull-cap. The soldiers had kilts of different kinds, coats or corslets of plate-mail, and either wore full hair or helmets.[10]

The dress of the queen differed from that of other ladies alone in certain royal ornaments. It consisted of a tight skirt, supported by shoulder-straps, and bound at the waist by a girdle or sash, with long ends falling in front, and descended to the ankles. Over this was usually worn a full shirt of fine linen, with wide sleeves reaching below the elbows, and having a broad skirt falling to the ground. It much resembles the upper dress of the king, or of men of the better classes. The queen was distinguished by her head-dress, which was in the form of a vulture with outspread wings, the bird's head projecting over the forehead, and the wings falling on either side, while the tail extended behind.[11] Sometimes the queen is also known by the uræus or royal asp above her forehead, and at other times she is represented with various forms of head-dress.

Egypt.

[1] "Gins Fara'oon," or "Race of Pharaoh," is a common form of reproach addressed by the Turks to the Egyptians; the latter retort by calling their oppressors "Gins Nemrood," or "Race of Nimrod." "Pharaoh" and "Nimrod," as described in the Kur-án, may be regarded as impersonations of both tyranny and ungodliness, and they are therefore objects of especial hatred to all good Muslims.

[2] *Ancient Egyptians*, vol. iii., p. 357.

[3] *Id.*, vol. iii., pp. 351–354.

[4] *Id.*, vol. iii., pp. 350–352.

[5] *Id.*, vol. iii., p. 347, *seq. et passim.*

[6] *Id.*, vol. i., pp. 277–280.

[7] *Id.*, vol. i., p. 330, *seq.*

[8] *Id.*, vol. iii., pp. 349–350.

[9] *Id.*, *passim.*

[10] *Ancient Egyptians*, vol. i. p. 291 *et seqq.*

[11] *Id.*, vol. iii., pp. 368–369.

Egypt. The queen also wore sandals. The princesses were dressed in the same manner. The dress of the ladies of the upper and middle classes was exactly the same as that of the queen, except that they more frequently appeared in the under garment or skirt alone.[1] The women of the lower class wore that garment only,[2] and sometimes it was much shorter than that of the ladies, particularly when they were engaged in manual labour.[3] The public female musicians and dancers usually were clad in the upper garment alone, and it appears to have been of the finest and most transparent stuff.[4] Occasionally the dancers had no dress whatever. The women's hair was worn in the same manner as the men's, but it was, of course, of greater length, usually reaching about halfway from the shoulders to the waist, being rarely longer, and sometimes much shorter. It was ornamented in various ways, but the general form was always the same.[5]

The dress of the children of all classes, when they were dressed at all, was very plain, though those of rich persons were sometimes attired as their elders. Boys were distinguished by the side-lock, which the princes also wore in a peculiar fashion, as before mentioned.

Religion. The religion of the ancient Egyptians cannot be said to be as yet fully unravelled. Notwithstanding the very numerous materials that we possess, the subject is so difficult that no one has advanced any distinct system of explanation applicable to the whole. In the following observations it is intended to arrange the principal tenets of this religion in as logical an order as may be, to enable the reader to judge for himself in the many points of difficulty which the matter presents.

The authorities for this part of the inquiry are the monuments and papyri of ancient Egypt: reference may be advantageously made to Greek and Roman works, such as Herodotus, Plutarch *De Iside et Osiride*, or whoever wrote that treatise, Macrobius, Iamblichus, and others; yet is it unsafe to base anything wholly on the statements found in these works, and with the ample materials which the monuments present, wholly unnecessary. Great care should also be taken not to acquire an incorrect view of this religion from the accounts of some of the late writers who interpreted it according to a philosophic system, whereof the monuments and papyri afford no distinct evidence. Many modern writers have accepted such interpretations, even since the Egyptian records have been accessible to them, and thus rendered the mythology more difficult of comprehension. The peculiar circumstances of these ancient interpreters should be borne in mind. They lived at a time when Greek philosophy had established among the learned a kind of deism in place of various forms of idolatry, and was endeavouring by it to oppose the spread of Christianity. That philosophy had rendered much of the ancient Egyptian religion ridiculous unless understood mystically, and it became the endeavour of the learned to systematize and explain so as to make the main doctrines of this faith consistent with one another, and the seeming absurdities, allegorical representations of physical and moral truths. Hence have arisen the errors of supposing the Egyptian religion to be, properly speaking, a system, and of concluding that everything contained in it must have some important signification, which errors have retarded the true explanation in a very high degree. If it can be shown that this religion is the offspring of various faiths, and that they have never been moulded together, on the one hand, and if it be admitted that other religions, such as those of ancient Greece and Rome, contained much that was puerile and unreasonable, on the other hand, then it must follow that the religion of ancient Egypt cannot properly be called a system, and that its tenets are not necessarily capable of a philosophical explanation.

Divinities. Manetho,[6] and Herodotus,[7] with other writers of less importance,[8] agree with the historical Turin Papyrus[9] in stating or implying that the reign of the gods, and then, according to the historian first mentioned, that of the demigods or heroes, and lastly, that of the manes, preceded the rule of mortals in Egypt. The consideration of the historical bearing of this statement belongs to a subsequent portion of the present article;[10] but it must be here mentioned, as, had we a complete list of the mythic rulers, we should probably possess one Egyptian classification of the divinities. The only reliable records are, however, in so mutilated a condition that it is unsafe to build any hypothesis upon them.

Herodotus states that the Egyptians had three orders of gods, the first, second, and third, whereof the first was the most ancient.[11] From what is said respecting them it is evident that these orders were mythic dynasties, while it appears almost as certain that the gods were arranged according to the importance of the towns in which they were worshipped,[12] and not according to the importance of the offices ascribed to them. This should be borne in mind when examining the relation of these dynasties to history. The orders of the gods therefore have nothing to do with the principles of the religion.

In order to form an opinion respecting those principles, it is desirable first to enumerate the chief divinities and their offices; then the ceremonies of their worship; and, lastly, the main doctrines with reference to man. From these data some leading ideas respecting the sources of the religion may be derived.

Num. Num, or Nu, called Kneph by the Greek writers, was one of the most important of the gods: he was worshipped throughout Ethiopia, in the island of Elephantine, and in the southern part of the Thebaïs.[13] He is represented as a man having the head of a ram and curved horns, with above the head broad horns more or less twisted.[14] The signification of his name, as stated by ancient writers, and verified by the most reasonable etymology, is "soul,"[15] and to him was ascribed the creation of both men and divinities, and of the material universe.[16] He seems thus to have corresponded to the soul of the universe of the philosophers, whereof so remarkable an account is given by Virgil in the Æneid.[17]

---

1 *Ancient Egyptians*, vol. ii., p. 167.
2 *Ancient Egyptians*, vol. ii., p. 167.
3 *Id.*, vol. iii., p. 162.
4 *Id.*, vol. ii., pp. 236–7.
5 *Id.*, vol. i., p. 256.
6 Cory's *Ancient Fragments*, pp. 91 and 92.
7 Herod. ii., 43.
8 Diod. Sic., i., 13, 14, 15, &c. Dicæarchus cited by Schol. in Apoll. Rhod. Arg., lib. iv., v. 276, p. 86, ed. Shaw, &c.
9 See Sir Gardner Wilkinson's edition. This is better than that given by Dr Lepsius in his Auswahl, as it is accompanied by a transcription into hieroglyphic characters, and the writing on the back is given.
10 See *infra*, section ii.
11 Herod. ii., 145, and 43, 46.
12 Chev. Bunsen advances this view, *Egypt's Place*, vol. i., p. 364.
13 *Ancient Egyptians*, vol. iv., p. 235.
14 *Id.*, plate 21.
15 Bunsen's *Egypt's Place*, vol. i., p. 375.
16 *Id.*, p. 377.
17 Principio cœlum ac terras, camposque liquentis,
Lucentemque globum Lunæ, Titaniaque astra,
Spiritus intus alit, totamque infusa per artus
Mens agitat molem, et magno se corpore miscet.
Inde hominum pecudumque genus, vitæque volantum,
Et quæ marmoreo fert monstra sub æquore pontus.

Egypt.

Seti.

Anka.

Kneph must not be confounded with Amen, who is sometimes, as in the Oasis called after him, represented under the form usually assigned to Kneph.[1] His consort is generally either the goddess Seti or Anka, the former of whom is represented as a female with the crown of Upper Egypt with high horns, or the crowns of Upper and Lower Egypt united,[2] and the latter likewise as a female, with a high head-dress, as if of feathers.[3] Sometimes, according to Sir Gardner Wilkinson, these form a triad.—The question of triads in the Egyptian religion is one of great difficulty. It cannot be denied, however, that triads were more frequently worshipped than one divinity or two divinities, and that the personages composing these triads were held to be related to one another.[4]

Amen.

The chief god of Thebes, Amen, bears more than one name, and is variously represented. His proper name, Amen, signifies the "hidden" or "concealed," as both the hieroglyphic inscriptions and ancient writers show, being derived from the verb *amen*, to "enwrap" or "conceal."[5] He is also called Amen-ra, the name of the sun-god, Ra, being added to his own; and in the inscriptions of the Roman times, Hammon-Cenubis, that is Amen-Num (Kneph). His peculiar form is that of a man wearing a cap with two very high and narrow plumes, and he is painted of a blue colour. But he is also represented with the figure of Khem the generative principle, when he is generally called Amen-ra ka mut-f, that is "the husband of his mother," according to the usual interpretation, which, however, may be considered doubtful.[6] Amen is further pourtrayed under the form of Kneph, the ram-headed god; and though when thus represented on the monuments he bears the name Amen-ra, he must also have received the name Amen-Num or Hammon-Cenubis before-mentioned. Amen was worshipped in the Great Oasis and in that called after him under the form last-mentioned, and hence arose the mistake of the Greeks and Romans who always assigned to him that figure.[7]

Mut.

The goddess Mut, or "the mother," is the companion of Amen, and seems to be the female form of Khem, or of Amen in the character of Khem. She is usually represented as a female wearing the crowns of Upper and Lower Egypt, and the vulture-head-dress of a queen.[8] There was also a feminine Amen, Ament ("*t*" being the feminine article), whose figure is that of a female with the crown of Lower Egypt.[9]

Khuns.

Khuns formed with his parents Amen and Mut the triad of Thebes. He is usually represented as a mummy-shaped male figure, differing from Ptah in having the crescent and globe of the moon upon his head, and in wearing the side-lock of a child. He is sometimes pourtrayed as a hawk-headed figure, likewise with the moon on his head; in this form he is connected with Ptah-Sokari-Osiris, and Ra the sun-god.[10]

Khem.

Khem was a god by whom the productiveness of nature was emblematized. He was represented as a swathed Phallic figure with a single arm, above which was a flail, raised behind his head, and wearing the high-plumed cap of Amen.[11] The reading of his name is still doubtful; the most probable one, Khem, reminds one of the patriarch Ham from whom the Mizraites were descended. The Greeks identified him with Pan, and called Chemmis, a city in the Thebaïs where he was worshipped, Panopolis. The monuments afford no evidence that obscene rites were celebrated to him; indeed nothing is more remarkable than the coarseness of allegorical representations of Khem and other divinities, which

---

Igneus est ollis vigor et cœlestis origo
Seminibus, quantum non noxia corpora tardant,
Terrenique hebetant artus, moribundaque membra.
Hinc metuunt, cupiuntque: dolent, gaudentque: neque auras
Dispiciunt clausæ tenebris et carcere cæco.—*Æn.*, lib. vi., v. 724–734.

Know first, the heavens and earth, and liquid plains,
And the moon's shining orb, and sun-like stars,
A spirit nourishes within, and mind
Prevading every part, governs the whole,
With the vast fabric mixing: hence the race
Of men and beasts, and all the flying tribes,
And the great monsters which the far-spread sea
Beneath its shining surface comprehends.
A fiery energy and heavenly source
Are theirs, though evil bodies counteract,
And earthly limbs and members that must die.
Hence 'tis they fear and hope, they mourn and joy,
Though heaven they see not from their prison dark.

Some apology is needed for venturing to translate a passage differently from that best and most eloquent of translators, Dryden: but in this case he is too free in his rendering, and has permitted poetic feeling somewhat to take the place of close accuracy.

[1] *Modern Egypt and Thebes*, vol. ii., p. 375. *Ancient Egyptians*, vol. iv., p. 237.
[2] *Id.*, pl. 21.
[3] *Id.*, pl. 48.

[4] The Chev. Bunsen remarks, "we must expressly warn our readers against a misunderstanding into which Egyptologers, from Champollion downwards, seem in danger of falling. He was perfectly right in considering it a matter of great importance to notice those groups of gods which are ordinarily found together. Now, as a principal god is very frequently met with in the temple-representations, conjoined with two others, in his letters from Egypt he formed out of these a series of so-called Triads, an idea which Rosellini and even Wilkinson have taken up, and carried out still farther. Upon this, it is first of all to be remarked that these groups often vary, and further, that they are not formed of gods of the same order, so that they can furnish us no sort of assistance in restoring the three orders." It must be observed, however, that Chevalier Bunsen, had he visited Egypt, would have seen that triad-worship was rather the rule than the exception, judging from the representations on the monuments. It should also be noted, that if the orders were, as he holds, indicative, not of the position of the gods in the Pantheon, but of the rank of the towns where their worship prevailed, then the inferior divinity or divinities of a triad would almost necessarily have been of another order than the greater, as their local worship was of less importance; so that an argument is thus afforded in favour of triads rather than against them. Chev. Bunsen continues, "We must also protest, in the name of philosophy, against the abuse of the word triad. Three times one certainly make three, but not a trinity complete in itself, still less a trinity which is at the same time a unity. The true idea, which must be considered as the origin of the formation of triads, certainly lies much deeper, and is assuredly not to be found in this manner upon the surface. This is especially the case, if, as has been the practice hitherto, we do not distinguish any epochs, but consider the representations of a period of 3000 years (during which two immense revolutions in the religious sentiments of the Egyptians can be historically demonstrated), as forming one single original system" (*Egypt's Place*, vol. i., pp. 365, 366). The learned author does not seem to have sufficiently borne in mind that in many heathen systems a triad originated from a monad, and that the Egyptian triads were formed of cognate personages.

[5] Manetho, cited by Plut., *De Is. et Osir.*, c. 9. Comp. Iamblichus, *De Mysteriis*, viii., 3. Bunsen's *Egypt's Place*, vol. i., pp. 63, 370.

[6] Mr Birch suggests "who is male and female," a probable rendering.

[7] For the different representations of Amen, see *Ancient Egyptians*, pl. 20 and 22.
[8] *Ancient Egyptians*, pl., 20.
[9] *Id.*, pl. 59.
[10] *Id.*, pl. 46.
[11] *Id.*, pl. 26.

Egypt.

evidently were intended to contain nothing indecent, whence we may reasonably suppose that the ceremonies were likewise free from intentional indecency. We must be particularly careful in receiving what was written of the Egyptian religion by those who were unfriendly to it or positively inimical, at a time when it had been much corrupted by Greek and Roman influence; and we must not receive the stories of passing travellers without caution because they lived two thousand years ago, when indeed it was more difficult to obtain accurate information, and the educated class was more credulous than now. Khem is usually accompanied in the sculptures by a stand whereon are representations of trees and of a flower, or a single flower.[1] This exactly corresponds to the asherah or idolatrous grove mentioned in the Bible. The "groves," however, were sacred to Baal, and the Egyptians called Seth Baal, and not Khem. The cause of this may be, that Baal was the chief divinity of many of their enemies, and that the Egyptians were therefore more ready to consider him the same as Seth, or physical evil, than as Khem, the personification of productiveness, and in some sense of physical good.

Ptah.

Ptah, or Phthah, the god of Memphis, is one of the most important personages in the Egyptian Pantheon. He has two ordinary forms; the one that of a mummy-shaped male figure, holding in his hands a long and complex sceptre; the other that of a pigmy or child, with a large head.[2] In the latter form he was worshipped at Memphis, if we may decide from the account of Herodotus,[3] and the number of small figures which have been found of Ptah as a pigmy on the site of that city. The temples have been so entirely destroyed, that we cannot judge of the worship of Memphis as we can of that of Thebes and many of the other towns of Egypt. The pigmy Ptah generally received the name Ptah-Sokari-Osiris (an appellation which connects him with Osiris, the judge of the dead), and has been supposed to be the same as the Phœnician πаταικος.[4] He was held to be the demiurgus or creator of the universe,[5] and is thus connected with Kneph, and Seb, the father of Osiris.

Neit or Neith.

The goddess Neit or Neith is often associated with Ptah.[6] She was the chief divinity of the ancient and famous city of Saïs in the Delta; and the Greeks relate that Cecrops, leading a colony thence to Athens, introduced her worship into Greece, where she was called Athena. This Greek name may be derived from the Egyptian, if we suppose the latter to have been sometimes pronounced Thenei, with the article prefixed; and the name of the goddess of truth and justice, Ma-t or Ma-th, may have been in the same manner the original of Themis. She is represented as a female having upon her head the crown of Lower Egypt, or the initial and chief character of her hieroglyphic name, supposed to be a shuttle.[7] She appears to have been a female form of Ptah. The fact of her being the chief divinity of Saïs, shows that it was not necessary that the most important person of a triad, or the principal object of worship, should be a god, and other instances support this view.

Ra.

Ra, or the sun, was worshipped at Heliopolis as chief god, and in many other places as a cotemplar divinity. His usual figure is that of a man having a hawk's head, upon which is placed the solar disk and the royal asp.[8] Sometimes he was adored as the solar disk Atin-ra, an object of worship pourtrayed in the form of the sun, whence issue numerous rays terminating in human hands, one of which gives the sign of life to the person supplicating.[9] This form of Ra is, however, almost entirely confined to the monuments of a foreign race of sun-worshippers, whose religion and history belong to a subsequent portion of this article.

Thoth.

Thoth, the god of letters, was especially regarded as the patron of the town of Hermopolis Magna, in Middle Egypt. His usual form is that of a man having the head of an ibis, and often bearing the crescent and disk of the moon; the latter, however, being distinguished from that of Khuns by its elongated and depressed form.[10] He presided over science, art, and every mental pursuit, and hence his position among the Egyptians was very high; and Hermes Trismegistus, a form of Thoth, has scarcely ceased to be regarded as a mysterious and powerful personage from the connection of his name with magic.

Atum.

Atum, and Pasht, or Pakht, were children of Ptah. The former was an important divinity with respect to the deceased, but inferior to Osiris. He is pourtrayed as a man, often wearing the crowns of Upper and Lower Egypt.[11] His sister Pasht, who is sometimes styled his mother, was called Bubastis by the Greeks, who identified her with Artemis (Diana), and was the goddess of the town Bubastis, in Lower Egypt. She is usually represented as a lion-headed, or cat-headed female, having the globe of the sun, and an uræus upon her head.[12] A great festival was annually held at Bubastis in her honour, whereof Herodotus gives some account.[13] Her offices are not clearly made out.

Pasht, or Bubastis.

The children of Ra were eight in number. Among the most important of these were the goddesses Athor or Hathor, and Ma-t or Thma. The former of these was identified with Aphrodite by the Greeks. Her name signifies "the abode of Horus," and she is pourtrayed as a female having a cow's head with a globe between her horns, or a human head above which are the horns of a cow and a globe and uræus.[14] She was the goddess of beauty and mirth,[15] and her worship was very prevalent in Egypt. The town of Tentyris (Dendera) was under her protection, and a magnificent temple to her yet stands there. Her name connects her with Isis, the mother of Horus.

Athor.

Mu and Ma-t.

The god Mu, and goddess Ma-t, brother and sister, would seem to be male and female personifications of one and the same principle; for each wears on the head the ostrich feather, and that is always the chief sign of the name of the former, and the symbol and sometimes name of the latter.[16] Mu is solar light, and Mat the goddess of truth and justice, and it seems therefore most probable that the former represented physical light, and the latter moral light. That the male divinity should personify physical excellence and the female moral, is remarkable, as indicating a philosophy which acknowledged that while man was more powerful of body, woman possessed a soul of greater delicacy and more capable of religious feelings.

Tafnet.

Tafnet and Munt must also be noticed as children of Ra. The former has the head of a lioness, and may be regarded as only another form of Pasht;[17] and the latter is represented as a hawk-headed figure having a disk and uræus on his head, above which rise the high plumes of Amen.[18] He appears to have corresponded to Mars, and the king is likened to him when he is waging a successful war against the enemies of Egypt, of which country Munt was regarded as a protector. Another son of Ra was Sebak, who is usually depicted with the head of a crocodile, and a head-dress composed of ram's horns, a disk and two ostrich feathers.[19] His offices are not as yet ascertained.

Munt.

Sebak.

Seb.

Last of the children of Ra, Seb and Nutpe must be mentioned as the heads of the Osirian group of divinities. Seb

[1] *Ancient Egyptians*, vol. vi., pl. 26; comp. pls. 22 and 76. The flowers are not always upon a stand.
[2] *Id.*, pls. 23 and 24 A.; comp., pl. 24.
[3] Herod., iii.
[4] Bunsen's *Egypt's Place*, vol. i., p. 383.
[5] *Id.*, p. 384.
[6] *Id.*, p. 385.
[7] *Ancient Egyptians*, pl. 28.
[8] *Id.*, pl. 29.
[9] *Id.*, pl. 30.
[10] *Id.*, pl. 45; comp. 46.
[11] *Id.*, pl. 47; comp. 48.
[12] *Id.*, pls. 27, 35 A.
[13] Herod., ii., 59, 60.
[14] *Ancient Egyptians*, pls. 36, 36 A.
[15] *Id.*, iv., p. 392.
[16] *Id.*, pls. 46, 49.
[17] *Id.*, pl. 51.
[18] *Id.*, pl. 49.
[19] *Id.*, pl. 50.

is represented as a man upon whose head usually stands a goose, which is also the initial letter of his name.[1] It refers to his character as creator, in which he is likened to a goose producing the egg so famous in the Orphic writings.[2] He is thus connected with Ptah, to whom the office of creator is likewise assigned. Nutpe, the consort and sister of Seb, is represented as a woman having sometimes upon her head a small vase, her symbol and the initial of her name.[3] That name is believed to signify "the abyss of heaven." She is stated in the hieroglyphics to have been the parent of the gods, like Seb, and she presided over the soul.[4] From these two sprang Osiris and Isis, Seth and Nephthys, and Aroëris.

Osiris.

Osiris is the most remarkable personage in the Egyptian Pantheon, and was probably more highly reverenced than any of the other gods. His usual form is that of a mummied figure holding the crook and flail, and wearing the crown of Upper Egypt, generally with an ostrich feather on each side.[5] He was regarded as the personification of physical and moral good, and hence one of his commonest names, Un-nufre, signifies "the opener" or "revealer of good things."[6] He is related to have been on earth instructing mankind in useful arts, to have been slain by his adversary Typhon, by whom he was cut in pieces, to have been bewailed by his wife and sister Isis, to have been embalmed, to have risen again, and to have become the judge of the dead, the righteous among whom were called by his name and received his form, in which indeed they are always represented. Although in this extraordinary story we may possibly trace a physical meaning, yet the moral meaning is far more prominent; and the intention appears rather to point to the struggle between moral good and moral evil, than between physical good and physical evil. Indeed, although the opponent of Osiris personified both physical and moral evil at a comparative late period, there is strong reason for supposing that such was not originally the case; and it is therefore not probable that the story of Osiris was intended to typify the opposition of good of both kinds to evil of both kinds. Admitting, then, that it teaches the doctrine of the conflict between moral good and moral evil, it is to be inquired why this doctrine was embodied in so remarkable a narration. Considering all the points of resemblance—bearing in mind that mankind must have been granted a primeval revelation, and what evidence of there having been such a revelation is afforded by the great doctrines of the immortality of the soul, the resurrection of the dead, judgment to come, and future rewards and punishments, all so closely interwoven with the story of Osiris—carefully weighing all this, it seems an unavoidable conclusion that this story is derived from some prophecy of the remotest times respecting the future Saviour of mankind. The discovery of this remarkable analogy was made some years since by Mr Lane, and a careful comparison of all the hieroglyphic documents which bear upon it in our hands, has afforded it a complete confirmation.

Isis.

Isis, the consort of Osiris, was scarcely less venerated than he, and shared the honours of his temples at the sacred city of Abydos and the holy isle of Philæ. She is usually represented with a small throne, her symbol, on her head, and more rarely with the globe and cow's horns as a head-dress, and sometimes as winged.[7] She is connected with Athor both in her figure and some of her offices, &c. She mourned over the dead, presided over the funeral rites, and was present, as well as Nephthys, with Osiris at the judgment of the dead. Her titles were so numerous that she received the appellation of Myrionyma, or one having ten thousand names.

Set, or Typhon.

Set, or Seth, called by the Greeks Typhon, was the brother of Osiris, and the personification of physical evil. He was represented as having the head of a fabulous animal, with a long snout and high square ears.[8] He was worshipped until at least the close of the Twentieth Dynasty, but after that period his figures were erased from the walls of the temples, even when forming part of the names of kings. This change is conjectured, with great ingenuity, by the Chevalier Bunsen to have been effected by the kings of the Twenty-second Dynasty, who were, partly at least, of an Assyrian or Babylonian origin.[9] Among the Persians and the neighbouring nations the doctrine prevailed that all good was traceable to the good principle and all evil to his opponent. Hence hard drinking was esteemed among the Persians a virtue, and calamities were not received as either ordained of the good principle or permitted by him. With the introduction of this doctrine into Egypt, Seth was at once expelled the Pantheon, and thenceforward regarded as the personification of both physical and moral evil, instead of being held to be a good being.[10]

Apep, or Apophis.

The only representation that we find of moral evil is that of an enormous serpent called Apep, which was, in the Greek form, Apophis. The gods are pourtrayed in the mystic subjects on the walls of the Tombs of the Kings at Thebes engaged in warfare with this monster, whom they ultimately destroy.[11] Moral evil being represented by a serpent, affords another link in the argument that much of primeval revelation was retained, more or less distorted, by the ancient Egyptians.

The consort of Seth was Nephthys his sister, called in the hieroglyphic inscriptions Nebt-hi, whose figure is that of a female having upon her head either her symbol, a basket and house, or the cow's horns and globe.[12] She much resembles Isis, and there can be little doubt that she stood in the same relation to Seth that Isis did to Osiris, being merely a female form of the male divinity. The monuments have afforded no light on this matter, but although not expelled with Seth, the statements of Plutarch[13] show that she was regarded as the barren condition, and in some sort destructive power of nature. We can, therefore, scarcely suppose with Bunsen that this explanation of the personification can be the result of the late notions respecting the story of Osiris.[14] Like Isis, she presided over the funeral rites, and was present with her at the judgment of the dead.

Har-oër, or Aroëris.

Aroëris is called in the hieroglyphics Har-oër, or the Elder Horus. He is represented as hawk-headed, and wearing the crowns of Upper and Lower Egypt.[15] In one character he was called Har-Het, Horus of Het or Adfoo, Apollinopolis Magna, and by the Greeks Agathodæmon, having the usual form of Aroëris, or that of a winged globe. He thus corresponded to the Feroher of the Persians, or the protecting good genius. It is very difficult to distinguish between Aroëris and Har the Younger, or Horus: indeed there is so much connection between these two divinities and Harpocrates, that they must be regarded as simply different forms of one personage.

Har, or Horus.

The children of Osiris and Isis require the next notice: they were Har, or Horus, Har-pi-chruti or Harpocrates, and Anup or Anubis. The god first mentioned was represented as Aroëris, hawk-headed and wearing the crowns of Upper and Lower Egypt.[16] He was distinguished, like Osiris, for

---

[1] *Ancient Egyptians*, pl. 31.
[2] Lepsius, *Todtenbuch*, first noticed by Mr Birch. Cory's *Ancient Fragments*, pp. 293–4, 5, 9, 310, *seq.*
[3] *Ancient Egyptians*, pl. 32.
[4] Bunsen's *Egypt's Place*, vol. i., pp. 406–7.
[5] *Ancient Egyptians*, pl. 33.
[6] Comp. Plut. *De Isid. et Osir.*, c. 42.
[7] *Ancient Egyptians*, pls. 34, 35, 35 A.
[8] *Id.*, 38, 39.
[9] Bunsen's *Egypt's Place*, vol. i., pp. 442–3.
[10] Comp. Reuvens, *Lettres à M. Letronne sur les Papyrus Bilingues et Grecs, &c.* 1er lettre, p. 39.
[11] Champollion, *Lettres*, p. 231. Wilkinson gives his name and figure in the *Ancient Egyptians*, pl. 42.
[12] *Ancient Egyptians*, pl. 35
[13] *De Isid. et Osir.*, c. 38.
[14] Bunsen's *Egypt's Place*, vol. i., p. 422.
[15] *Ancient Egyptians*, pl. 37.
[16] *Id., loc. cit.*

Egypt.

his part in the strife between good and evil, in which he assisted his father, as well as in the judgment of the deceased, whom he conducted before him. To his brother Anup, or Anubis, the jackal-headed god,[1] was assigned the weighing of the souls of the departed in the judgment, and he especially presided over embalming and funeral rites. He and another jackal-headed god, Hepu-her,[2] who was also connected with the future state, were the guards of the paths of the sun, which would seem to indicate a cosmic character, but they are probably so called in relation to the cycles of the future state. Harpocrates, in the hieroglyphics, Har-pi-chruti, or Horus the Child (a reading and etymology which we owe to the ingenuity of Bunsen, aided by Lepsius[3]), is represented as a naked boy wearing a side-lock, and sometimes the crowns of Upper and Lower Egypt. He is often pourtrayed seated upon a lotus-flower, and with his finger in his mouth, not to denote silence, but a childish action, as Sir Gardner Wilkinson has justly remarked.[4] Osiris was likewise parent of the four genii of Amenti or Hades, who were supposed to protect the parts of the body which, being not embalmed, were placed in jars, bearing the names of these genii, and having lids in the form of their heads.[5]

Anup, or Anubis.

Hepu-her.

Har-pi-chruti, or Harpocrates.

Several other divinities might be mentioned, but those enumerated above are the most important. The androgynous Nilus, who has been already described in an earlier portion of this article, and the goddess Seben or Lucina,[6] who was especially held to protect Upper Egypt, may be particularized. There are not, however, many more divinities, several which have been supposed to be distinct being merely different forms of those before described, while others must be regarded as foreign, or as merely mystical, and having no place in the Pantheon.

Hapi-mou, or Nilus. Seben, or Lucina.

Animal-worship.

The distinguishing peculiarity of the ancient Egyptian religion, with respect to worship, is the adoration of sacred animals as emblems of the gods. It was a custom of great antiquity, for Manetho tells us that in the reign of Chaiechôs, the second king of the Second Dynasty (about B.C. 2400), the bulls Apis at Memphis, and Mnevis at Heliopolis, and the Mendesian goat, were called gods.[7] This shows not only that the Egyptian religion was not wholly developed until that time, or later, but probably that animal worship was unknown in the most ancient form of that religion. Afterwards, however, this strange custom had become so prevalent that we find at the time of the Eighteenth Dynasty (about B.C. 1525–1340) one animal at least sacred to every god, and no city without such an object of worship. No satisfactory cause has been assigned as the origin of this superstition, as it has been the endeavour of those who have written respecting it to furnish a philosophical explanation of an unphilosophical custom. The existence and popularity of such worship proves, however, whence it originated; for the desire felt by mankind for a living or material object of adoration has in all ages led priests to offer them something to satisfy this desire, by giving them a material representation of a divinity, and the common people have entirely lost sight of the immaterial in the material, while their instructors have not been willing to undeceive them, and thus lose a source of wealth and influence.

Of certain if not all of these animals, one was always held especially sacred, and during its lifetime received peculiar honours, and at its death a magnificent funeral. The most celebrated of these were the bulls Apis at Memphis and Mnevis at Heliopolis, both sacred to Osiris, though some say the latter was sacred to the sun, and the Mendesian goat—which three Manetho mentions as having been made objects of worship at the same time. Of the sacred animals generally a mere enumeration must suffice, in the order of their importance, as nearly as can be ascertained. The most important seem to have been bulls, sacred to Osiris, and cows, to Athor; a kind of hawk, to Ra and other gods; the ibis, to Thoth; the crocodile, to Sebak; the asp, to Num and the goddess Rannu; the cat, to Pasht; the scarabæus (beetle), to Ptah and Ra; and the goat, to the god called Mendes by the Greeks, whoever he may be. As of secondary rank may be mentioned the ram and sheep, sacred to Num; the cynocephalus, to Thoth; the cerastes, to Amen; the jackal, and probably more than one allied species, to Anubis; a great vulture, to the goddess Seben; the kind of heron called in the hieroglyphics bennu, to Osiris; and five kinds of fish—the oxyrhinchus, the latus, the lepidotus, the phagrus, and the mœotes, the first of which was sacred to the goddess Athor.[8] Among the animals of the least note may be remarked the lion, sacred to Hercules or Mu; the shrew-mouse, to the goddess Buto, whoever she may be, and the ichneumon. From this enumeration, which is taken from the list and excellent account of the sacred animals by Sir Gardner Wilkinson,[9] it is evident that the selection of many of them must have been inconvenient, and that of others dangerous, so that it is vain to endeavour to trace wise motives in their choice. None of the animals, except some of those selected from their fellows, such as the bull Apis, received more than a local veneration, and some of them were as much execrated, or as little respected, in one nome, as revered in another.

Sacrifices.

The worship of the Egyptian divinities was conducted with much ceremony and mystery. The objects sacrificed or offered were animals of various kinds, and parts of animals, vegetables and fruit, first-fruits of the corn, libations of wine, and incense. There is no representation of an undoubted human sacrifice on the Egyptian monuments. The king is sometimes pourtrayed slaying a group of foreign captives before a divinity, but the accompanying inscriptions render it most probable that the subject has merely a symbolical meaning, being intended to signify the destruction of enemies generally. Manetho, however, related that the custom of human sacrifices in Heliopolis was abolished by Amosis, almost certainly the king having that name who is the head of the Eighteenth Dynasty;[10] and Plutarch says, on his authority, that such sacrifices were performed in the city Eilethyas.[11] The human sacrifices at the latter place were probably abolished, like those at the former, in early times. Magnificent temples, some of which will be described in a later part of this article, were raised in honour of the gods, and a numerous body of priests was engaged in their service.

The future state.

The most interesting aspect of the religion of ancient Egypt is in its influence on the people. Man was held to be accountable hereafter for his actions done in this life, and to be judged or condemned according to his works. He was to be brought before Osiris, and his heart weighed against the feather of truth; he was to be questioned respecting his actions by the forty-two assessors, as to whether he had committed the forty-two sins concerning which they inquired. If guiltless, he took the form of Osiris his judge, and entered into a state of happiness, living among the gods in a region of perpetual day, by the banks of the celestial Nile; but if guilty, he was taken by ministers of vengeance, sometimes changed into the form of some base animal, such as a sow,[12] and consigned to a fiery place of punishment and perpetual night. It is not certain whether the judgment was believed to occur at each man's death, or generally at a remote future period; nor whether the

[1] *Ancient Egyptians*, pl. 44.
[2] *Id.*, pl. 44.
[3] *Egypt's Place*, vol. i., p. 434.
Ancient Egyptians, vol. iv., pp. 408, 409; pl. 37 A.
[5] *Id.*, pl. 61.
[6] *Id.*, pl. 52.
Cory's *Ancient Fragments*, pp. 98, 99.
[8] *Id.*, vol. v., p. 250.
[9] *Id.*, vol. v., p. 90, *et seqq.*
[10] Porphyrius *de Abstin.*, p. 199, R.
[11] Plut. *de Isid. et Osir.*, lib. i. cap. 13.
[12] Champollion, *Monumens*, pl. cclxxii.

Egypt.

rewards and punishments were believed to be of eternal duration, but the soul was held to be immortal. Many good results of these important doctrines can be traced, but they were unfortunately neutralized by the baseness of the idolatry, so that we can only detect the effect on the mind in accustoming it to think of eternity, and thus giving it sublime ideas, while the soul was debased from true religion by the superstitions and allegories wherein what the Egyptians possessed of it was hidden.

Origin of religion.

From the preceding account of the Egyptian religion, some opinion of its origin may be deduced. We trace in it certain well-defined relics of what can only have been a primeval revelation; we observe a strong Sabæan element, particularly as the verb "to adore" is expressed by the symbol of a man in an attitude of worship to a star; we find much of a cosmic religion or nature-worship, besides Sabæism; and, lastly, we remark an intellectual polytheistic system in the adoration of abstract intelligences. Hence we must conclude that this religion had at least a triple origin; but having been evidently comparatively complete at a very remote period, coeval with the earliest inscribed monuments now remaining, or antecedent to them, we cannot attempt to guess the manner in which its sources became moulded, and the time which was occupied in this being effected.

Laws.

The monuments tell us little respecting the laws of the country, and that little is gathered inferentially. Ancient writers in some measure supply this deficiency, as far as we can venture to rely upon their statements.—Some of the kings were celebrated as lawgivers, as were also the gods, and especially Thoth or Hermes.

The laws respecting crimes and offences must have been generally severe in their nature, and unbending in their application, as the sculptures show that men and women of all classes went for the most part unarmed and unprotected. Now, it is usual in the Turkish empire to see the ploughman with pistols in his belt, and a gun over his shoulder, or at least armed with a dagger or a heavy staff. Murder was punished with death, whether the person killed were a free man or a slave, but otherwise capital punishment was sparingly inflicted. Indeed, at one time, under the rule of Sabaco the Ethiopian (of the Twenty-fifth Dynasty of Manetho), according to Herodotus,[1] who may mean the whole Ethiopian dynasty, the king's power of commuting the sentence was exercised in all cases of persons capitally condemned, and the culprits were employed to raise the mounds on which their cities stood. Adultery was punished by the man being beaten with a thousand strokes of rods, and the woman's nose being cut off. Forging of money and deeds, and similar crimes, were punished by the loss of both hands of the guilty person. Theft was not regarded as a heinous offence, if we may believe Diodorus, but this can only apply to petty theft. The common punishment for this and such like breaches of the law was beating with a stick; and the right thus to chastise was permitted to masters and all persons of authority, to ensure the obedience of inferiors, and avoid the inconvenience of having to refer all causes to a legal tribunal. Respecting debt, king Bocchoris, surnamed the Wise, of the Twenty-fourth Dynasty, enacted that if a man were sued for a borrowed sum of money by one who produced no written agreement, he should be quit of the debt if he denied having borrowed on oath. Usury was not permitted to the lender above what would double the sum lent, and payment was taken from the debtor's property, but it was not lawful to imprison him. Of the laws relating to the tenure of land mention has been made in an earlier place. It may be repeated here, that under Joseph's administration the whole of the land, except what belonged to the priests, became the property of the king, but that it appears that the military class soon regained possession of their lands.[2]

Government.

The government of Egypt was of the monarchical form, but limited so as by no means to deserve the character of a despotism. The will of the king was restrained by the power and wisdom of the priesthood, into whose class he was admitted, though not as head of the religion, on or before his accession. The priests could refuse an unjust king the rites of burial, for every one was judged before those rites were permitted to be performed; and there is no doubt that in other ways they restricted the unlimited exercise of regal authority. The power of various kings was, of course, more or less despotic, but on the whole it does not seem to have been unreasonably exercised; and the greatest of them appear generally to have been regarded as benefactors by the common people, if we except, perhaps, the builders of the Great Pyramid and of the Second. The government of the country under the king was administered by nomarchs or governors of nomes, and toparchs or governors of toparchies, into which the nomes were subdivided, as well as minor officers. Some of these seem to have been hereditary rulers, and those of Eilethyas appear at one time to have been not only hereditary but of royal descent. The governor of Ethiopia, under the Pharaohs of the Eighteenth and Nineteenth Dynasties, always received the title, "Prince of Cush," and was probably a kind of viceroy. The king's sons do not seem to have been made governors, although they commanded bodies of troops, and held court appointments.

Domestic life.

The subjects on the walls of the ancient Egyptian tombs give us a great insight into the domestic life of that people. Of their infancy and youth we know little, but it is evident that boys were trained to manly sports and exercises, and educated to read and write, as well as instructed in their religion. Circumcision was practised from the earliest periods, but it does not appear whether it was considered a religious rite. On attaining to manhood they married, and appear to have restricted themselves to but one wife. Diodorus Siculus relates that, while the priests were allowed but a single wife, the rest of the people were permitted to marry as many as they pleased.[3] If such were the case, this privilege was very rarely taken, and the monuments have not as yet afforded a decided instance of it. No marriage ceremonies are represented, as far as is known, but the state was evidently considered honourable and binding. Concubines were allowed, and their children, though acknowledged, were probably held to be inferior to those of wives. The women, doubtless, received a lower education to that of the men, but not so much so as among the modern Egyptians. They were not restrained by any system resembling the hareem-seclusion of El-Islâm, and always mixed freely with the other sex. Those of the upper classes were treated with marked respect; the wife being called the "lady of the house," and held in all respects to be her husband's equal. Among the poor, the wife was very subject, as in all other countries. There was also no separation into castes, as has been supposed, and we can only distinguish the classes of soldiers, priests, and labourers. These were not prohibited from intermarrying, and sometimes a man held both a military and a sacerdotal appointment.[4] There were no hereditary titles, although some families appear, or one, at least, to have possessed a hereditary government, as above mentioned. In these circumstances, therefore, it is not to be wondered that the condition of society was flourishing, and the intercourse of the people for the most part comparatively liberal and friendly. Foreigners, however, were regarded with dislike and jealousy, perhaps especially after the rule of the Shepherds. The

[1] Herod., ii., 137.

[2] For the laws of the ancient Egyptians, see particularly Diod. Sic., i., 27, 70–80.

[3] Diod. Sic., lib. i., cap. 80.

[4] M. Ampère first proved that the Egyptians were not divided into castes.

Egypt.

lower class being uneducated, and for the most part very poor, seems to have been despised by the higher; and the agricultural labourers and herdsmen appear to have been regarded with particular contempt. The servants were chiefly free Egyptians, but were sometimes negro and other captives.

Entertainments.

The rich were very hospitable, delighting in giving feasts at which the guests were provided with very varied entertainment. The host and hostess sat together, as did other married people, and the rest of the company were arranged in various ways, the men and women generally being seated apart. The seats were single or double chairs, but many sat on the ground. Each guest was adorned with necklaces of flowers by the servants, and a lotus flower was bound to the head, on which was likewise placed a lump of ointment. Small tables were set before them, whereon were piled meat dressed in many ways, fruits, cakes, and other viands, and wine-cups were carried round. Before the repast, hired musicians and dancers amused the company, and often the entertainment seems to have been solely music and the performances of dancers, the guests being offered wine and flowers, and anointed.[1] The ancient Egyptians had many other amusements, such as various games, one of which resembles chess in appearance, but probably is rather to be likened to the game of draughts, and they were diverted by dwarfs, and the male and female performers of various feats.[2] Of their everyday life the sculptures give us some idea. The proprietor of land and cattle went out in the morning and superintended agricultural processes on his estates, such as sowing or reaping; or he saw the flocks and herds brought before his scribes to be registered. Sometimes he directed the shipment of his produce for some town, or went to view the fisheries. When he was at liberty he diverted himself by going among the fenny tracts in a canoe, generally with some of his children of both sexes, to spear the hippopotamus, or more frequently to knock down birds with the curved throw-stick. At other times he fished with a line in the preserves of his gardens or lands, or went to the desert, generally a-foot, to hunt various animals of the antelope kind, which he shot with arrows, often stone-tipped, sometimes coursing with hounds.[3] Every man of the better classes had a chariot, generally drawn by two horses, which he usually drove himself, standing in it. The life of the ladies was not unlike that of the men, except that they did not join in the sports, but sometimes as spectators. They seem to have spent their time principally in household matters, in visiting, and walking in the gardens. Occasionally they rode in heavy chariots drawn by oxen. Their manners seem to have been indolent and luxurious, and in these respects similar to those of the modern inhabitants of the same class, unlike the men who were so much more active than those of the present day. Among the lower orders the men were employed as labourers and artisans, while the women were engaged in work which was generally lighter than that of the other sex. Both led hard lives, having scanty clothing and poor food; yet the cheapness of living, and the mild climate, rendered their condition easier than one would at first suppose.

Games.

Sports.

Language.

The language of the people was that which has been called the Egyptian, and in its later form, after the people had become Christians, the Coptic. The Egyptian was kindred to the Syro-Arabian class, though not actually belonging to that group. At least two dialects appear to have prevailed, which we find in the Coptic, besides a third: these are the ordinary Coptic or Memphitic dialect, that of Lower Egypt; the Sahidic or Theban, that of Upper Egypt; and the Bashmuric, prevailing in the Bucolia, and perhaps the Oases. The last-mentioned may therefore be almost considered as provincial. The language was monosyllabic in its roots, and abounding in vowels. Its sound must have been somewhat harsh if the Copts have rightly retained the pronunciation. The inscribed and written character was the hieroglyphic, an extremely complex system, which expressed words partly by representations of objects and symbols of ideas, and partly by signs which denoted phonetically all or the chief letters of a word. From this was formed the hieratic, which is but a running hand or common written form of the other, in which documents were usually written on papyrus, and from which sprang another system. This last was the demotic, or enchorial writing, composed of a few characters selected from the phonetic signs in hieratic, usually two to each letter, and more simply written, forming a convenient system of writing for deeds and other legal documents, as well as for ordinary use among the people. The hieroglyphic and hieratic writing, we find to have prevailed at very early periods; the former is found on monuments of the age of the Great Pyramid (B.C. 2400), and the latter in the time of the Ninth Dynasty (about B.C. 2100). The demotic appears to have been introduced at a comparatively late period, as we find no examples of it earlier than under the Twenty-sixth Dynasty; and it did not come into general use until the period of Greek and Roman rule. For further details on this subject, the reader is referred to the article HIEROGLYPHICS.

Literature. Papyri.

Much remains to us of the literature of ancient Egypt. Numerous papyri have been discovered containing religious and historical documents, the former generally in hieratic, the latter always, and these with the inscriptions of the tombs and temples, as well as of almost countless tablets, afford us specimens of the character of this literature. The religious papyri are all portions or complete copies of one work which Champollion entitled "the Funeral Ritual," and Lepsius "the Book of the Dead."[4] This is a strange rambling composition, which some have supposed to be a collection of various pieces of different ages (a hypothesis that must be cautiously accepted, as it is such a favourite one of German criticism, often used to explain what needs no explanation of the sort), and divided into many chapters headed by rubrics. It consists of a series of prayers to be said by the soul during its wanderings after death until reunited to the body, and instructions as to what will happen in this intermediate state. Although much study has been bestowed upon it, its contents have not been understood in detail; which is owing partly to the use of words which are not found in the Coptic, having been abandoned at the conversion of the Egyptians to Christianity, and partly to the extreme obscurity of the subject. It has not been found to contain any passages of eloquence or beauty, and as a composition is certainly most disappointing. The religious inscriptions are often portions of this great work, but many are simply addresses to the gods, or lists of their titles. The historical papyri do not much, if at all, excel the religious in the matter of composition, though far exceeding them in the interest of their subjects. Some of these are a kind of poetical account, probably in measured prose, if not in verse, of the exploits of the king of Egypt, while others are merely narratives of various matters from one official to another.[5] The historical inscriptions are generally inflated panegyrics of the king, relating the overthrow of his enemies and other great actions of his reign, whether civil or mili-

Funeral ritual.

Historical papyri.

Historical inscriptions.

[1] *Ancient Egyptians*, vol. ii., p. 207, *et seqq.*
[2] *Id.*, vol. ii., p. 414, *et seqq.*
[3] *Id.*, vol. iii., p. 1, *et seqq.*
[4] *Das Todtenbuch der Aegypter*, Leipzig 1842.
[5] The Rev. Dunbar Heath is about to publish a work on some of these historical papyri, which is expected to throw much light upon their contents, and to afford great assistance to others who may endeavour to decypher them.

Egypt.

tary.[1] Some moral sayings have been discovered, and one romance, of which the Vicomte de Rougé has published a very interesting account.[2] It is full of curious incidents, and displays a most remarkable supernatural machinery. A complete translation of this and other works of the same kind, should they be discovered, would furnish us with much curious matter, and, in particular, throw light upon the question as to how much of the superstitions of the Arabs and modern Egyptians, and their fairy mythology, may be traceable to the ancient people of Egypt. It is also to be hoped that the books relating to sacred ceremonies, to laws, to arts and sciences, and the like, or some of them, may be recovered, and that we may thus be enabled to form a tolerably fair estimate of the state of literature, science, and art among this remarkable people.

A romance.

Science.

Respecting the sciences we have chiefly to depend upon the evidence founded on the monuments, and some of the sculptures and inscriptions which remain—evidence which is therefore partly inferential, and when direct, is only based on incidental data. It is nevertheless of the most satisfactory character, and corroborative of the accounts of ancient writers. Astronomy was the chief of the sciences, and it was carried to the highest point which it could attain without the aid of modern instruments. In order to determine the length of various periods, and the times at which certain religious ceremonies should be celebrated, a very accurate observation of the heavenly bodies became necessary; and the belief that these bodies influenced the wellbeing of mankind induced the most careful registry of their movements, and in particular of those phenomena so difficult to observe, the heliacal risings of stars. It has been asserted by ancient writers, and modern scholars have supported their statements, that the Egyptians, besides being acquainted with the Julian year, had even ascertained its inaccuracy as a tropical year, having attained to a knowledge of the precession of the equinoxes.[3] When we consider the long period through which their observations must have been carried on, and that the Greeks must have discovered this doctrine if they did not derive it from the Egyptians or Chaldees, without being more favourably placed, such an opinion seems in nowise unreasonable. Geometry held the next place to astronomy. The necessity of measuring the height of the rise and inundation of the Nile, the construction of dams and dikes, and many such like matters, must have required a knowledge of geometry and the kindred sciences quite as much as mechanical skill; and we find that the ancient Egyptians were famous in these branches of science, which, indeed, is sufficiently attested by existing works. Their mechanical skill is remarkably evidenced by the construction of the pyramids of Memphis at a very early period of their history. The transport of part of the materials for these structures from quarries on the opposite bank of the Nile, of part from those of Syene, nearly 550 miles above Memphis by the course of the river—the transport of such masses of stone by water and land, the elevation of the blocks, some of enormous size, while the buildings were in progress, the beautiful fitting of the polished masonry, and the accurate excavation in the rock of part or all of the passages and chambers, show a very great mechanical knowledge, the results of which have not been excelled by that of Europe at the present day. With chemistry the Egyptians must have possessed considerable acquaintance, as we may conclude from the state of various arts which in a great measure depend upon it. The workers in metals used the blow-pipe, and made knives of steel, though these and swords were usually of a *hard* bronze; and the manner in which Moses destroyed the golden calf is an evidence of the chemical skill of the Egyptians, from whom it is reasonable to suppose he had acquired the knowledge of which he then made use. Medicine and surgery, including anatomy, were much studied, and attained a high degree of excellence relatively speaking. Of the purely abstract sciences we can scarcely judge, and it is dangerous to reason from the character and religion of the people.

Astronomy.

Geometry.

Mechanics.

Chemistry.

Egypt.

Medicine and surgery.

Arts: architecture.

Of the arts architecture claims the first place, painting and sculpture being subservient to it among the Egyptians. Temples were not raised to contain statues, but statues were set up to adorn temples whereof they formed architecturally a part, and the walls were decorated with painted sculptures and paintings, which again formed parts of the architectural whole. The group of these arts may therefore be considered as one, and it should be our object to discover the grand principle which was intended to be expressed by the Egyptians in their application of them. Their houses were slight and temporary; they cared only for two classes of edifices, temples and tombs; the former as abodes of the gods, the latter as resting-places for bodies they deemed sacred and to be preserved for ever. In both the builders aimed at solidity of material, massive grandeur of form, richness and sobriety of colour—that they should last for ever, and express at once the solemnity of the present and of the future. The idea that originated this architecture was the contemplation of eternity and of the immortality of the soul; and in recognising that idea, and the noble manner in which it was carried out, we find something great and admirable in the ancient Egyptians. If we compare the same arts of Assyria and of Greece, we trace a far different leading idea. In Assyria the greatness of the king as the vicegerent of the gods is constantly brought before us; his figure crowds the temple walls, where the gods are ever represented protecting him, and he rarely offering to them, while in Egypt the king is constantly pourtrayed worshipping and sacrificing, and not so constantly attended by the gods. In Assyria the palaces contain temples, but in Egypt the temples are palaces. In Assyria, and afterwards in Persia, the great king was the one object of respect or fear; and when the Persian princes introduced that famous edict, that none was to ask a petition of any god or man for thirty days save of the king only,[4] they were but carrying into effect what had been virtually practised by almost all the people; and their being able to procure such a decree sufficiently proves this. The leading idea then that influenced the Assyrian artist, was the majesty of the king. In Greece we see another leading idea. However it may have been in older times, at the best period of art among the Greeks, we perceive that sculpture, which was their highest art, was designed to express the perfection of human beauty, not ideal beauty, as it has been called, but a perfect form composed, like the famous picture of Zeuxis, from a study of the most beautiful human examples. The architecture expresses the same idea; it is always symmetrical, elegant, pure in taste, but never massive or sublime. The leading idea here is beauty, and that of a material kind. In ancient art, therefore, the Egyptian has the highest place with respect to intention, and equals that of Greece and Assyria in the excellence with which the intention has been carried out. He who has been pleased with the temples of Greece and interested with the palaces of Assyria, is confounded by the Great Pyramid, and struck with awe in the hypostyle hall of El-Karnak.[5]

---

[1] In Champollion's *Lettres ecrites de l'Egypte et de la Nubie*, the reader will find much information as to the historical and religious inscriptions, conveyed in an interesting style of writing.

[2] *Revue Archéologique*, 1852, p. 385.

[3] The evidence from ancient writers on this point has been collected by Lepsius in his *Chronologie der Aegypter*.

[4] Dan. vi. 7.

[5] "Aucun peuple ancien ni moderne n'a conçu l'art de l'architecture sur une échelle aussi sublime, aussi large, aussi grandiose, qui le

Egypt. Magic.

Egypt has always been regarded as the home of magic arts: as early as the time of Joseph there was a class of magicians, and by them was Moses opposed. The monuments have not been found to contain any distinct notice of such persons, and our information respecting them is derived from the Bible, and from the narratives of Greek and Roman writers: there are also some magical papyri of the Roman period. The magicians were interpreters of dreams and omens, and they also pretended to work wonders. They endeavoured to bring about what they desired by invocations composed in a great measure of a strange jargon, and partly of foreign words, and they even threatened to reveal the mysteries. And it is not a little remarkable, that the performances of the modern Egyptian magicians, and their reputed results, bear a strong resemblance to one of the ancient modes of working an enchantment and the effect it was said to produce.[1] Probably the magicians were of the priestly class, but magic was most likely practised by persons of all positions, not being deemed a black art. Some kinds of magic were however regarded to be unlawful, as the invocation of Typhon after he had been expelled from the Pantheon,[2] and the use of enchantments to produce illegal results.

Character.

From the foregoing observations and other data, we may gain a not inaccurate idea of the character of the ancient Egyptians. They were religious, though much given to superstition, and of a contemplative disposition; in war they were brave, without the hideous cruelty of the Assyrians; to their country they bore a patriotic affection, and were hospitable to their fellow-countrymen; in their dress they were usually simple, and frugal in their diet. On the other hand they sometimes indulged in wine to excess, and were very sensual, especially the women, as in modern times; they were much addicted to falsehood, and did not show that kindness to foreigners that they did to their own people. This last fault is however chargeable to their religious and political system.

Industrial arts.

The industrial arts were carried to a great degree of excellence in ancient Egypt. In weaving, and all the processes connected with the manufacture of linen and the like, they have not been surpassed in modern times. Their pottery was very good, and their glass is not inferior to that of the Greeks, except in beauty of colour. In the making of instruments of music, and household furniture, of vases, and various vessels of metal, alabaster, and other materials, arms, and domestic implements, they displayed equal taste and skill, and we can trace in many instances how greatly the Greeks were indebted to them for patterns and forms which they often rendered more elegant.—The agriculture and gardening have been already noticed.

Music.

In the sculptures we find representations of a great variety of musical instruments of which scarcely more than the names can be mentioned here, the multiplicity of which shows how much attention had been bestowed on music. Various kinds of harps are represented, often richly ornamented, and differing from one another in their size and the number of their strings: they were played with the hand. We also see lyres, varying in the number of strings, and played with or without the plectrum, and the guitar which always had three chords. Besides these, there were other stringed instruments for which it is difficult to find modern appellations. The Egyptians had also flutes as well as single and double pipes, the tambourine of various forms, cymbals, cylindrical maces, drums of different kinds beaten with the hands or sticks, including that called by the modern inhabitants the darabukkeh, the trumpet, and the sacred sistrum. The military music was that of the trumpet, drum, and cylindrical maces, the first of which was confined to the army; but almost all the instruments were used in the services of the temples.[3] Respecting the character of the ancient Egyptian music it is difficult even to form a guess.[4]

Musicians and dancers.

The musicians often likewise sang or danced while playing on their instruments. The dances of both men and women were of various kinds, from what might be called feats of agility to slow and graceful movements. The dancers were chiefly women, and their performances seem generally to have resembled those of the modern dancing-girls of Egypt. They wore either a very transparent and full dress of fine linen, or nothing but a narrow girdle.[5] These circumstances would give us a very low opinion of the civilization and morals of ancient Egypt, did we not find almost their parallel in modern Europe, at exhibitions which the great of both sexes especially favour by their presence.

Religious festivals.

The festivals of the gods, or panegyries, were very numerous; and some of them attracted a great number of pilgrims to the chief temple of the divinity in whose honour they were held. The most important of these were, according to Herodotus, the festival of Bubastis, at the city called after her, then that of Isis at Busiris, next that of Neith at Saïs, that of the Sun at Heliopolis, that of Latona, at the city of Buto, and lastly that of Mars at Papremis.[6] In this enumeration of the chief festivals in the order of importance, it will be observed that they were nearly all celebrated in the Delta, and none at all south of that tract except that of the Sun at Heliopolis, which indeed was situated only a little above the ancient point of the Delta. As we find Herodotus was imperfectly acquainted with Upper Egypt, and as in his time some great towns of the earlier period had fallen into decay, we may conclude that both then and in preceding times there were other great periodical festivals. The panegyry of Amen at Thebes must have been very anciently of the highest rank; and subsequently so long as Thebes was a town, it cannot have sunk to the condition of an ordinary religious festival. These great celebrations were distinguished, not only by the grandeur of the ceremonies performed and the expense lavished upon the sacrifices, but by the concourse of people who flocked to them rather to divert themselves than to perform a religious duty, and among whom every kind of amusement was unrestrainedly practised. The festivals in honour of Osiris, whereof two were annually kept, though inferior to none in solemnity, were probably less popular, as only the initiated were admitted to the mysterious rites, which seem to have been more characteristic of them than of the other festivals.

Private festivities.

We know little of the private festivities of the ancient Egyptians, and, in particular, there is no evidence of any having been usual at a marriage, the marriage-ceremony itself being, as has been previously remarked, not represented upon the monuments. The most remarkable ceremonies connected with their private life were those celebrated at a funeral.

Funeral rites.

At the time of death the period of mourning commenced, and lasted seventy-two days or a shorter time. During this time the body was embalmed and swathed in many bandages, the outermost of which was covered with a kind of pasteboard, on which were painted the features of the deceased, and various emblems and inscriptions. A mummy

firent les vieux Egyptiens; ils concevaient en hommes de 100 pieds de haut, et l'imagination qui, en Europe, s'élance bien au-dessus de nos portiques, s'arrête et tombe impuissante au pied des 140 colonnes de la salle hypostyle de Karnac."—Champollion's *Lettres*, p. 98.

[1] See a very curious fragment of a Greco-Egyptian work on magic edited by Mr Goodwin, published by the Cambridge Archæological Society, and a notice of it in the Archæological Journal, No. 41.

[2] Reuvens, *Lettres*, &c., cited *supra* p. 438.

[3] *Ancient Egyptians*, vol. ii., p. 222, *et seqq.*

[4] The reverence in which it was held, its use in the sacred ceremonies, and the numerous and very different instruments, would lead us however to suppose that music had attained no little excellence, unless indeed the priests restricted it to conventional limits.

[5] *Id.*, vol. ii., pp. 329, 390.

[6] Herod., ii., 59.

Egypt.

was thus formed, bearing the shape of a bandaged human figure, of which the form of the head and hands alone was seen. When the tomb, which had been long previously commenced, and was either an excavated grotto or stone structure, was complete, the funeral ceremony usually took place, though it was often delayed to a later period. The mummy was inclosed in a case of wood having the same shape as itself, and this was again inclosed, when the deceased was a wealthy person, within either another wooden case, or more usually a sarcophagus of stone, sometimes of the same form as the mummy, but generally rectangular, or nearly so. The mummy was then placed upon a sledge, drawn by oxen or by men, and taken to the bank of the river, or shore of a sacred lake, which was to be crossed in order to reach the place of burial. This procession by water was an important part of the ceremony. The mummy, attended by mourners, was placed in a sacred baris or boat, which was towed by another boat, and followed by others carrying mourners, offerings, and all things necessary for the occasion.[1] On arriving at the tomb the sarcophagus was deposited in a sepulchral chamber, usually at the bottom of a pit within the tomb, and offerings to the deceased and others of his family buried there were made by the relatives, as well as to the gods presiding over the future state. Visits were afterwards paid to the tomb in order to make these offerings, probably at stated periods. One tomb sufficed for each family, and sometimes for two generations; and, in the case of the poorer classes, many were buried in the sepulchral chambers of a single pit, above which was no structure or grotto. The law has already been noticed whereby every one was judged by a legal tribunal before the right of burial was permitted.

Modern inhabitants.

The modern inhabitants must now be considered. Mr Lane (1834) estimates the population of Egypt at less than 2,000,000, and gives the following numbers as nearly those of the several classes of which it is mainly composed:—

Muslim Egyptians (fellâheen or peasants, and towns-people)	1,750,000
Christian Egyptians (Copts)	150,000
'Osmánlees, or Turks	10,000
Syrians	5,000
Greeks	5,000
Armenians	2,000
Jews	5,000

and the remainder, exclusive of the Arabs of the desert, about 70,000.[2]

Sir Gardner Wilkinson (1843) computes the total at about 1,800,000;[3] but Clot-Bey (1840), not always an impartial writer, places it much higher, upwards of 3,000,000.[4] The following result of the government census, taken in 1847–8, is remarkable as showing the system of falsifying statistics for state purposes. It is copied from an official return.

Middle Egypt	591,294
El-Gharbeeyeh	529,930
El-Kalyoobeeyeh	184,240
Upper Egypt	1,190,118
Esh-Sharkeeyeh	342,509
El-Geezeh	223,554
El-Boheyreh	215,810
El-Menoofeeyeh	440,519
Ed-Dakahleeyeh	347,347
Shubra	10,116
El-Kuseyr	3,435
Rosetta	18,405
Damietta	28,922
Suez	17,399
El-'Areesh	2,347
Alexandria	143,134
Cairo	253,541
	4,542,620

Of the present population of Egypt, the Muslims constitute seven-eighths, and nearly four-fifths of that of the metropolis; and to this class, and more particularly to the people of Cairo, the following sketch of personal characteristics and customs will relate, excepting in some few cases, which will be distinguished from the rest.

Personal characteristics.

In describing the personal characteristics of this remarkable people, Mr Lane, in his admirable work, *The Manners and Customs of the Modern Egyptians*[5] (which was written just before European influence was felt in the country, and now deservedly ranks as the only book of authority on the subject), says: "In general the Muslim Egyptians attain the height of about five feet eight, or five feet nine inches. Most of the children under nine or ten years of age have spare limbs and a distended abdomen; but as they grow up their forms rapidly improve. In mature age most of them are remarkably well proportioned; the men muscular and robust; the women very beautifully formed, and plump; and neither sex is too fat. I have never seen corpulent persons among them, excepting a few in the metropolis and other towns, rendered so by a life of inactivity. In Cairo, and throughout the northern provinces, those who have not been much exposed to the sun have a yellowish but very clear complexion, and soft skin; the rest are of a considerably darker and coarser complexion. The people of Middle Egypt are of a more tawny colour, and those of the more southern provinces are of a deep bronze, or brown complexion—darkest towards Nubia, where the climate is hottest. In general the countenance of the Muslim Egyptian (I here speak of the *men*) is of a fine oval form: the forehead of moderate size, seldom high, but generally prominent; the eyes are deep sunk, black, and brilliant; the nose is straight, but rather thick; the mouth well formed; the lips are rather full than otherwise; the teeth particularly beautiful; the beard is commonly black and curly, but scanty. I have seen very few individuals of this race with grey eyes; or rather, few persons supposed to be of this race; for I am inclined to think them the offspring of Arab women by Turks, or other foreigners. The Fellâheen, from constant exposure to the sun, have a habit of half shutting their eyes; this is also characteristic of the Bedawees. Great numbers of the Egyptians are blind in one or both eyes. They generally shave that part of the cheek which is above the lower jaw, and likewise a small space under the lower lip, leaving, however, the hairs which grow in the middle under the mouth; or, instead of shaving these parts, they pluck out the hair. They also shave a part of the beard under the chin. Very few shave the rest of their beards, and none their moustaches. The former they suffer to grow to the length of about a hand's-breadth below the chin (such at least is the general rule, and such was the custom of the Prophet), and their moustaches they do not allow to become so long as to incommode them in eating and drinking. The practice of dyeing the beard is not common; for a grey beard is much respected. The Egyptians shave all the rest of the hair, or leave only a small tuft (called 'shoosheh') upon the crown of the head. * * * The general form and features of the *women* must now be described. From the age of about fourteen to that of eighteen or twenty, they are generally models of beauty in body and limbs; and in countenance most of them are pleasing, and many exceedingly lovely; but soon after they have attained their perfect growth, they rapidly decline:" the relaxing nature of the climate, and other predisposing causes, contribute to render many of them absolutely ugly at the age of forty. "In the Egyptian females the forms of womanhood begin to develop themselves about the ninth or tenth year: at the age of fifteen or sixteen they generally attain their highest degree of perfection. With regard to their complexions, the same

[1] *Ancient Egyptians*, plates 83–86.
[2] *Modern Egyptians*, Introduction. Since that time the population has certainly not increased.
[3] *Mod. Egypt and Thebes*, i. 256.
[4] *Aperçu Général*, i. 166–7.
[5] *The Manners and Customs of the Modern Egyptians*, by E. W. Lane; Knight, London, 1842.

Egypt.

remarks apply to them as to the men, with only this difference, that their faces, being generally veiled when they go abroad, are not quite so much tanned as those of the men. They are characterized, like the men, by a fine oval countenance, though in some instances it is rather broad. The eyes, with very few exceptions, are black, large, and of a long almond-form, with long and beautiful lashes, and an exquisitely soft, bewitching expression—eyes more beautiful can hardly be conceived: their charming effect is much heightened by the concealment of the other features (however pleasing the latter may be), and is rendered still more striking by a practice universal among the females of the higher and middle classes, and very common among those of the lower orders, which is that of blackening the edge of the eyelids, both above and below the eye, with a black powder called 'kohl.'"[1] Both sexes, but especially the women, tattoo several parts of the person, and the latter stain their hands and feet with the red dye of the hinnè.

Dress.

Their dress can be but briefly described. That of the men of the upper and middle classes consists of cotton drawers, and a cotton or silk shirt with very wide sleeves. Above these are generally worn a waistcoat without sleeves, and a long vest of silk, called kaftân, which has hanging sleeves, and reaches nearly to the ankles. The kaftân is confined by the girdle, which is a silk scarf, or cashmere or other woollen shawl. Over all is worn a long cloth robe, the gibbeh (or jubbeh) somewhat resembling the kaftân in shape, but having shorter sleeves, and being open in front. The dress of the lower orders is the shirt and drawers, and waistcoat, with an outer shirt of blue cotton or brown woollen stuff; some wear a kaftân. The head-dress of all is the turban wound round a skull-cap. This cap is usually the red cloth fez, or tarboosh, but the very poor wear one of coarse brown felt, and are often without the turban. Many professions and religions, &c., are distinguished by the shape and colour of the turban, and various classes, and particularly servants, are marked by the form and colour of their shoes; but the poor go usually barefoot. The ladies wear a shirt and drawers, a very full pair of silk trousers, and a close-fitting vest with hanging sleeves and skirts, open down the front and at the sides, and long enough to turn up and fasten into the girdle, which is generally a cashmere shawl; a cloth jacket, richly embroidered with gold, and having short sleeves, is commonly worn over the vest. The hair in front is combed down over the forehead and cut across in a straight line; behind it is divided into very many small plaits, which hang down the back, and are lengthened by silken cords, and often adorned with gold coins and ornaments. A small tarboosh is worn on the back of the head, sometimes having a plate of gold fixed on the crown, and a handkerchief is tastefully bound round the temples. The women of the lower orders have trousers of printed or dyed cotton, and a close waistcoat. All wear the long and elegant head-veil. This is a simple "breadth" of muslin, which passes over the head and hangs down behind, one side being drawn forward over the face in the presence of a man. A lady's veil is of white muslin, embroidered at the ends in gold and colours; that of a person of the lower class is simply dyed blue. In going abroad the ladies wear above their indoor dress a loose robe of coloured silk without sleeves, and nearly open at the sides, and above it a large enveloping piece of black silk, which is brought over the head, and gathered round the person by the arms and hands on each side. A face-veil entirely conceals the features, except the eyes; it is a long and narrow piece of thick white muslin, reaching to a little below the knees. The women of the lower orders have the same out-door dress of different materials and colour. Ladies use slippers of yellow morocco, and abroad, inner boots of the same material, above which they wear, in either case, thick shoes having only toes. The poor wear red shoes, very like those of the men.

Egypt.

Religion.

In religion the Muslim Egyptians are Sunnees, professing the creed which is commonly termed "orthodox," and are principally of the persuasion of the Shâfe'ees, whose celebrated founder, the Imâm Esh-Shâfe'ee, is buried in the great southern cemetery of Cairo. Many of them are, however, Hanafees (to which persuasion the Turks chiefly belong), and in parts of Lower, and almost universally in Upper, Egypt, Mâlikees. For the tenets of El-Islâm, the reader is referred to the article MAHOMMEDANISM.

Civil administration of justice.

The civil administration of justice is conducted in four principal courts of judicature; that of the Zâbit, or chief of the police, where trivial cases are summarily disposed of; the Deewân el-Khideewee, in the citadel, in which the pasha or his deputy presides, and where judgment is given in cases which either do not require to be referred to the two other courts yet to be mentioned, or which do not fall within their province; the Deewân el-Mahkemeh, the court of the kâdee, or chief judge, who is a Turk sent annually from Constantinople, and who must be a Hanafee; and that of the Muftee of the Hanafees, or chief doctor of the law, who decides all cases of difficulty. There are besides five minor mahkemehs or courts in Cairo, and one in each of the neighbouring towns of Boolâk and Masr El-'Ateekah, from which cases are always referred to the court of the kâdee; and each country town has a native kâdee, whose authority is generally sufficient for the villages around. The Council of the 'Ulama, or learned men, consists of the sheykh, or religious chief, of each of the four orthodox persuasions, the sheykh of the great mosque called the Azhar, who is of the persuasion of the Shâfe'ees, and is sometimes its sheykh, the kâdee, and the chief (Nakeeb) of the Shereefs, or descendants of the Prophet, with several other persons. This body was until lately very powerful, but now has little influence over the Pâshâ. Cairo is divided into quarters (Hârah, pl. Hârât), each of which has its sheykh, who preserves order among the people; and the whole city is partitioned into eight larger divisions, each having a sheykh called Sheykh et-Tumn. Various trades also have their sheykhs or chiefs, to whom reference is made in disputes respecting the craft; and the servants have similar heads who are responsible for their behaviour. The country is divided into governments, as before stated, each presided over by a Turkish officer, having the title of Mudeer, and sub-divided into districts under the control of native officers, bearing the title "Mamoor" and "Nâzir." A responsible person called Sheykh el-Beled (or "sheykh of the town," or "village"), presides over each small town and village, and is a native of the place. It must also be mentioned that the Sa'eed, or Upper Egypt, is governed by a pasha, whose residence is at Asyoot. Notwithstanding the consistent, able, and in many respects commendable, code of laws which has been founded on the Kur-ân and the Traditions, the administration of justice is lamentably faulty. As is the custom throughout the East, judgment in Egypt is usually swayed by bribes, and a poor man's case is generally hopeless when his adversary is rich. To this rule there have been some notable exceptions, and the memory of a few virtuous judges is cherished by the people, but such instances are very rare. The moral and civil laws observed by the Egyptians being those of El-Islâm will be found under another article.

Infancy, and early education.

It is very worthy of notice, that in Cairo, as in some other Muslim cities, any one may obtain gratuitously an elementary education, and he who desires the fullest attainable education may receive that also without the payment of a single fee, by joining a class of students in a collegiate mosque. The elementary instruction which most boys receive consists chiefly of reading, and learning the Kur-ân by

[1] *Modern Egyptians*, chap. i.

Egypt.

heart; day-schools, as charitable institutions, abound in Cairo, and every town possesses its school; a trifling fee to the fikee (or master) is the only expense incurred by the scholars. Girls are seldom taught anything beyond needle-work. The children of both sexes, except those of the wealthy, have generally a very dirty and slovenly appearance; and often intentional neglect is adopted to avert the effects of the "evil eye," of which the Egyptians entertain great dread. The children of the upper classes are excessively indulged, while the poor entirely neglect their offspring. The leading doctrines of El-Islâm, as well as hatred for all religions but their own, and a great reverence for their parents and the aged, are early inculcated. This deference towards parents cannot fail to strike every foreigner who visits Egypt, and does not cease with their growth; presenting an example well worthy of imitation in the west. Circumcision is observed at about the age of five or six years, when the boy is paraded, generally with a bridal procession, on a gaily caparisoned horse, and dressed in women's clothes. Some parents, however, and most of the learned, prefer a quieter and less expensive ceremony.[1]

Domestic life.

It is deemed disreputable for a young man not to marry when he has attained a sufficient age; there are therefore few unmarried men. Girls, in like manner, marry very young, some even at ten years of age, and few remain single beyond the age of sixteen; they are generally very prolific. The bridegroom never sees his future wife before the wedding night, an evil which is somewhat mitigated by the facility of divorce. A dowry is always given, and a marriage ceremony performed by a fikee (a schoolmaster, or one who recites the Kur-ân), in the presence of two witnesses; the ceremony is very simple, but constitutes a legal marriage. The bridal of a virgin is attended with great festivity and rejoicing; a grandee's wedding sometimes continuing eleven days and nights. On the last day, which should be that terminating with the eve of Friday, or of Monday, the bride is taken in procession to the bridegroom's house, accompanied by her female friends, and a band of musicians, jugglers, wrestlers, &c. As before stated, a boy about to be circumcised joins in such a procession; or, frequently, a succession of such boys. A Muslim is allowed by his religion four wives, but advantage is rarely taken of this license, and very few attempt to keep two wives in one house; the expense and discomfort which polygamy entails, act, therefore, as a restriction to its general adoption. A man may however possess any number of concubine slaves, who though objects of jealousy to the legal wife, are yet tolerated by her in consideration of her superior position, and conceded power over them, a power which she often uses with great tyranny: but certain privileges are possessed by the concubine, especially if she have born a son to her master. Such slaves are commonly kept only by grandees, the generality of the Muslim Egyptians being content with one wife. A divorce is rendered obligatory by the simple words, "Thou art divorced," and a triple divorce is irrevocable under ordinary circumstances. The hareem system of appointing separate apartments to the women, and secluding them from the gaze of men, is observed in Egypt as in other Muslim countries, but less strictly. Mr Lane says on this subject—"I believe that in Egypt the women are generally under less restraint than in any other country of the Turkish Empire; so that it is not uncommon to see females of the lower orders flirting and jesting with men in public, and men laying their hands upon them very freely. Still it might be imagined, that the women of the higher and middle classes feel themselves severely oppressed, and are much discontented with the state of seclusion to which they are subjected; but this is not commonly the case; on the contrary, an Egyptian wife who is attached to her husband is apt to think, if he allow her unusual liberty, that he neglects her, and does not sufficiently love her; and to envy those wives who are kept and watched with greater strictness."[2] The females of an Egyptian household never sit in the presence of the master, but attend him at his meals, and are treated in every respect as inferiors. The mother, however, forms a remarkable exception to this rule; in rare instances, also, a wife becomes a companion to her husband. On the other hand, if a pair of women's shoes are placed outside the door of the hareem apartments, they are understood to signify that female visitors are within, and a man is sometimes thus excluded from the upper portion of his own house for many days. Ladies of the upper or middle classes lead a life of extreme inactivity, spending their time at the bath, which is the general place of gossip, or in receiving visits, embroidering, and the like, and in absolute *dolce far niente*. It is therefore no cause for wonder that their tone of morals is generally low. Both sexes are abstemious in their food, though fond of pastry, sweetmeats, and fruit. The principal meals are breakfast, about an hour after sunrise; dinner, or the mid-day meal, at noon; and supper, which is the chief meal of the day, a little after sunset. Coffee is taken at all hours, and is, with a pipe, presented at least once to each guest. Tobacco is the great luxury of the men of all classes in Egypt, who begin and end the day with it, and generally smoke all day with little intermission. Many women, also, especially among the rich, adopt the habit. Men who can afford to keep a horse, mule, or ass, are very seldom seen to walk, and numberless excellent asses are to be hired in Cairo. Ladies always ride asses and sit astride. The poorer classes are of course unable to observe the hareem system, but the women are in general carefully veiled. Some of them keep small shops, and all fetch water, make fuel, and cook for their households. The food of the poor is very meagre; flesh meat is rarely tasted by them, and (besides bread), dates, raw cucumbers, and onions, are their common food, with soaked beans, roasted ears of Indian corn, &c.

Character, &c.

In their social intercourse the Muslim Egyptians are regular, and observe many forms of salutation and much etiquette; yet they are very affable, entering into conversation with strangers at shops and elsewhere. Their courtesy and dignity of manner are very striking, and are combined with ease, and a fluency of discourse. Of their mental qualifications Mr Lane remarks—"The natural or innate character of the modern Egyptians is altered, in a remarkable, degree, by their religion, laws, and government, as well as by the climate and other causes; and to form a just opinion of it is, therefore, very difficult. We may, however, confidently state that they are endowed, in a higher degree than most other people, with some of the more important mental qualities, particularly quickness of apprehension, a ready wit, and a retentive memory. In youth they generally possess these and other intellectual powers; but the causes above alluded to gradually lessen their mental energy."[3] Their principal virtues are piety and strong religious feeling, a strict observance of the injunctions of El-Islâm, and a constant sense of God's presence and overruling providence, combined however with religious pride and hypocrisy. Their common discourse is full of asseverations and expressions respecting sacred things, often however used with a levity which it is difficult for a person unacquainted with their feelings easily to reconcile with their respect for God. They entertain an excessive reverence for their Prophet; and the Kur-ân is treated with the utmost respect—never, for example, being placed in a low situation—and this is the case with everything they esteem holy. They are fatalists, and bear calamities with perfect resignation to the Divine will. Their filial piety and respect for the

[1] *Modern Egyptians*, chap. xxvii. [2] *Id.*, vi. [3] *Id.*, xiii.

Egypt.

aged have been before mentioned, and benevolence and charity are conspicuous in their character; poverty is therefore not accompanied by the distressing circumstances which too frequently attend it in Europe. Humanity to dumb animals is another virtue, and cruelty is openly discountenanced in their streets, even to unclean animals; this is however unfortunately wearing off in consequence of their intercourse with Franks. Their affability, cheerfulness, and hospitality, are remarkable, as well as frugality and temperance in food and drink, scrupulous cleanliness, a love of country, and honesty in the payment of debt. It should be added, however, that the Egyptians rarely, if ever, exercise their social virtues but towards persons of their own persuasion and country. Their vices are indolence, obstinacy, and libidinousness, especially among the women, cupidity (mitigated by generosity), envy, a disregard for the truth, and a habit of cursing. Murders, and other grave crimes of this nature, are rarely committed, but petty thefts are very common.

Language. "The Arabic spoken by the middle and higher classes in Cairo is," on the unquestionable authority of the *Modern Egyptians*, "generally inferior, in point of grammatical correctness and pronunciation, to the dialects of the Bedawees of Arabia, and of the inhabitants of the towns in their immediate vicinity, but much to be preferred to those of Syria, and still more to those of the Western Arabs."[1] The language varies in Upper and Lower Egypt, and is more correct inland than near the shores of the Mediterranean.

Literature. In the decay of Arab literature, Cairo still holds the chief place as a seat of learning, and its University, the Azhar, is undoubtedly the first of the Eastern world. Its professors teach "grammatical inflexion and syntax, rhetoric, versification, logic, theology, the exposition of the Kur-ân, the Traditions of the Prophet, the complete science of jurisprudence, or rather of religious, moral, civil, and criminal law, which is chiefly founded on the Kur-ân and the Traditions, together with arithmetic as far as it is useful in matters of law. Lectures are also given on algebra, and on the calculations of the Mohammedan calendar, the times of prayer, &c."[2] The students, as already remarked, pay no fees, and the professors receive no salaries. The latter maintain themselves by private teaching, and by copying manuscripts, and the former in the same manner, or by reciting the Kur-ân. The number of students may be, on an average, from 1500 to 2000. Except the professors of literature, few Egyptians are taught more than to read and write; and of these, still fewer can read and write well. The women, as before mentioned, are very rarely taught even to read.

Science. Science is but little studied, and barbers generally practise medicine and surgery. Mohammad 'Alee endeavoured to improve this state of things, by sending young men to Europe for the purpose of scientific study, and by establishing various schools, with the same object, in Egypt. His improvements were discouraged by Abbâs Pâshâ, who, happily for the country, is not now living; and we may hope that Sa'eed Páshâ may follow the example of his father, Mohammad 'Alee.

Saints. In common with other Muslims, those of Egypt have very many superstitions, some of which are peculiar to themselves. Tombs of saints abound, one or more being found in every town and village; and no traveller up the Nile can fail to remark how every prominent mountain has the sepulchre of its patron saint. The great saints of Egypt are the Imâm Esh-Shâfe'ee, founder of the persuasion called after him, the seyyid Ahmad El-Bedawee, and the seyyid Ibrâheem Ed-Dasookee, both of whom were founders of orders of Darweeshees. The former of these two is buried at the town of Tanta, in the Delta, and his tomb attracts many thousands of visitors annually to his principal festival: the latter is also much revered, and his festival draws together, in like manner, great crowds to his birthplace, the town of Ed-Dasook. But, besides the graves of her native saints, Egypt boasts of those of several members of the Prophet's family; the tomb of the seyyideh Zeyneb, daughter of 'Alee, that of the seyyideh Sekeeneh, daughter of El-Hoseyn, and that of the seyyideh Nefeeseh, great-grand-daughter of El-Hasan, all of which are held in high veneration. The mosque of the Hasaneyn (or that of the "two Hasans") is the most reverenced shrine in the country, and is believed to contain the head of El-Hoseyn. As connected with the superstitious practices of Egypt, Darweeshees must be mentioned, of whom there are many orders found in that country, the following being the most celebrated:—1. The Rifâ'eeyeh, and their sects the 'Ilwâneeyeh, and Saadeeyeh. 2. The Kâdireeyeh. 3. The Ahmedeeyeh, or followers of the seyyid Ahmad El-Bedawee, and their sects the Beiyoomeeyeh, Shaarâweeyeh, Shinnâweeyeh, and many others. 4. The Barâhimeh, or followers of the seyyid Ibrâheem Ed-Dasookee. These are all presided over by a direct descendant of the Khaleefeh Aboo-Bekr, called the Sheykh El-Bekree. The Saadeeyeh are the most famous for charming and eating live serpents, &c., and the 'Ilwâneeyeh for eating fire, glass, &c.

Darweeshees.

Charms. The Egyptians firmly believe in the efficacy of charms, a belief which is associated with that in an omnipresent and overruling Providence. Thus, the doors of houses are inscribed with sentences from the Kur-ân, or the like, to preserve from the evil eye, or avert the dangers of an unlucky threshold; similar inscriptions may be observed over most shops, while almost every one carries some charm about his person. Among so superstitious a people, with whom, as we have already seen, science is in a very low state, it is not to be wondered that the so-called sciences of magic, astrology in the place of astronomy, and alchemy in that of chemistry, are in a comparatively flourishing condition.[3]

The arts; industry. Since the time of the Turkish Conquest, the arts in Egypt have rapidly fallen into decay; this is partly attributable to the deportation of most of the skilled artificers of Cairo to Constantinople by the Sultân Seleem, but it is mainly owing to the misrule of the Turkish pâshâs, who have successively domineered over this unfortunate country. Cairo contains the most splendid specimens of Arab architecture of any part of the Arabian empire; but at present new buildings are erected after the Constantinopolitan model, or, what is still worse, the purely European—both styles immeasurably inferior to the Arab, and very ill suited to the requirements of the climate. In like manner, every other kind of native art is gradually perishing; and it is to be feared that even should the people be relieved from oppression and bad government, their industry will be encouraged rather to adopt imaginary improvements imported from Europe, than to cultivate the beautiful taste of their ancestors. The manufactures of the present inhabitants of Egypt are generally inferior to those of other eastern nations: their handicrafts are clumsy, and the inevitable results of tyranny are everywhere evident; nevertheless, the curious shops, the markets of different trades (the shops of each trade being generally congregated in one street or district), the easy merchant sitting before his shop, the musical and quaint street cries of the picturesque venders of fruit, sherbet, water, &c., with the ever-changing and many-coloured throng of passengers, all render the streets of Cairo a delightful study for the lover of Arab life, nowhere else to be seen in such perfection, or with so fine a back-ground of magnificent buildings.

---

[1] *Modern Egyptians*, chap. ix.

[2] *Id.*, *ibid.*

[3] For very interesting details on the subject of Eastern magic, with its kindred sciences, the reader should consult the *Modern Egyptians*, and Lane's *Thousand and One Nights*, Knight, London, 1839, vol. i. chap. i., *note* 15.

Egypt. Luxuries, games, music.

Among the luxurious habits of the Egyptians must be classed the immoderate use of tobacco (as before mentioned), and coffee. They are, however, rarely guilty of the vice of drunkenness, wine being prohibited by the Kur-ân. Eaters of opium, and smokers of hemp, called hasheesh, are not uncommon, though they are always of the dregs of the people. The bath is a favourite resort of both sexes and all classes. In Cairo alone are upwards of sixty public baths, and every good house has a private bath. Their amusements are generally not of a violent kind, being rather in keeping with their sedentary habits, and the heat of the climate. They are acquainted with chess, draughts, backgammon, and other games, among which is one peculiar to themselves, called Mankalah, and played with cowries. The game of the gereed requires great bodily exertion; and wrestlers, &c., are found in the country, though not in any number. Music is the most favourite recreation of the people of Egypt; the songs of the boatmen, the religious chants, and the cries in the streets, are all musical. There are male and female musical performers; the former are both instrumental and vocal, the latter (called 'Almeh, pl. 'Awâlim) generally vocal. The 'Awâlim are, as their name ("learned") implies, generally accomplished women, and should not be confounded with the Ghawâzee, or dancing-girls. There are many kinds of musical instruments. The music, vocal and instrumental, is generally of little compass, and in the minor key; it is therefore plaintive, and strikes a European ear as somewhat monotonous, though often possessing a simple beauty, and the charm of antiquity, for there is little doubt that favourite airs have been handed down from remote ages. The prophet Mohammad condemned music, and its professors are in consequence lightly esteemed by the generality of Muslims, who nevertheless scruple not to enjoy their performances, and resort to the coffee-shops and to private festivities, where they are almost always to be found.

Dancing girls.

The Ghawâzee (sing. Ghâzeeyeh) form a separate class, very similar to the gypsies. They always intermarry among themselves only, and are all brought up to the venal profession. Their performances are too well known to need a description here, but it should be observed that the religious and learned Egyptians hold them to be improper. They dance in public, at fairs and religious festivals, and at private festivities, but not in respectable houses, whether before the men or the ladies. Mohammad 'Alee banished them to Isnè, in Upper Egypt; and the few that remained, occasionally dancing in Cairo, called themselves 'Awâlim, to avoid punishment. A most objectionable class of male dancers also exists, who imitate the dances of the Ghawâzee, and dress in a kind of nondescript female attire. Not the least curious of the public performances are those of the serpent-charmers, who are generally Rifâ'ee, or Saadee Darweeshes. Their power over serpents has been doubted by most European travellers, yet their performances remain unexplained; and apparently they possess means of ascertaining the haunts of these and other reptiles, and of alluring them forth; they, however, always extract the fangs of venomous serpents. Jugglers, rope-dancers, and farce-players, must also be mentioned. In the principal coffee-shops of Cairo are to be found reciters of romances, surrounded by interested audiences. They are of three classes, and recite from several works, among which was included, until lately, the *Thousand and One Nights;* but manuscripts of the latter have recently become so rare, as to render it almost impossible to obtain a copy.

Periodical public festivals.

The periodical public festivals are exceedingly interesting, and many of the remarkable observances with which they abound are passing away; but, happily, the *Modern Egyptians* contains the descriptions of its learned and minutely accurate author, an eye-witness of what he relates. The first ten days of the Mohammadan year are held to be blessed, and especially the tenth; and many curious and superstitious practices are observed on these days, particularly by the women. The tenth day, being the anniversary of the martyrdom of El-Hoseyn, the mosque of the Hasaneyn is thronged to excess, mostly by women. Following the order of the lunar year, the next festival is that of the Return of the Pilgrims, which is the occasion of great rejoicing, many having friends or relatives in the caravan. The Mahmal,[1] a kind of covered litter, first originated by the celebrated Queen, Sheger-ed-Durr, is brought into the city in procession, though not with as much pomp as when it leaves with the pilgrims. These and other processions have lost much of their effect since the extinction of the Memlooks, and the gradual disuse of gorgeous dress for the retainers of the officers of state. A regiment of regular infantry makes but a sorry substitute for the splendid cavalcade of former times. The Birth of the Prophet (Moolid en-Nebee), which is celebrated in the beginning of the third month, is the greatest festival of the whole year. During nine days and nights its religious ceremonies are observed at Cairo, in the open space called the Ezbekeeyeh. Next in time, and also in importance, is the Moolid El-Hasaneyn, commemorative of the birth of El-Hoseyn, and lasting fifteen days and nights; and at the same time is kept the Moolid of Es-Sâlih Eiyoob, the last king but one of the Eiyoobee Dynasty. In the seventh month occur the Moolid of the Seyyideh Zeyneb, and the commemoration of the Mearâg, or the Prophet's miraculous journey to heaven. Early in the tenth month (Shaabân), the Moolid of the Imâm Esh-Shâfe'ee is observed; and the night of the middle of that month has its peculiar customs, being held by the Muslims to be that on which the fate of all living is decided for the ensuing year. Then follows Ramadân, the month of abstinence, a severe trial to the faithful; and the Lesser Festival (El-'Eed es-Sagheer), which commences Showwâl, is hailed by them with delight. A few days after, the Kisweh, or new covering for the Kaabeh at Mekkeh, is taken in procession from the citadel, where it is always manufactured, to the Mosque of the Hasaneyn to be completed; and, later, the caravan of pilgrims departs, when the grand procession of the Mahmal takes place. On the tenth day of the last month of the year, the Great Festival (El-'Eed el-Kebeer), or that of the Sacrifice, closes the calendar.

Observances connected with the rise of the Nile.

The rise of the Nile is naturally the occasion of annual customs, some of which are doubtless relics of antiquity: these are observed according to the Coptic year.[2] The commencement of the rise is fixed to the night of the eleventh of Ba-ooneh (Paôni), the seventeenth of June, and is called that of the Drop (Leylet en-Nuktah), because a miraculous drop is then supposed to fall, and cause the swelling of the river. The real rise commences at Cairo about the summer solstice, or a few days later; and on about the third of July a crier in each district of the city begins to go his daily rounds, announcing, in a quaint chant, the increase of water in the Nilometer of the island of Er-Rôdah. When the river has risen twenty or twenty-one feet, he proclaims the Wefà en-Neel, "Completion" or "Abundance of the Nile." On the following day, the dam which closes the canal of Cairo is cut with much ceremony, and

[1] Mahmil is probably the correct pronunciation of this word.

[2] With reference to this curious fact, and also in connection with the subject, it may here be mentioned that the period of the hot winds, called the Khamâseen, that is "The Fifties," is calculated from the day after the Coptic Easter, and terminates on the day of Pentecost, and that the Muslims observe the Wednesday preceding this period, called "Job's Wednesday," as well as its first day, when many go into the country from Cairo "to smell the air." This day is hence called Shemm en-Neseem, or "the smelling of the zephyr." The 'Ulama observe the same custom on the first three days of the spring quarter.

this is the signal for letting the inundation over the surface of the country. A pillar of earth before the dam is called the "Bride of the Nile," and Arab historians relate that this was substituted, at the Muslim conquest, for a virgin whom it was the custom annually to sacrifice, to ensure a plentiful inundation. A large boat, gaily decked out, representing that in which the victim used to be conveyed, is anchored near, and a gun on board is fired every quarter of an hour during the night. Rockets and other fireworks are also let off, but the best, strangely, after daybreak. The Governor of Cairo attends the ceremony of cutting the dam, with the Kádee and others. The crier continues his daily rounds, with his former chant, excepting on the Coptic New-Year's Day, when the cry of the Wefà is repeated, until the Saleeb, or Discovery of the Cross, the 26th or 27th of September, at which period, the river having about attained its greatest height, he concludes his annual employment with another chant, and presents to each house some limes and other fruit, and dry lumps of Nile mud.

Funeral rites.

This brief account of the modern Egyptians would be incomplete without a few words concerning the rites attendant on death. The corpse is immediately turned towards Mekkeh, and the females of the household, assisted by hired mourners, commence their peculiar wailing, while fikees recite portions of the Kur-ân. The funeral takes place on the day of the death, if that happen in the morning; otherwise on the next day. The corpse, having been washed and shrouded, is placed in an open bier, covered with a Cashmere shawl, in the case of a man; or in a closed bier, having a post in front, on which are placed female ornaments, in that of a woman or child. The funeral procession is headed by men called "Yemeneeyeh," chanting the profession of the faith, followed by male friends of the deceased, and a party of schoolboys, also chanting, generally from a poem descriptive of the latter state. Then follows the bier, borne on the shoulders of friends, who are relieved by the passers-by, such an act being deemed highly meritorious. On the way to the cemetery the corpse is generally, in Cairo, in the case of the northern quarters of the city, carried either to the Hasaneyn, or, if the deceased be one of the 'Ulama, to the Azhar; or, in the case of the southern quarters, to the seyyideh Zeyneb, or some other revered mosque. Here the funeral service is performed by the Imám, or minister of the mosque, and the procession then proceeds to the tomb. In the burials of the rich, water and bread are distributed to the poor at the grave, and sometimes a buffalo or several buffaloes slaughtered there, and the flesh given away. The tomb is always a vault, surrounded by an oblong stone monument, with a stela at the head and feet, and a cupola, supported by four walls, covers the whole in the case of sheykhs' tombs and those of the wealthy. During the night following the interment, called the Night of Desolation, or that of Solitude, the soul being believed to remain with the body that one night, fikees are engaged at the house of the deceased to recite various portions of the Kur-ân, and, commonly, to repeat the first clause of the profession of the faith, "There is no deity but God," three thousand times. The women alone put on mourning attire, by dyeing their veils, shirts, &c., dark blue, with indigo; and they stain their hands, and smear the walls, with the same colour. Everything in the house is also turned upside down. The latter customs are not, however, observed on the death of an old man. At certain periods after the burial, a khatmeh, or recitation of the whole of the Kur-ân, is performed, and the tomb is visited by the female relations and friends of the deceased. The women of the Felláheen (or peasants) of Upper Egypt observe some strange dances, &c., at funerals, which must be regarded as partly relics of ancient Egyptian customs.

For the fullest information on the subjects of the foregoing sketch, the reader is referred to Lane's *Modern Egyptians*, to its author's translation of the *Thousand and One Nights*, and, in particular, to the notes appended to that translation; and to the *Englishwoman in Egypt*, by Mrs Poole.

Copts.

The native Christians of Egypt, or Copts, are chiefly descended from the ancient Egyptian race; and as they rarely intermarry, they preserve in their countenances a great resemblance to the representations of the tombs and temples. Their dress and customs are very similar to those of the Muslim Egyptians, but their reserve towards persons of another persuasion renders a knowledge of their peculiar observances exceedingly difficult. The causes which produced the separation of their Church will be noticed in the historical portion of this article; and in the same part will be found mention of the chief persecutions which they have suffered. Under Mohammad 'Alee they were relieved of much oppression, and the immunities then granted to them they still enjoy. The neglected appearance of their houses, and their want of personal cleanliness, is in strong contrast to the opposite habits of the Muslims, and European residents generally prefer the latter as domestic servants.

Jews.

The Jews of Egypt, of whom there have been great numbers since the captivity of the Ten Tribes, appear to be even more degraded than their fellows in other countries. They are held in the utmost abhorrence by the dominant race, and often are treated with much cruelty and oppression. Many are bankers and money-changers, &c. The quarter of the Jews in Cairo is exceedingly filthy, and would give a stranger the notion that they labour under great poverty. But such is not the case; the fear of the Muslims inducing them to adopt this outward show of misery, while the interior of many of their houses is very handsome and luxurious.

SECTION II.

CHRONOLOGY AND HISTORY.

Chronology.

It is not possible, within the limits of the present article, even to enumerate the various opinions which have prevailed respecting the chronology of ancient Egypt, strictly speaking, and respecting the chronological results deduced from different arrangements of its dynasties. On the former subject it will suffice to mention the divisions of time, particularizing those which are generally received, as to their characteristics, or as to their periods of commencement also; and on the latter, to state the main differences between the views of the learned.

Seasons.

The Egyptians, from very early times, subdivided the year which they commonly used into three seasons, each containing four months, called the first, second, third, and fourth months of these seasons. This notation obtained from a very remote period,[1] probably dating as far back as near the commencement of Egyptian history. The three seasons were called "the season of Vegetation," "the season of Manifestation," and "the season of the Waters," or "the Inundation."[2] The interpretation of the names of the first two seasons is doubtful, but that of the third is certain, and enables us to ascertain the characteristics of the year to which these names of the seasons must have originally applied.

Tropical Year.

The fitness of the division is shown by our finding it universally used in Egypt in the present day, though vaguely defined; the three seasons being called الشِّتَاء "Winter," الصَّيْف "Summer," and النِّيل "the Inundation," literally "the Nile," meaning the season at which the Nile is spread over the cultivable parts of Egypt. The season of the waters can be shown to have commenced a month before the autumnal equinox, and to have terminated

[1] Lepsius, *Chronologie der Aegypter*, i., p. 148.

[2] *Horæ Æg.*, pl. i., No. 1.

at the winter solstice, at which period, therefore, the Tropical Year commenced, when all things in Egypt begin anew. At what time the Tropical Year was instituted has not been ascertained, but it must have been at least as ancient as the nomenclature of the months, which, as above mentioned, was in use in very early times; and when it came to be disused is likewise uncertain.[1] That the Egyptians possessed a Tropical Year is generally admitted, but its time of commencement has been matter of doubt and difference.

Vague Year.

The Egyptians had also, in ancient times, a year consisting of 365 days, apparently older than the Tropical Year, and consecrated by its antiquity. This year is commonly called the "Vague Year," and was subdivided into twelve months of thirty days each, with an addition of five Epagomenæ, or intercalary days, after the twelfth month. It was divided into the three seasons of the Tropical Year, and the months were called after those seasons. It was in common use at least as early as the time of the second king of the Eighteenth Dynasty[2] (about B.C. 1500), and was not abandoned until it was made a Julian Year by Augustus, B.C. 24. No diversity of opinion prevails respecting the Vague Year.

Sothic Year.

Another year was used by the ancient Egyptians, but, apparently, only for astronomical and possibly for religious purposes, for both of which the Vague Year was also employed. It was the Sothic Year, commencing on the 20th of July, the day of the so-called heliacal rising of Sothis.[3] There is a calendar sculptured on the exterior of the great temple of Medeenet-Haboo at Thebes, which may be that of a Sothic Year; and if so, this year would have been in use as early as about B.C. 1200; but this cannot be considered certain.[4] It seems most probable that the Sothic Year was only a year of the priests, which originated not long before, or subsequently to, the commencement of the first Sothic Cycle, B.C. 1322, and it does not seem unreasonable to conjecture that it was instituted with the cycle.[5] Its length was 365¼ days, so that it differed from the Julian alone in the time of its commencement. There is no disagreement among scholars respecting it.

Egyptian Julian Year.

When Egypt had become a province of the Roman empire, Augustus commanded the inhabitants to make use of a Julian Year in their public records. But instead of fixing its commencement to be that of the common Julian year, the Egyptians made the Vague Year Julian by intercalation; consequently the Egyptian Julian Year always began on the 29th, or, in the year next after their leap-year, the 30th, of August, O.S., which was the day on which the Vague Year commenced B.C. 24, when the new reckoning was instituted. The Copts and the Egyptian peasants still make use of this year.[6]

Names of months.

The names by which the Egyptian months were called (excepting in hieroglyphic inscriptions) in the times of the Ptolemies and Cæsars—Thôth or Thôÿth, Paôphi, &c.—are never found, as such, in hieroglyphics of any time. They were chiefly or wholly derived from the names of the divinities to which the months were held to be sacred.[7] These names were, in the Memphitic dialect of Coptic, if we adopt the most probable reading assisted by the manner in which they have been written in Greek, as follows: 1, Thôüt; 2, Paôpi; 3, Athôr; 4, Choiak; 5, Tôbi; 6, Mechir; 7, Phamenôth; 8, Pharmuthi; 9, Pachôn (or rather Pachôns, as the name in the Sahidic dialect is Pashons or Pashôns, and in Arabic, Beshens, and its etymology supports this correction); 10, Paôni; 11, Epêpi; 12, Mesôrê. The Arabic names are merely corrupt forms of these.[8]

Day.

The day among the ancient Egyptians commenced in the morning six hours before noon,[9] and was equally divided into day and night, each of which contained twelve hours, numbered from one to twelve, as is shown by the astronomical tables in the tombs of the kings at Thebes[10] (about B.C. 1200). The hour is also mentioned in earlier inscriptions. It was subdivided into smaller periods, of which the length has not been ascertained with certainty.[11]

Hour.

Cycles.

Ancient writers speak of various cycles in use among the Egyptians, and the monuments mention great periods of time. It has been argued that the coincidence of the Vague Year and the Tropical was probably the commencement of a cycle; and it is known that a cycle began when Sothis rose heliacally on the first of Thôth, or, if the Sothic Year had been already instituted, when that year coincided with the Vague.

Tropical Cycle.

The Tropical Cycle claims the first notice. Such a cycle, comprehending the period during which the Vague Year passed through all the seasons of the Tropical, would properly exceed by a few years fifteen centuries of Vague Years, but, if also lunisolar, would consist of exactly fifteen hundred Vague Years; and we may fairly suppose that to have been its length, because the Egyptians could scarcely have arrived at a more accurate determination, and because they are stated to have used periods of five hundred years, a third of that sum. Admitting that such would have been the length of an ancient Egyptian Tropical Cycle, we must inquire, in the next place, when it would have commenced. The most natural period of its commencement would be the coincidence of the Tropical and Vague Years, and of the years in which this coincidence might be considered by the ancient Egyptians to take place, that would be chosen in which there was a new moon on the first day of Thôth. But if we consult the monuments, we find that the vernal equinox was the most important of the tropical points, and the greater ease of its determination would give it a preference above the winter solstice. It is, therefore, not unreasonable to conclude that the beginning of the cycle was marked by the coincidence of the Tropical and Vague Years, and the occurrence of a new moon on the day of the vernal equinox. At a period which the chronology of the dynasties, apart from all astronomical considerations, shows to have been by no means distant from that of the coincidence of the Vague and Tropical Years, we find the record of the commencement of some unknown period, apparently connected with the vernal equinox; and again, fifteen hundred years later, we observe another though less distinct record of the same nature. Hence, if it be admitted that the year with which the Tropical Cycle began was one in which a new moon fell on or very near the day of the vernal equinox, we may compute the commencements of two of these cycles,—as, January 7, B.C. 2005, in the reign of Amenemha II., the second king of the Twelfth Dynasty, and December 28 B.C. 507, when Egypt was a Persian province, under Darius Hystaspis.[12]

Sothic Cycle.

The Sothic Cycle is one respecting which chronologers are agreed. It was a period of 1460 Sothic or Julian, and 1461 Vague Years, and its commencement was marked by a so-called heliacal rising of Sothis, or Sirius,[13] on the first day of the Vague Year, which could only recur at the return of the cycle, according to the Egyptian calculation. One of these cycles commenced July 20, B.C. 1322, most pro-

[1] *Horæ Æg.*, p. 3, *et seqq.*
[2] *Id.*, p. 5–7, pl. 1, No. 2.
[3] *Id.*, p. 9.
[4] *Id.*, pp. 31, 32. M. Biot considers this calendar to be of a Vague Year, *Recherches de Quelques Dates Absolues*, &c., 1er Mem., p. 35.
[5] *Horæ Æg.*, p. 9.
[6] *Id.*, *loc. cit.*
[7] *Id.*, pp. 7, 14.
[8] *Chronologie der Aegypter*, i., p. 134, *et seqq.* *Horæ Æg.*, p. 7, *et seqq.*
[9] *Chronologie der Aegypter*, i., p. 130.
[10] Champollion, *Monumens de l'Egypte et de la Nubie*, Pl. cclxxii *bis*, *et seqq.* Biot, *Recherches*, &c., 2ème Mem., p. 156, *et seqq.*
[11] *Chronologie der Aegypter*, i., p. 127.
[12] *Horæ Æg.* p. 12, *et seqq.* and Pl. i., Nos. 5, 6.
[13] *Id.*, p. 28.

Egypt.

bably during the reign of Sethee I., the head of the Nineteenth Dynasty;[1] and the next, on the same day A.D. 138, in the reign of Antoninus Pius. The only matter of argument respecting these periods is, whether there were any before that commencing B.C. 1322. There is no distinct evidence to show that such was the case, but, on the contrary, there is presumptive evidence that the period was instituted in that year.[2]

Phœnix Cycle.

The Phœnix Cycle is a very important period in Egyptian chronology, but one respecting which the statements of ancient writers, as well as the opinions of modern scholars, have presented a remarkable diversity. An examination of the Egyptian monuments, however, indicates the length of the true Phœnix Cycle, and the dates of its commencements. In the celebrated astronomical ceiling of the Rameseum of El-Kurneh, commonly, but incorrectly, called the Memnonium, we find a representation of a constellation bearing the name Ben-nu Osir, or the Phœnix of Osiris, and having the form of a kind of heron. It is placed under the sixth month, indicating that it rose heliacally, in the Egyptian acceptation of the term, during that month, when Sothis so rose on the first of Thôth, or during that month. As no precise day is fixed as that of the rising of the Phœnix, we cannot determine to what constellation it corresponded, but it most probably represents Cygnus, the "Bird" (Ὄρνις) of the Greeks, and perhaps it also partly included Aquila, or comprehended part of each of those constellations. Ancient writers speak of the appearance of the Phœnix on various occasions: this must allude to the heliacal rising of the constellation, that is, of its principal, or of its last star; for the ancient Egyptian expression for heliacal rising, meaning thereby the rising of a star about one hour before sunrise, is "manifestation," or "appearance." Reasoning, therefore, from analogy, the Phœnix Cycle would commence when the Phœnix rose about an hour before the sun on the first day of the Vague Year, and consist, like the Sothic Cycle, of 1460 Julian years, and 1461 Vague. Supposing this to have been its duration, the position of the Phœnix in the ceiling of the Rameseum of El-Kurneh would enable us to fix approximatively the commencement of a Phœnix Cycle preceding the date of that sculpture, to some one of the years B.C. 2042 to 1923 inclusive. This view of the Phœnix Cycle is strengthened by a remarkable passage of Tacitus, wherein he says that some assigned a length of 1461 years as the interval between appearances of the Phœnix, and stated that they occurred first in the reign of Sesostris, then in that of Amasis, and then in that of Ptolemy, "the third Macedonian sovereign."[3] Now, the reign of Amasis falls within the approximative date of the commencement of the Phœnix Cycle following that already calculated from the ceiling of the Rameseum. The duration of that reign was B.C. 570 to 525 inclusive;[4] whence we may calculate the limits of the commencement of the preceding cycle, supposing the length to be 1460 years, as B.C. 2030 to 1985 inclusive, the approximative date being thus narrowed. But the means of accurately fixing these dates appears to be afforded by the Calendar of the Panegyries, for it has been argued with much probability, that the Egyptians had great Panegyrical periods, whereof four composed a sum of 1461 Julian years, and that two of these periods commenced respectively Jan. 2 B.C. 1986, which will agree with the reign of the old Sesôstris, Sesertesen III., and Jan. 2 B.C. 525 during that of Amasis. These, therefore, would be likewise commencements of the Phœnix Cycle, the duration of which would be 1461 Julian Years, and not 1460, which indeed may be the meaning of Tacitus. The appearance of the Phœnix in the time of Ptolemy, the third Macedonian sovereign, by whom Ptolemy Euergetes is intended, is clearly at variance with the statement respecting the length of the interval, if the appearance in the reign of Amasis be accepted, and there is every reason for giving the latter the preference.[5]

Egypt.

Panegyrical Periods.

On the monuments of ancient Egypt, mention is frequently made of various Panegyrical periods in particular, and of periods of Panegyries in general. Many opinions have prevailed respecting them, and the subject is one of so intricate a nature, that it cannot be investigated in the present article. It is intended rather, in the following observations, to present an outline of the only distinct and complete explanation of these divisions of time, giving references to where the reader will find a full investigation of them.

It is important to distinguish between the system of Panegyrical periods and the Royal Panegyries, of which somewhat will be said subsequently. The former consisted of a year, month, and division of a month. The year, or Great Panegyrical Year, had a mean length of 365¼ Julian years, having alternately a length of 364½ and 366 years. The Great Panegyrical Month, of which there were twelve to the year, contained thirty Julian years, and was divided into twenty Divisions of the Great Panegyrical Month, each having a length of one Julian year and a half. There must also have been an intercalation of four years and a half, or six years, after the twelfth Panegyrical Month. The commencement of the Tropical Cycle being dated as having occurred in the twelfth Division of the twelfth Great Panegyrical Month, enables us to ascertain the beginning of one Great Panegyrical Year, and consequently of the rest. The following are the dates of their commencements:—

First Great Panegyrical Year, B.C. 2717, Era of Mênês, the first king of Egypt. Length 364½ years.

Second Great Panegyrical Year, B.C. 2352, in the time of Sûphis I. and II., kings of the Fourth Dynasty. Length 366 years.

Third Great Panegyrical Year, and commencement of the first Phœnix Cycle, B.C. 1986, in the time of Sesertesen III., the fourth king of the Twelfth Dynasty. Length of the Great Panegyrical Year 364½ years.

Fourth Great Panegyrical Year, B.C. 1622. Length 366 years.

Fifth Great Panegyrical Year, B.C. 1256. Length 364½ years.

Sixth Great Panegyrical Year, B.C. 891. Length 366 years.

Seventh Great Panegyrical Year, and commencement of the Second Phœnix Cycle, B.C. 525, in the reign of Amasis. Length of Great Panegyrical Year, 364½ years.

Eighth Great Panegyrical Year, B.C. 161, in the reign of Ptolemy Philometor. Length 366 years.

Ninth Great Panegyrical Year, A.D., 205, in the reign of the Roman Emperor Septimius Severus.

The earliest mention upon the monuments of the Panegyrical periods of this class is found in the inscriptions commemorating the commencement of the Second Great Panegyrical Year, and the latest certain notice is probably of the time of Darius Hystaspis. The following are the dates recorded on the monuments, wherein these periods are used:—

2352 B.C.	Commencement of the Second Great Panegyrical Year. Time of Sûphis I. and II. Fourth Dynasty.
2005	Commencement of the First Tropical Cycle. Time of Amenemha II. Twelfth Dynasty.
1472-1	Date in fourth year of Skhee. Eighteenth Dynasty.

[1] *Horæ Æg.*, p. 33.

[2] *Horæ Æg.*, p. 35.

[3] Paullo Fabio L. Vitellio consulibus post longum seculorum ambitum, avis Phœnix in Ægyptum venit; præbuitque materiem doctissimis indigenarum, et Græcorum, multa super eo miraculo disserendi; de quibus congruunt, et plura ambigua, sed cognitu non absurda, promere libet. Sacrum soli id animal, et ore ac distinctu pinnarum à ceteris avibus diversum, consentiunt qui formam ejus definiere. De numero annorum varia traduntur. Maxime vulgatum, quingentorum spatium. Sunt qui adseverent, mille quadringentos sexaginta unum interjici; prioresque alites Sesostride primum, post Amaside dominantibus, dein Ptolemæo, qui ex Macedonibus tertius regnavit, in civitatem cui Heliopolis nomen, advolavisse, multo ceterarum volucrum comitatu, novam faciem mirantium. Sed antiquitas quidem obscura: inter Ptolemæum ac Tiberium minus ducenti quinquaginta anni fuerunt, unde nonnulli falsum hunc Phœnicem, neque Arabum è terris credidere, nihilque usurpavisse ex his quæ vetus memoria firmavit.—*Ann.* vi., 28.

[4] It is generally agreed that Amasis died in the year B.C. 525; and since the Phœnix Cycle commenced in January of that year, as is subsequently shown, it can hardly be doubted to have fallen in his reign.

[5] See *Horæ Æg.*, p. 39, and pl. ii.

Egypt.

1442 B.C. Date in sixteenth year of Queen Amen-numt. Eighteenth Dynasty.
1412 Date in thirty-third year of Thothmes III. Eighteenth Dynasty.
591 Date in reign of Psammetichus II. Twenty-sixth Dynasty.
561 Date in reign of Amasis. Twenty-sixth Dynasty.[1]

It is necessary to mention the Calendar of the Decans, which was connected with that of the Panegyries. The ancient Egyptians distinguished thirty-six stars or asterisms, nearly equidistant, throughout a great circle of the heavens (like the signs of the zodiac), which rose at intervals of about ten days. The two most important of the Decans were Sothis and Smat, which were distant half a year from one another.[2]

Royal Panegyries.

Besides the Panegyrical periods above mentioned, were those of the Royal Panegyries. These were thirty-year periods or Triacontaëterids, as they are called on the Rosetta Stone, and subdivisions, having apparently a length of three years. They were probably counted from the king's accession, and his first Triacontaëterid festival, celebrated at or about the completion of his thirtieth year. They seem to have been reckoned by Julian years, and celebrated at the first indication of the rise of the Nile.[3] Respecting the duration of the Triacontaëterids, there is of course a general agreement, since it rests upon indubitable authority.[4]

Arrangement of Dynasties.

Modern writers have generally depended upon an arrangement of the dynasties for the duration of ancient Egyptian history. Some have held those dynasties to have ruled consecutively; but others have maintained that many of them were contemporaneous. Hence have arisen two chronological systems, of which some account must here be given.

Those who hold the dynasties to have been all consecutive, assign to the Egyptian monarchy a duration of upwards of 5000 years. It is, however, generally admitted in the present day, that this is an extravagant period, and that both the writings of ancient historians, and the evidence of the monuments, lead to the conclusion that many of the earlier dynasties were contemporary. But here again there is a wide difference of opinion; some holding, that though the monuments afford general evidence of contemporaneousness—for example, by the progress of art—no distinct evidence has been yet obtained from them of the contemporaneousness of any two kings of different dynasties; while others maintain that the hieroglyphic inscriptions do afford such distinct evidence of contemporaneousness. Chevalier Bunsen and Professor Lepsius are the best scholars who have advanced the former view, and it is necessary therefore to give an outline of their method. They both recognise the absurdity of the opinion that the dynasties were all consecutive; but being unable to obtain monumental evidence as to the order of their contemporaneousness, and the obvious order, to be mentioned subsequently, not occurring to them, they were forced to look to ancient writers for some distinct statement of the duration of the Egyptian kingdoms as a whole. This wished-for sum they found in a passage of the Byzantine Syncellus, who states that, according to Manetho, the duration of the Thirty Dynasties, from Mênês the first king, to Nectanabo [II.] the last, was 3555 years. This sum they unhesitatingly accept, and rest their whole chronology upon it, having, for that part of it which is anterior to the sixteenth or seventeenth century B.C., and respecting which alone there are serious differences of opinion, absolutely no other reliable support.[5] It is important, therefore, to examine into the trustworthiness of a vessel which has carried these inquirers so far into the ocean of time.

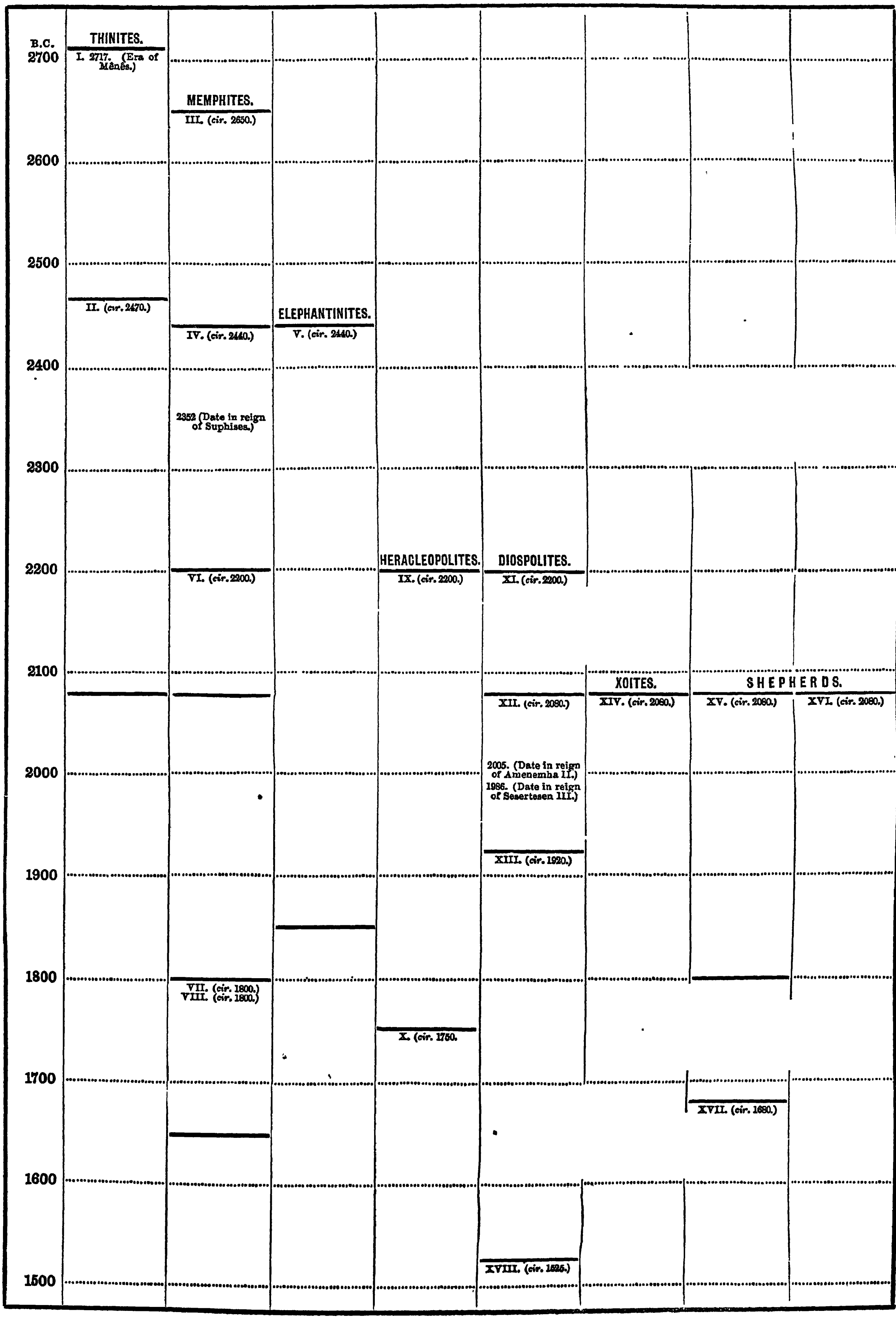
In the first place, it must be remarked that a solitary number which is found in a single work of a single author is always to be regarded with caution, more especially when that author is as careless as Syncellus. It becomes, therefore, a hazardous matter to build a chronological arrangement upon this number. But the next inquiry should be, whence Syncellus derived the sum, since two persons have the name of Manetho without distinction in his writings—the true Manetho, the native historian of Egypt, and the false Manetho, usually called Pseudo-Manetho, who usurped the historian's name as a passport for his impostures. Besides Syncellus, four other writers, all preceding him in time, Africanus, Eusebius, Theophilus of Antioch, and the Jewish historian Josephus, quote from the true Manetho or refer to him. Syncellus does not appear to have had access to his work, and makes no distinction between him and the impostor, calling both Manetho. In every instance in which what he states on Manetho's authority is not found in the works of the four writers above mentioned, excepting that of the passage under consideration, it is admitted by all to have been derived from Pseudo-Manetho. External evidence therefore would induce an unprejudiced inquirer to ascribe the sum of 3555 rather to the false Manetho than to the true. Internal evidence increases this suspicion of the passage. Therein it is stated that the time was that of 113 generations in thirty dynasties. Now the Old Chronicle, an undoubted imposture, treated in like manner of the history of Egypt under thirty dynasties in 113 generations during a great and imaginary cycle. By this Old Chronicle, according to Syncellus's opinion, was Manetho, that is the Pseudo-Manetho, as Bunsen acknowledges, led astray.[6] The agreement in the sum of generations is most striking; that of the number of dynasties affords no argument, thirty being the true number. Hence an additional doubt is thrown upon this statement; and a careful comparison of its sum of years with what we may believe to be derived from the chronology of Pseudo-Manetho or his followers, does not tend to lessen our suspicion, although a positive proof cannot be thus obtained. In the order of the dynasties, Bunsen and Lepsius have admitted some of the earlier to have been contemporary, but in arranging them they have differed considerably. The main point of disagreement is with respect to the Shepherd dynasties, of which Bunsen makes a Middle Empire between the Old Empire and the New, as he terms them, supposing these dynasties to have ruled without any contemporary Egyptian line. This Lepsius opposes, holding the Shepherds never to have governed without contemporary Egyptians, and dividing the dynasties into the Old Empire and the New.

To Mr Lane archæology is indebted for the discovery of the true order of contemporaneousness of the dynasties. As long ago as the year 1830 he discovered that order from "the evidence given by Manetho and others, that some of the early dynasties were contemporary, and upon a consideration of the ordinal and other appellations (or numbers and names) by which those dynasties are distinguished [by Manetho]; for the interpretation of hieroglyphics was not then certain enough for him to obtain clear monumental evidence." An examination of the hieroglyphic inscriptions has proved Mr Lane's accuracy,[7] and the arrangement has received the high sanction of Sir Gardner Wilkinson.[8] The following table will explain the order of the contemporary dynasties, that is, the first seventeen: under the eighteenth dynasty Egypt was a single kingdom, and most, if not all, of the subsequent dynasties were successive. The dates of the commencement of each dynasty in the table are more or less approximative, as are also their durations; but the fixed dates show that neither can be far wrong in all the most important instances.

1 *Horæ Æg.*, pp. 61–68. The date of Thothmes III. is mentioned (p. 72–73) as of Royal Panegyries, but the author has since come to the conclusion that it is that of the commencement of a Great Panegyrical Month.
2 *Id.*, pp. 53, 54, and 56, 57. *Chronologie der Aegypter*, i., p. 66.
3 *Horæ Æg.*, p. 71, *et seqq.*
4 *Chronologie der Aegypter*, i., p. 161.
5 *Egypt's Place*, vol. i., p. 86, *et seqq.* *Chronologie der Aegypter*, i. p. 488, *et seqq.*
6 *Egypt's Place*, vol. i. p. 214 *et seqq.*
7 *Horæ Æg.*, p. 79, *et seqq.*
8 *Architecture of Ancient Egypt*, p. 132.

Egypt.

Table of the first seventeen dynasties.



Egypt.

Table of the first seventeen dynasties.

Egypt.

History.

Mênês, the head of the First Dynasty, is related to have been the first mortal king of Egypt.[1] Manetho states that the period before his reign was occupied by the rule of the gods, demigods or heroes, and manes, extending through nearly 25,000 years, according to Eusebius.[2] Similar statements are found in the writings of Herodotus and Diodorus.[3]

Divine Dynasties.

These divine dynasties, whether cyclical or not, have no place in history, being purely mythical and not traditionary. And it should be observed, that whereas in the annals of other ancient nations a time of tradition intervenes between that of myths and that of facts, no such period of transition is found in the Egyptian records, where we find pure fiction immediately followed by accurate history.

First Dynasty. Mênês, or Menee.

Hence it seems reasonable to suppose that at the time of Mênês, or not long before, Egypt was colonized from another country, and this is entirely in accordance with the most probable Septuagint date of the Dispersion about half a century before the Era of Mênês, B.C. 2717, which was probably the date of his accession.[4] Whether or not the Mizraite settlers may have found an aboriginal population is a question too large to be discussed in this brief historical notice.[5]

With Mênês, therefore, Egyptian history commences. His dynasty is stated to have been one of Thinite kings, of the city of This, situated near to Abydos in Upper Egypt.[6] Respecting Mênês, Manetho, according to Eusebius, relates that he made a foreign expedition and acquired renown; and, moreover, that he was killed by a hippopotamus, as Africanus also mentions.[7] Diodorus Siculus, who calls him Mênas, states that he first instructed the Egyptians in religion, and so changed their simple manners that Trephachthus, the father of Bocchoris the Wise, finding from experience the happiness of a frugal life, and the evils of luxury, inscribed a curse against him in the temple of Jupiter (or Amen-ra), at Thebes.[8] Herodotus says that Mênês founded the city of Memphis, after he had diverted the course of the river by raising a dyke. The same historian mentions that he built the temple of Hephæstus (or Ptah) in Memphis.[9] His name, written Menee, has been found in hieroglyphic characters in a sort of list, or procession of small statues of kings, in the Rameseum of El-Kurneh,[10] and in hieratic characters in the Royal Turin Papyrus.[11]

Athôthis.

Mênês was succeeded, after a long reign, by Athôthis his son, respecting whom Manetho tells us that he built the palace at Memphis, and that he was a physician, and left the anatomical books.[12] This, as well as what Herodotus relates of his father having changed the course of the river, however that be understood, shows that the Egyptians were at this remote period a highly civilized people; and the circumstances that, after an interval of less than four centuries from the accession of the first king, we find magnificent pyramids as royal sepulchres, and the tombs of the subjects sculptured and having hieroglyphic inscriptions, confirm this opinion. The Third Dynasty commenced, and Memphis became independent, during, or soon after, the reign of Athôthis; but as the exact time of this change is not determined, it will be best to notice the later Thinite kings before speaking of the Memphite line of sovereigns.

Uenephês.

Uenephês, the fourth Thinite king, is said by Manetho to have built the pyramids near Kôchômê, a place which has not been identified; and it is added that Egypt was afflicted by a famine in his reign.

Semempsês.

In the time of Semempsês, the seventh king, there was a very great plague.[13] With his successor the dynasty terminated, having ruled, in all probability, about two centuries and a half.

Second Dynasty.

The few particulars that we know of the history of the Second Dynasty, in which the Thinite line was continued, are related by Manetho alone. He says that in the reign of the first king Boêthos, a chasm of the earth opened at Bubastis, and many perished; that under the second king Kaiechôs, the bulls Apis in Memphis, and Mnevis in Heliopolis, and the Mendesian goat, were called gods, as already mentioned; and that under the next king Binôthris, it was adjudged that women could hold the sovereign power.

Kaiechôs. Binôthris.

Nepherchêrês.

During the reign of the seventh king Nepherchêrês, called Nufre-ka-ra in the hieroglyphical list known as the Tablet of Abydos,[14] Manetho tells us that it was fabled that the Nile flowed mixed with honey for the space of eleven days. His successor, according to the Egyptian historian, was Sesôchris, a man of gigantic stature.[15]

Sesôchris.

Nothing further is related by Manetho of the occurrences of this dynasty, to which he assigns a duration of about 300 years. From the monuments, however, it appears most probable that it lasted little less than four centuries, and that the Thinite kingdom came to a close with it at the time of the Shepherd invasion.

Third Dynasty. Necherôphês.

The Memphite kingdom, as already noticed, commenced not long after the Thinite, with the Third Dynasty. Manetho relates that during the reign of its first king Necherôphês or Necherôchis, the Libyans revolted from the Egyptians, but returned to their allegiance, being terrified by a sudden increase of the moon.

Tosorthros.

The second Memphite sovereign Tosorthros, or Sesorthos, is said by the same authority to have been called by the Egyptians Æsculapius, on account of his medical knowledge, and to have invented the art of building with hewn stones, and to have patronized literature.[16] After having lasted about two centuries, this dynasty was succeeded by the Fourth, one of the most famous of the lines which ruled in Egypt, while the Fifth Dynasty of Elephantinite kings arose at the same time.

Fourth Dynasty. Sôris, or Shura.

Of Sôris, the head of the Fourth Dynasty, nothing is known; his name, written Shura, occurs in the hieroglyphic inscriptions of tombs near the Pyramids of El-Geezeh, and was found by Mr Perring in the quarry-marks of the Northern Pyramid of Aboo-Seer, which was therefore his tomb.[17] In Manetho's list, according to Africanus, he was followed by two kings bearing the name of Sûphis, who may be called Sûphis I. and II.

Sûphis I., or Shufu, and Sûphis II., or Num-Shufu. Great Pyramid.

These correspond to the Shufu, or Khufu, and Num-Shufu, or Num-Khufu of the monuments. Since these names are found together, particularly in the quarry-marks of the Great Pyramid which has *two* principal chambers, and which all are agreed in assigning to the reign of *one* king, it is most reasonable to suppose that they ruled together for the greater part of their reigns. Manetho makes Sûphis I. to have ruled for 63 years, and Sûphis II. 66. The latter, therefore, probably reigned for some years after the former. Shufu must be the first of these kings, since he is the Cheops (Khufu) to whom Herodotus ascribes the building of the Great Pyramid, which, according to Manetho, was the work of Sûphis I.[18] This is the period at which we first find undoubted contemporary monuments of which we know the date, the earliest whereof is most probably the Northern Pyramid of Aboo-Seer before mentioned. Under

---

[1] Manetho in Cory's *Ancient Fragments*, pp. 94, 95; Herod., ii., 99; Diod. Sic., i., 45.
[2] *Ancient Fragments*, pp. 92, 93.
[3] Herod., ii., 43, 145; Diod., i., 23, 26, 44.
[4] *Horæ Æg.*, p. 93.
[5] On this subject see a letter in the *Journal of Sacred Literature*, January 1855, p. 433.
[6] Θίς, πόλις Αἰγυπτία πλησίον Ἀβύδου. ὁ πολίτης Θινίτης. Ἀλέξανδρος Αἰγυπτιακῶν πρώτῳ. *Steph. Byz.*, s. v. The author referred to is Alexander Polyhistor. See *Fragmenta Historicorum Græcorum*, vol. iii., p. 237.
[7] *Ancient Fragments*, pp. 94, 95.
[8] Diod., i., 45.
[9] Herod., ii., 99.
[10] Lepsius, *Denkmäler*, abth. iii., bl. 163.
[11] See Wilkinson's edition.
[12] *Ancient Fragments*, pp. 94–97.
[13] *Id.*, 96, 97.
[14] *Horæ Æg.*, pp. 101–2.
[15] *Ancient Fragments*, pp. 96–99.
[16] *Id.*, pp. 100–1.
[17] Vyse's *Pyramids of Gizeh*, vol. iii. p. 13 and pl. facing p. 14.
[18] *Horæ Æg.*, p. 118.

Egypt.

the rule of the two Sûphises such monuments are extremely numerous[1] and afford us far better knowledge of the state of Egypt at that time than do the scanty remains of Manetho and the traditionary tales of Herodotus and Diodorus. The names of both the Sûphises occur among the rock inscriptions of Wâdee-el-Magharah in the Peninsula of Sinai, where the second of them, or Num-Shufu, is represented slaying a foreigner.[2] The military expeditions of the Egyptians, however, at this period were probably of little importance, and designed to repress the nomad tribes which have at all times infested the eastern and other borders of Egypt, and to maintain the possessions beyond these borders. The Memphite Pharaohs were rather celebrated for the arts of peace and for the care with which they promoted the interests of literature and science. Of Sûphis I. Manetho writes that he was arrogant towards the gods, but, repenting, wrote the Sacred Book.[3] This seems to agree well with what Herodotus and Diodorus relate of the impiety and cruelty of the king who built the Great Pyramid;[4] but if we suppose that he was arrogant towards the priests, we find a sufficient cause for the ascription to him of this character, so ill according with the prosperity and peacefulness of his time as shown by the monuments. The power of the king or kings is evidenced by the magnitude of the Great Pyramid, and the costly manner of its construction; the safety of the kingdom, by no soldiers being represented in the sculptures, and the general custom of going unarmed common to the great and the small; the wealth of the subjects, by the scenes pourtrayed upon the walls of their tombs; and the state of science and art, by the construction of monuments, gigantic in size, of materials many of which were transported from a great distance, and fitted together with an accuracy that has never been excelled, as well as by the astronomical and other knowledge, of which evidence is found in the contemporary inscriptions. After the Sûphises ruled Mencherês, called in the hieroglyphic inscriptions "Men-kau-ra," and by Herodotus "Mykerinos." By him the Third Pyramid was raised, in which the late General Howard Vyse found part of his mummy case, bearing his name, now in the British Museum.[5] According to Manetho, Queen Nitôkris, the last sovereign of the Sixth Dynasty, built this pyramid; but it should be observed that Eusebius's version of the lists seems to state this merely on the authority of tradition. It is most probable, from its plan, that the building was enlarged and a new passage and chamber excavated in the rock beneath it after its first completion, whence it seems that the later sovereign, by this additional work, made the tomb of Mencherês her own sepulchre also. Of the subsequent kings of the Fourth Dynasty, who were, according to Africanus's version of the lists of Manetho, four in number, nothing is known. The duration of the dynasty probably somewhat exceeded two hundred years, and it was succeeded by that called the Sixth, in like manner of Memphite sovereigns.

Mencherês, or Men-kau-ra. Third Pyramid.

Fifth Dynasty.

The Fifth Dynasty, of Elephantinites, commenced about the same time as the Fourth. The names of several of its earlier kings occur in the necropolis of Memphis, and sometimes with those of the contemporary sovereigns of the Fourth Dynasty.[6] The most important of these is Sephrês, the Shaf-ra or Khaf-ra of the monuments, the builder of the Second Pyramid. Herodotus calls him Chephrên,[7] and Diodorus Siculus, Kephrên.[8] The Elephantinite Dynasty lasted not much less than six hundred years, and appears to have consisted of thirty-one kings, the last of whom, called by Manetho Onnos, and in hieroglyphics Unas, was contemporary, as is shown by an ancient inscription, with Assa the fifth king of the Fifteenth Dynasty of Shepherds, ruling at Memphis.[9]

Sephrês, or Shaf-ra. Second Pyramid.

Onnos, or Unas.

Sixth Dynasty.

The Sixth Dynasty, by which the Memphite kingdom was ruled after the close of the Fourth, lasted about a century and a half. The most famous sovereign was the second of the line, Papa or Phiôps, who is related to have ruled a hundred years, a statement which the monuments seem to corroborate, although not directly. His sculptured records are numerous throughout Egypt, showing him to have been a powerful king, but not giving us any account of remarkable events during his reign. The second sovereign after him was Queen Nitôkris, called in the Royal Turin Papyrus, Neet-akartee. With her the Dynasty closed, Memphis being taken by the foreign invaders called Shepherds, whose first king made it his capital.[10]

Phiôps, or Papa.

Nitôkris, or Neet-akartee.

Ninth Dynasty.

Another royal line, that of the Heracleopolites, arose while the Sixth Dynasty ruled at Memphis. The time of the commencement of the first Heracleopolite Dynasty, the Ninth, is not certain, but it was probably not long after that of the Memphite Dynasty above mentioned. The names of six kings of the Ninth Dynasty have been found in hieroglyphics, and their order is shown by the list of the Chamber of Kings: all these bear the name of Nantef, excepting the fifth, who is called Munt-hotp. The king last mentioned seems to have been the most powerful of the six; his successor in the list of the Chamber of Kings receives a title equivalent to that of "chief," and his name appears not to have been inclosed in a royal ring. Munt-hotp was contemporary with the last king of the Eleventh Dynasty, and it is therefore probable that his successor was deprived of all but titular power by the potent head of the Twelfth Dynasty. After this time the monuments have not been found to afford us any information respecting the Heracleopolite kingdom. Probably the Ninth Dynasty lasted about four hundred years, and the Tenth nearly two hundred, terminating at the time of the great Shepherd war of expulsion, which resulted in the overthrow of all the royal lines except the Diospolite.[11]

Munt-hotp.

Tenth Dynasty.

Eleventh Dynasty.

With the Eleventh Dynasty commenced the Diospolite or Theban kingdom, which afterwards attained to greater power than any other, and had a longer uninterrupted duration. Its first dynasty was that called the Eleventh, the kings of which, excepting the last, seem to have been of little power, and are probably mentioned in subsequent inscriptions rather because they were the founders of the Diospolite line than as illustrious rulers. The duration of this dynasty is doubtful, and the time of its commencement has not been determined; it may be supposed that it began not long after the Ninth Dynasty. Amenemha I., its last sovereign, was a potent king who succeeded in a time of great disorder in establishing his kingdom as supreme in Upper Egypt. During part of his reign he was co-regent of Sesertesen I., head of the Twelfth Dynasty.[12]

Amenemha I.

Twelfth Dynasty.

The commencement of the Twelfth Dynasty forms an epoch in Egyptian history. Until then the country seems to have enjoyed a long period of prosperity, and then to have been suddenly surprised and subdued by a foreign force, which succeeded in gaining possession of Lower

Shepherd-invasion.

1 Lepsius, *Denkmäler*, abth. ii., bl. 1, &c.

2 *Id.*, abth. ii., bl. 2. b. c.

3 *Ancient Fragments*, pp. 102–3. Africanus does not state but implies the king's repentance.

4 Herod., ii., 124; Diod., i., 64. The latter author does not ascribe impiety to the builder of the Great Pyramid, but makes him to have been an oppressive king.

5 Vyse's *Pyramids of Gizeh*, vol. ii., p. 93, *et seqq.*

6 Lepsius, *Denkmäler*, abth. ii., bl. 55; *Horæ Æg.*, p. 110.

7 Herod., ii., 127.

8 Diod., i., 64. Diodorus says he was the brother of his predecessor Cheops, whom he calls Chemmis or Chembês, according to the readings of different manuscripts; but adds that some said that he was that king's son, by name Chabryïs. This, however, is but another form of the Egyptian name Shaf-ra.

9 Lepsius, *Denkmäler*, abth. ii., bl. 75. *Horæ Æg.*, pl. 5, p. 122.

10 *Horæ Æg.*, pp. 136 and 166.

11 *Id.*, p. 136, *et seq.*

12 *Id.*, p. 144, *et seqq.*

Egypt, and maintained itself for upwards of five centuries, being at length expelled, after a protracted struggle, which did not probably finally terminate until upwards of a century or even more after its power was broken. This period—that of the Shepherd-rule—lasting from the invasion of Egypt until the beginning of the Eighteenth Dynasty, under which the foreigners are generally held to have been ultimately forced to leave the country, was one for the most part of great suffering to the inhabitants; yet it comprehends the rule of many sovereigns, both native and foreign, of strength and wisdom; and there can be no doubt that it brought out those martial qualities which afterwards so greatly distinguished the Egyptian race.

Subjugation of Egypt.

The manner in which Egypt was subdued by the foreigners is not known for certain. Manetho states that they easily gained possession of the country without a battle. This success may have been partly owing to the undisturbed good fortune which preceded the invasion, but must have been also attributable to other causes; and it is not improbable that some one of the Egyptian kings had called in the foreigners as allies, or hired them as mercenaries, both dangerous expedients, more especially the latter, which is generally regarded as a symptom of a decaying state or a tyrannical government. Manetho relates that the Shepherds having subdued the country, burnt the cities, demolished the temples, aud treated the people with great barbarity. It is probable that this account of their conduct is somewhat exaggerated, having been coloured by the hatred which the Egyptians bore to the foreigners, and a recollection of the troubles of the great struggle which ended in their expulsion. At all events it is evident that they soon accommodated themselves to the manners of the Egyptians, adopted their religion, and endeavoured in every way to promote the welfare of the subjugated country. The race of the foreigners has been much disputed; the Egyptians

Origin of Shepherds.

called them "Shepherds" and "Hycsôs," or "Shepherd-kings," according to Manetho, who stated that "Hyk" signified "a king" and "Sôs" "a shepherd" and "shepherds;" but in another place, said that "Hyk" and "Hak" signified "captives." In hieroglyphics "Hak" is one of the names for "king," and "Huk" means a "captive;" but the second word of those composing Hycsôs, according to Manetho, is not found except in Coptic, in which language occurs the word *shωs*, "a shepherd." The most reasonable etymology seems to be "captive," that is, "foreign, shepherds;" for it should be observed that in the inscriptions foreigners are frequently called captives, and so represented on the monuments, when not actually such. In the inscriptions we find mention of "Shepherds," "Penu" (or "Phœnicians"), and "enemies" or "foreigners," the last-mentioned appellation being undoubtedly applied to Manetho's Shepherds. The Egyptian historian says that some said they were Arabs, and in his lists the kings of the first Shepherd Dynasty, the Fifteenth, are called Phœnicians. There is reason to suppose the latter statement to be true, and there is also evidence that some of the foreign race were Arabs, and certain of their kings, most probably of the Sixteenth Dynasty, appear to have been Assyrians.[1] Having said thus much respecting the establishment of the Shepherds in Egypt, we must return to the Diospolite kingdom.

Sesertesen I.

The first king of the Twelfth Dynasty was Sesertesen I., of whose long reign many records, but those chiefly of subjects, yet remain. The most interesting of the national monuments is a tablet found by Dr Ricci at Wadee Hâlfeh, in Nubia, near the Second Cataract, recording the king's triumph over foreign tribes, probably Ethiopians, and showing that at this early period the Egyptian rule had stretched thus far into Nubia.[2] For part of his reign Sesertesen I. was co-regent with Amenemha I., the last sovereign of the Eleventh Dynasty, and with Amenemha II. towards the close of his reign.

Amenemha II.

Under the latter king the first Tropical Cycle commenced B.C. 2005. Late in his reign he took as his colleague Sesertesen II.

Sesertesen II.

The next king, who probably was for part of his reign co-regent with Sesertesen II., was Sesertesen III., the Sesôstris of Manetho.

Sesertesen III., Manetho's Sesôstris.

This name of Sesôstris is applied by ancient historians to several kings. It is probably derived from Sesertesen: other derivations have indeed been proposed, but none of these is equally satisfactory.[3] We can recognise an early Sesôstris, that is, Sesertesen III., and a later one, Rameses II., of the Nineteenth Dynasty, and it is not unlikely that Sesertesen I. is also spoken of under this name. If this supposition be correct, we may distinguish the two very ancient kings as Sesôstris the conqueror, or Sesertesen I., and Sesôstris the lawgiver, or Sesertesen III. In Manetho's lists we find, after a short account of the conquests of Sesôstris, which seems inapplicable to this king's reign, that he was considered by the Egyptians as "after," or "the first after," Osiris;[4] which may be explained by concluding that he was regarded by them as the greatest of mortals, and to be honoured next to Osiris, "the youngest of the gods." In ancient sculptures in Nubia we find kings of the Eighteenth Dynasty, of the Thothmes family, worshipping Sesertesen III. as a god, and this is *the only case* of the kind. We find indeed one solitary instance of another early monarch being thus worshipped in later times, and some examples of several monarchs being worshipped together, and several cases of kings worshipping their fathers or other progenitors, but, as far as has been ascertained, no example of a king of any dynasty being frequently represented as a god, and worshipped, in sculptures of other kings not of the same dynasty. The monuments thus seem to indicate that Sesertesen III. is Manetho's Sesôstris. Sesertesen II. was apparently a king of little note, and it is improbable, notwithstanding his name, that anything ascribed to Sesôstris by those who confounded different kings under that name applies to him. During the reign of Sesertesen III. the First Phœnix Cycle commenced, B.C. 1986.

Amenemha III.

The next king was Amenemha III., of whom we are told in the lists that he built the Labyrinth in the Arsinoïte nome as a tomb for himself. His prenomen reads Ra-en-ma or ma-t, or Ma-en-ra or Ma-t-en-ra, and from it most probably originated the Mœris of the Greeks. Mœris seems, like Sesôstris, to have been a name applied to more than one sovereign; but there can be no doubt that the principal person intended by it was this king, for the Greeks ascribe to him the building or founding of the Labyrinth, and his name has been discovered by Dr Lepsius in the sculptures of the ruins of that structure or its pyramid.[5]

Amenemha IV. Ra-sebak-nufret.

After the reigns of two other sovereigns Amenemha IV. and Ra-sebak-nufret, who was, according to Manetho, as preserved by Africanus, a queen, the sister of her predecessor, the dynasty came to a close. It is probable that these two ruled with Amenemha III., as successive co-regents, perhaps towards the close of his reign. This dynasty lasted about 160 years: Africanus assigns to it, in his version of Manetho's list, exactly that duration, and the monuments and Royal Turin Papyrus afford confirmation of this sum.[6] At its termination the power of the Diospolites became greatly diminished, and did not recover until the beginning of the Eighteenth Dynasty.

Fourteenth Dynasty.

The Fourteenth Dynasty, or Xoïte kingdom, seems to have arisen with, or during, the Twelfth Dynasty. It had its seat of government at Xoïs, a town of Lower Egypt in the northern part of the ancient Delta. Seventy-six kings

---

[1] See Manetho in Cory's *Ancient Fragments*; and *Horæ Æg.*, p. 148.

[2] Rosellini, *Monumenti Storici*, No. xxv., 4.

[3] A derivation lately suggested by the Vicomte de Rougé is very ingenious, and more probable than any other except that from the name Sesertesen. See the *Athenæum Français*, 1854, No. 48, p. 1128.

[4] *Ancient Fragments*, pp. 110, 111.

[5] Lepsius, *Denkmäler*, abth. ii., bl 140.

[6] For the chronology and history of this dynasty, see *Horæ Æg.*, p. 155.

Egypt. are assigned to this line, and a duration of either 184 or 484 years. The latter sum is the more probable if the number of kings be correct. Supposing, then, that the Fourteenth Dynasty lasted for nearly five centuries, it probably terminated during the great Shepherd war, and perhaps some years before the beginning of the Eighteenth.[1]

Shepherd kings. According to Africanus, three dynasties of Shepherd kings ruled in Egypt, the Fifteenth, Sixteenth, and Seventeenth. Eusebius, however, makes but one of these dynasties, the Seventeenth, to have been of the foreign invaders, while he assigns to it kings who are of the Fifteenth in Africanus's list. According to Josephus, the Shepherds ruled 511 years, until the great war commenced which terminated in their expulsion from Egypt. The monuments, as well as internal evidence, are in favour of Africanus's version instead of that of Eusebius, and it is therefore generally preferred. Admitting, then, that there were three Shepherd dynasties, we must next inquire what was the period of their rule. In the list of Africanus the sum of the three is 953 years, which, if correct, would prove that they could not have been successive. That it is correct is most probable, and that the Fifteenth Dynasty was contemporary with the earlier portion of the Sixteenth, and the Seventeenth with the later portion of the same dynasty, the Seventeenth Dynasty being, however, separated from the Fifteenth by a Memphite dynasty or dynasties.[2]

Fifteenth Dynasty. Salatis. The Shepherd kings of the Fifteenth Dynasty were the greatest of the foreign rulers. The first of these, Salatis or Saïtês, was made king, according to Manetho, after the conquest of the country (*cir.* B.C. 2080). "He lived at Memphis, making the Upper and Lower Country to pay tribute, and placing garrisons in the most fit situations." Of these the greatest was Avaris, an old city, to the east of the Pelusiac Branch, which he rebuilt and fortified strongly, placing in it an enormous garrison.[3] His object was to defend the frontier against the Assyrians, who, Manetho tells us, he foresaw would have a desire to invade his kingdom. Salatis died after an active reign of nineteen years.[4] In the lists he and his successors are called Phœnicians, and it is very probable that they were of that race. His nomen is not found in the hieroglyphic inscriptions, but his prenomen occurs both on a contemporary monument and in the Royal Turin Papyrus.[5]

Pi-ankhee, or Bêôn. The successor of Salatis was Bêôn, in the hieroglyphics Pi-ankhee, and he was followed by Apachnas, whose nomen is found only in the Royal Turin Papyrus, and is of doubtful reading. The next king was Iannas, called on the monuments A-an, to whom succeeded Assis, whose hieroglyphic name is Assa. There are several tombs of the time of this king in the necropolis of Memphis, from the sculptures and inscriptions of which we obtain great insight into the state of the Shepherd kingdom under his rule.[6] In the sculptures we see the same evidences of the prosperity and wealth of the subjects as in those of the period of the Fourth Dynasty. The foreigners appear to have adopted the Egyptian dress and manners so completely that we do not find a single foreign name. In one tomb the inscriptions show that the Shepherd kings of this dynasty held Leontopolis or the Leontopolite nome in the eastern part of the ancient Delta, which shows that their dominion must have been extensive.[7] Most probably Assa was the Pharaoh of whom Joseph was the prime-minister, the patriarch receiving that appointment towards the close of his reign, and continuing to hold it in the next reign. The reasons for this opinion will be given a little later. Of the last king of the Fifteenth Dynasty, the successor of Assa, the monuments tell us nothing, and it is not even certain that his name has been found in hieroglyphics or hieratic. In Manetho's lists he is called Aphôbis or Apôphis. With him the greatest Shepherd Dynasty came to a close, and Memphis was again the seat of native kings. If Dr Brugsch's view be correct, Apôphis reigned just before the Eighteenth Dynasty, no doubt after the Shepherds had lost Memphis.[8]

A-an, or Iannas. Assa, or Assis.

Thirteenth Dynasty. After the end of the Twelfth Dynasty, about B.C. 1920, the Diospolite kingdom was ruled by the Thirteenth, which lasted about 400 years, until the commencement of the Eighteenth Dynasty. The kings seem to have been of little power, for the most part, and probably tributary to the Shepherds. They possessed, however, a considerable tract south of Egypt; and this may be supposed to have been an asylum for them during the troublous period of their rule. All the names of these kings have not been found, and those which are known are chiefly prenomens, and not nomens; many of the latter appear to have been Sebak-hotp and Nufre-hotp.[9] The Fourteenth Dynasty, or Xoïte Kingdom, has been already noticed.

Eighth Dynasty. The Eighth Dynasty, of Memphites, succeeded the Fifteenth, and ruled, according to Africanus's version of Manetho's List, nearly a century and a half. It is not certain whether the Seventh Dynasty, likewise of Memphites, to which the same version assigns a duration of only 70 days, intervened between the Sixth and Fifteenth Dynasties, or the Fifteenth and Eighth.[10] The native successors of the Shepherds at Memphis seem to have been princes of little power and contracted dominions. The Shepherds of the Sixteenth Dynasty appear to have succeeded to the political position of those of the Fifteenth. It is very remarkable that in the Royal Turin Papyrus among kings who must be assigned to this dynasty or the Seventeenth are certain who appear to be Assyrians, and one of these is probably a Pharaoh who oppressed Israel, the predecessor of him who was drowned in the Red Sea. Indeed there are strong grounds for supposing that this dynasty was composed of kings of a different race or races to those of the Fifteenth, and bitterly opposed to them; and that when the rule of the latter came to a close they seized their possessions in the eastern part of the Delta, and persecuted the Israelites who had been favoured by the earlier sovereigns. Of the Seventeenth Dynasty nothing is known, except that its kings were Shepherds. Africanus's version indeed makes them to have been co-regent Diospolites and Shepherds, but this is generally held to be a mistake.[11]

Seventh Dynasty.

Sixteenth Dynasty.

Seventeenth Dynasty.

Shepherd war. From the time of Assa to the commencement of the Eighteenth Dynasty, a period of about three centuries and a half, scarcely any monuments have been discovered, and this indicates that Egypt was then in a weak and distracted condition,[12] and agrees with the statement of Manetho, that after the Shepherds had ruled Egypt for 511 years, the kings of the Thebaïs and of the rest of Egypt made an insurrection against them, and a great and long war raged between them.[13] The kings here meant must have been a Diospolite of the Thirteenth Dynasty, probably with a Heracleopolite of the Tenth, and a Xoïte of the Fourteenth. The great war thus commenced had resulted at the beginning of the Eighteenth Dynasty in the restoration to Egyptian

[1] *Horæ Æg.*, p. 181.
[2] For the chronology of the Shepherd Dynasties, see *Horæ Æg.*, p. 163.
[3] See a paper by Dr Brugsch, *Zeitschrift der Deutschen morgenländischen Gesellschaft*, 9 band, i. & ii. heft, p. 200 *et seqq.*
[4] *Ancient Fragments*, p. 170, and preceding page. The extraordinarily careless pagination of the second edition of this work renders reference to a particular page sometimes impossible.
[5] *Horæ Æg.*, pl. vii., p. 166.
[6] Lepsius, *Denkmäler*, abth. ii., bl. 60 *et seqq.*
[7] *Horæ Æg.*, pl. vii., pp. 176–7.
[8] *Zeitschrift der Deutschen morgenländischen Gesellschaft*, *loc. cit.*
[9] *Horæ Æg.*, p. 179.
[10] *Id.*, p. 168. Most probably the Seventh Dynasty followed the Fifteenth.
[11] *Id.*, p. 165.
[12] In Lepsius's *Denkmäler* only three plates (abth. ii., bl. 149–151) are assigned to the monuments of the Thirteenth Dynasty, and of these many are ascribed by others to an earlier period.
[13] *Ancient Fragments*, p. 171.

Egypt.

rule of nearly all Lower Egypt; and the other lines having then come to an end, the whole power was centred in the Theban monarchy. It was, however, probably more than a century before the foreigners were finally expelled.

Connection of the Israelites and Greeks with Egypt.

Before noticing the history of the Eighteenth Dynasty, it is necessary to mention briefly the connection between the Israelites and the Egyptians, and between the Greeks and the Egyptians. The sojourn and exodus of the Israelites have been variously assigned to the time of the Dynasties preceding the Eighteenth, and to that or the following Dynasty; and this is, therefore, the proper place in which to notice some of the grounds on which these different opinions rest. Certain of the Greek traditions point to the Shepherd-period, if there be any truth in their approximative chronology; and these, therefore, likewise here demand a brief consideration.

Date of Exodus.

A wide difference has prevailed among critics respecting the date of the Exodus, and the length of time for which the Hebrews sojourned in Egypt before that event. Some, rejecting all the numbers mentioned in the Bible by which the time of the Exodus has been usually computed, take the genealogies as their guides, and calculate that event to have occurred about 1300 B.C.; others, following Archbishop Ussher, place it B.C. 1491; and others, agreeing with Dr Hales, carry it back to the middle of the seventeenth century. The last view, which is in accordance with the opinions of several of the early Christian chronologers, is supported by evidence not easily shaken, which may be thus stated:—1. The numbers of years occurring in the Book of Judges added together, and St Paul's statement that the Israelites were ruled by judges for "about the space of four hundred and fifty years, until Samuel the prophet,"[1] would carry up the date of the Exodus to about B.C. 1650. The mention in Jephtha's message to the king of the Ammonites that Israel had already dwelt 300 years in the trans-Jordanite possessions,[2] is agreeable with this date of the Exodus and with Ussher's, but not with that of about B.C. 1300. Against the date of about B.C. 1650 may, however, be urged the statement in the first Book of Kings,[3] that the temple was commenced by Solomon in the 480th year after the Exodus, which is the basis of Ussher's computation; but this number is given differently in the Septuagint version as 440 years, and it cannot be reconciled with the period mentioned by St Paul, nor, except by an arbitrary arrangement, with the numbers given in the Book of Judges. 2. A comparison between the Hebrew calendar and the Egyptain leads to the same results as do the data mentioned under the previous head. The ancient Hebrew civil year commenced about the time of the autumnal equinox; and we find that at the approximative date of the Exodus obtained from the numbers given in the Book of Judges, the Egyptian Vague Year commenced at or about that period. This approximative date, therefore, falls about the time at which the Egyptian Vague Year and the civil year of the Hebrews nearly or exactly coincided in their commencements. It may be supposed that the Israelites had made use of the Egyptian Vague Year, which, indeed, is rendered not unlikely by the circumstance that they had for the most part adopted the Egyptian religion,[4] the ceremonies of which were regulated by the months of that year. The ordinances of the Law, however, made it necessary that the Israelites should use a year virtually solar, and such a year was at the time of the Exodus either restored or instituted. But the inquiry may be carried farther; for, if the Egyptian and Hebrew months corresponded, the fourteenth day of Abib, on which fell the full moon of the Passover of the Exodus, corresponded to the fourteenth day of Phamenoth. Now, a full moon fell on the fourteenth day of Phamenoth, or Thursday, April the 21st, in the year B.C. 1652. A full moon would not fall on the same day of the Vague Year at a shorter interval than 25 years before or after B.C. 1652; and the triple coincidence of the occurrence of a full moon on a certain day of the Vague Year, with reference to the autumnal equinox, could not recur in less than 1500 Vague Years. 3. There are certain indications which would induce us to place the commencement of the first sabbatical period in the year B.C. 1605, and since the Exodus took place 47 years previously, to date the latter event B.C. 1652. The inquiry which leads to this result is very intricate, and the result cannot be regarded as more than hypothetical; yet it should be remembered that it is founded on evidence totally distinct from that adduced under the preceding heads. 4. To the Israelites in the desert a command was given "that they make them fringes to the borders of their garments throughout their generations, and that they put upon the fringe of the borders a ribband of blue,"[5] as a memorial of the covenant.[6] In an Egyptian battle-scene representing, in the great temple of Aboo-Simbel, the capture by Rameses II. of a stronghold in or near Palestine, probably that called in the hieroglyphics Ketesh, which corresponds to the Ashteroth-Karnaim mentioned in the Bible, a peasant is pourtrayed driving away some cattle. His dress has a blue stripe resembling a ribband near its border, and a blue fringe, and his physiognomy is not unlike that of the Jews.[7] This seems to afford strong evidence that Rameses II. reigned subsequently to the Exodus. The date of the campaign to which this sculpture relates may be placed about B.C. 1300, or not more than a few years later at the utmost. The Exodus, therefore, on this ground, appears to have taken place in or before the year B.C. 1340, and certainly prior to the reign of Rameses II. This result would show that those who hold the latest date of the Exodus—that deduced from the genealogies—are wrong in assigning the event to the reign of Men-ptah, the successor of Rameses II.; and it is in opposition to their best argument that the city Raamses or Rameses, built or fortified during the oppression,[8] was named after Rameses I., or his grandson Rameses II., since the oppression would probably have ended before the accession of the former king. The weight of evidence, therefore, is in favour of the earliest of the dates mentioned above, that of B.C. 1652. Respecting the duration of the sojourn of the Israelites in Egypt, the sum of 215 years seems, on the whole, far preferable to 430; but there is not space here for the discussion of the question. Admitting then that Joseph's government probably began B.C. 1876, that Jacob came into Egypt B.C. 1867, and that the Exodus took place in the year B.C. 1652, these data may be applied to Egyptian history with a view to test their accuracy.

Joseph governor of Egypt.

Granting these premises, Joseph became governor of Egypt towards the close of the reign of Assa or Assis, the fifth king of the Fifteenth Dynasty and this Shepherd king would well correspond to the Pharaoh mentioned in the Bible, as the most powerful sovereign not of those of the Lower Country only but of all Egypt. Various passages in the Bible-narrative seem to confirm this view, which is most agreeable with the testimony of the monuments; for an Egyptianized foreigner would be far more ready to favour the strangers than would a native Egyptian. The Fifteenth Dynasty was followed, after perhaps the seventy days' rule of the Seventh, by the Memphite line of the Eighth Dynasty, about the time of Joseph's death. The kings of the Eighth Dynasty seem, however, to have been of little strength, and it appears that the Shepherds of the Sixteenth Dynasty succeeded to much of the power of the rulers of the Fifteenth. We cannot suppose the new

---

1 Acts xiii. 20.
2 Judges xi. 26.
3 1 Kings vi. 1.
4 Josh. xxiv. 14; Ezek. xx. 7, 8.
5 Numbers xv. 38.
6 *Id.*, 39–41.
7 Rosellini, *Monumenti Storici*, No. lxxx.
8 Exod. i. 11.

Egypt.

Oppression of the Israelites.

king, which knew not Joseph, and the other oppressors of the Israelites, to have been of the Eighth Dynasty, for this was a line of Memphite kings, and it is said in the Bible, "My people went down aforetime into Egypt to sojourn there; and the Assyrian oppressed them without cause:"[1] from which we must infer that at least one of the Pharaohs of the oppression was an Assyrian. Now, in the list of kings called the Royal Turin Papyrus, among the names of a dynasty of foreigners, which could not have been the Fifteenth, and was therefore either the Sixteenth or Seventeenth, occur those of Assyrian kings.[2] One of these, who bears the name of Uben-ra (a name likewise borne by two other kings of the same period, as well as found on one of the Nemrood ivories in the British Museum, and likewise taken as a foreign title, in the feminine Ubent, by the Semiramis who ruled in Egypt[3]), appears to have reigned forty years (the number is imperfect, but is probably forty), while to his successor is assigned a reign of but one year. And the Bible-narrative seems to indicate that the Pharaoh from whom Moses fled to Midian reigned at least forty years, while it is quite clear that his successor, who was drowned in the Red Sea, must have reigned about a year, somewhat more or less. These circumstances seem to confirm the early date of the Exodus, no less than others. Among the latter may be particularized the subsequent policy of the Egyptians and Assyrians towards the Israelites, and the friendship of the Israelites and the Egyptians in after times, as well as the many difficulties in accepting the later dates which arise from the absence of any mention of the sojourn and Exodus on monuments supposed to be contemporary.[4] The friendship of the native Egyptian and Ethiopian kings, without any known exception, for Shishak and his family were partly, at least, of Assyrian or Babylonian origin, and the constant enmity with which the Israelites were regarded by the Assyrians and Babylonians, are satisfactorily explained by our finding that the Assyrians oppressed both the Israelites and the Egyptians in Egypt. For it is evident that the Shepherd kings of the period which followed the Fifteenth Dynasty, or, at least, those after Assa, were those whose memory was so hateful to the Egyptians. It must also be borne in mind that many of the Shepherds must have been Egyptianized; like Moses, whom the daughters of the priest (or prince) of Midian thought to be an Egyptian; and that they were evidently so mixed up with the Egyptians of Lower Egypt as to be, under Shepherd rule, almost one people; and thus one can understand their being generally, though not always, mentioned as Egyptians, or not as distinct from them, in the Bible. Probably the Egyptians joined with the oppressors of the Israelites sometimes without being forced to do so, for they were included in the same punishment; yet their conduct towards them in after times, and the remarkable command in the law, "Thou shalt not abhor an Egyptian, because thou wast a stranger in his land," to which it is added that their children, like those of Edomites, should enter into the congregation of the Lord in their third generation,[5] whereas Amalekites could never be admitted, both tend to show convincingly that the Egyptians had in many instances treated the Israelites with kindness while they sojourned in their land; and the punishment which partly fell upon them may have been in their case rather for idolatry and vice than for oppression. The inference thus drawn from the passage in the Book of Deuteronomy is strengthened by an examination of what precedes it; for there are three other nations only mentioned, the Moabites, Ammonites, and Edomites, of which the last were admitted to the same privilege as the Egyptians, though the other two were excluded. The reason of their exclusion is alone mentioned: it was their inhospitality to the Israelites when they came out of Egypt, whereas the Edomites, we know, treated them hospitably. In reviewing the subsequent history of Egypt, we cannot fail to be struck with the constant amicable feeling which subsisted between the Israelites and the Egyptians. The capture of Gezer, a Canaanite town, by one of the Pharaohs, without opposition on the part of Solomon, and the giving of that city to his daughter, Solomon's Egyptian queen, and that marriage itself, show what a friendly alliance existed in those days. And in later times, though we may think that the policy of Tirhakah and Apries was dictated by a regard to their own interests, Neco appears to have been unwilling to add the rich kingdom of Judah to his dominions, when Josiah disputed his passage to the Euphrates. The conduct of Shishak was far different, but he was, as already remarked, of a line partly at least of Assyrian or Babylonian origin, and his policy was that of an Assyrian or Babylonian prince. These matters have been dwelt upon in some detail, but their importance, as tending to establish a synchronism between Hebrew and Egyptian history, make it impossible to pass them by without something more than a mere notice.

Policy towards the Israelites.

Civilization of Greece from Egypt.

The traditionary accounts of the civilization of Greece by colonists from Egypt are so obscure, and so interwoven with undoubted mythological relations, that some have rejected them as either false or doubtful. Yet it is hard to believe that the traditions of any nation respecting their ancestors are altogether unworthy of reliance; and our wisest plan is to endeavour, by a comparison of the monumental data in Greece and Egypt, first to ascertain whether there is any truth in these traditions, and then to separate that truth from the error which surrounds it. Greek art affords evident traces of Egyptian influence, if not rather of an Egyptian origin; a column resembling the Doric being found in the rock tombs of Benee-Hasan, which were excavated about the time of Abraham. The earliest Greek pottery affords still stronger evidence in bearing patterns and devices of an unmistakable Egyptian origin, and especially one which is imitative of a well-known hieroglyphic group. This shows that the two countries must have been connected at least as early as the time of Homer, and probably as far back as the date to which the taking of Troy is usually assigned. Then, again, we find on an Egyptian monument of about B.C. 1200 a sea-fight represented between Cretans and Carians on the one side and Egyptians on the other, a circumstance which confirms the Greek tradition that the Cretans held the empire of the sea in ancient times, and lost it not long before the siege of Troy, likewise indicating in what manner their maritime power was broken. This case warns us not to disregard even earlier traditions, especially as they also are very consistent with the history of Egypt at the period to which they relate, and were received by the learned Greeks and Egyptians of subsequent times. We may admit that many colonists went from Egypt to Greece during the Shepherd rule, carrying arts and sciences to the rude inhabitants of Hellas. These emigrations commenced at least as early as the middle of the nineteenth century before our era, and continued as late as the close of the sixteenth, if, as we may suppose, there be any truth in the approximative chronology of the traditions. The kings of the Fifteenth Dynasty are said to have been Phœnicians, and many of their people seem to have been of the same race: thus we see wherefore certain of the colonists are made both Phœnician and Egyptian, for, as evidently in the Bible, Shepherds are often called Egyptians. Towards the close of the Fifteenth Dynasty many of the Shepherds would seem to have sought a home in Greece; and when the great war had commenced these emigrations appear to have become more frequent, until after the time when the foreigners were finally expelled Egypt, when notice of them ceases.

War of the Egyptians with the Cretans and Carians.

Colonization of Greece from Egypt.

1 Is. lii. 4.
2 Wilkinson's edition.
3 This name occurs on a scarabæus in the possession of Sir G. Wilkinson.
4 See a review of Lepsius's *Letters* in the *Journal of Sacred Literature*, July, 1854.
5 Deut. xxiii. 7, 8.

Egypt.

The history of the Shepherds in Egypt, and the traditions of the colonization of Greece, agree so well that the only difficulty to one's mind is to understand how so much truth can have been preserved amidst the myths and exaggerations of the ancient Greeks. Thus much may be safely affirmed, but the details of the traditions must be regarded with great caution, lest by hastily accepting them, as did most critics until lately, the truths with which they are interwoven should appear perplexed and doubtful, and historical scepticism take the place of justifiable circumspection.

Eighteenth Dynasty.

With the Eighteenth Dynasty, about B.C. 1525, a new period of Egyptian history commences, new in the abundance of materials for its reconstruction, and in the greatness of the monarchy whose fortunes it relates. The sources of information are no one connected history, but numerous inscriptions, sculptures, and papyri, whence we can gather many of the remarkable events by which this and the succeeding dynasty were distinguished.

Aah-mes.

The first king of the Eighteenth Dynasty was Aah-mes, whom Manetho called Amôs or Amôsis. No great monuments of his reign remain, but from various inscriptions we must infer that he was a powerful king, and that in his time the Shepherds had quitted the greater part of Egypt. Two records of especial interest may be particularized. One is a long inscription in the tomb at Eilethyas of one Aah-mes, chief of the mariners, who served several of the early kings of the Eighteenth Dynasty, having commenced his career under King Aah-mes. The inscription speaks of war at sea, or on the river, mentions the famous Shepherd-city Avaris, and relates that the king made in his sixth year an expedition by water to Ethiopia to impose tribute.[1] The other record is a tablet at the quarries of El-Ma'sarah, a little above Cairo, on the east bank of the river, opposite Memphis, which relates that in the twenty-second year of his reign Aah-mes cut stone for the temple of Ptah, most probably at Memphis, and for that of Amen at Thebes. These inscriptions show that Aah-mes must have ruled nearly all Egypt, and thus explain why some (as it appears, but it is a disputed point) supposed him to have finally expelled the Shepherds.

Amenoph I.

Amenoph I., the successor of Aah-mes, was at least as potent a king, and the memorials of his reign are more numerous. They are chiefly found in the representations or paintings of the tombs of his subjects; but chambers in the more ancient portion of the great temple of Amen-ra, now called that of El-Karnak, at Thebes, show that he did not neglect public edifices.[2] He was evidently successful in wars against the Ethiopians as well as against Asiatics.

Thothmes I.

To him succeeded Thothmes I., in whose reign the arms of Egypt were carried into Mesopotamia, for one of his officers has left an inscription recording that he brought booty thence.[3] The same king warred in Ethiopia also.[4] In the great temple at Thebes he made additions, and, in particular, set up there two obelisks of red granite, of which one yet stands.[5]

Thothmes II.

Under the next sovereign, Thothmes II., the prosperity of Egypt continued, and the extent of his kingdom is proved by his name being found as far south as Napata (Gebel Berkel), in Ethiopia.[6]

Amen-numt, a Semiramis.

With him was associated in the government a Queen Amen-numt, who appears to have possessed much greater power than he, if not to have ruled solely while he was but nominally a king. For at least 16 years, that is, for the whole of the reign of Thothmes II. and the first 3 or 4 years of that of Thothmes III., this queen continued to govern, and left many beautiful monuments to attest her magnificence and power, chiefest of which are the lofty obelisks of the temple of Amen-ra at Thebes, one of which is still standing,[7] while the other is fallen and broken in pieces. Queen Amen-numt is called the daughter of Thothmes I., and the sister of Thothmes III., and therefore of Thothmes II. also; but she appears to have been a foreigner, and if so, only related to the Egyptian royal family by marriage, unless her mother was likewise a foreigner, and a wife of Thothmes I. Several circumstances seem to show that she was a Semiramis, for one cannot say Semiramis simply, since more than one sovereign appears to have been intended by the name, as in the case of Sesôstris. The strongest reasons in favour of this opinion are founded on the circumstance that Queen Amen-numt is constantly represented in the sculptures as wearing male attire, that she receives in one instance what we may almost conclude to be an Assyrian title "Ubent" as her appellation "in the foreign land," and that her name was afterwards effaced from the monuments; particulars which are strikingly in accordance with the statement that the Assyrian Queen Semiramis, who dressed as a man, subdued Egypt. It may be added that the time of Amen-numt is not far anterior to the approximative date of a Semiramis obtained from the fragments of Berossus.[8]

Thothmes III.

Thothmes III. appears soon to have emancipated himself from the control of Queen Amen-numt. His reign was marked by many successful expeditions conducted by him in person, in one of which he penetrated as far as Nineveh, though it is not said whether he besieged that city or not.[9] If Manetho be accurate, the most important military event must, however, have been his successful war with the Shepherds, who, according to that historian, were driven by him out of all Egypt excepting the stronghold of Avaris on the frontier.[10] Many monuments, especially at Thebes, remain to prove the greatness of this king and the wealth of his subjects. The tombs of private persons are not the least interesting of these memorials, and afford, in the representations which adorn their walls, very beautiful specimens of ancient Egyptian painting. Indeed, the reign of Thothmes III., with that of Thothmes II. preceding it, and those of Amenoph II., Thothmes IV., and Amenoph III. following it, may be considered as comprising the best period of art, all the earlier time showing a gradual improvement, and all the later a gradual declension. We do not, however, trace a very marked falling away until the power of Egypt had begun to decline, full two centuries later than the end of Thothmes III.'s reign.

Amenoph II.

Of Amenoph II., the son and successor of Thothmes III., little is known, and we can scarcely err in supposing his reign to have been short and unmarked by very important events.

Thothmes IV.

Departure of Shepherds.

In the reign of Amenoph's son Thothmes IV., occurred, according to Manetho, the departure of the Shepherds from their last possession in Egypt.[11] The Egyptian historian relates that having unsuccessfully beleaguered Avaris, the stronghold of the foreigners, Thothmes agreed to terms, and the Shepherds were permitted to leave the country unmolested with their families and effects. The monuments have not been found to allude to this event, and they tell us little of this reign, but that little shows that, short as it evidently was, it was marked by prosperity and success.

Amenoph III.

Thothmes IV. was succeeded by his son Amenoph III., one of the most illustrious kings of the best period of Egyptian history. In his time we find a distinct record of the extent of the kingdom, which is stated to have had Nehereena (Mesopotamia) as its northern boundary, and Keruee or Keluee (probably Coloe) as its southern.[12] Although it does not distinctly appear whether these are to be understood as the outermost provinces or as the lands bounding those provinces, and although the southern boundary cannot be

---

1 Champollion, *Lettres*, pp. 197, 198, and *De Rougé Tombeau d'Ahmès*.
2 *Modern Egypt and Thebes*, vol. ii., p. 250.
3 Lepsius, *Auswahl*. taf. xiv. A.
4 Lepsius, *Id.*, *loc. cit.*
5 Rosellini, *Monumenti Storici*, No. xxx.
6 Lepsius, *Denkmäler*, bl.
7 Rosellini, *Monumenti Storici*, Nos. xxxi. to xxxiv.
8 *Horæ Æg.*, pp. 198, 199.
9 *Transactions of the Royal Society of Literature*.
10 *Ancient Fragments*, pp. 171, 172.
11 *Id.*, pp. 172, 173.
12 Rosellini, *Monumenti Storici*, No. xliv., l.

Egypt.

positively ascertained, yet we can gain some idea of the power of Egypt from the inscription. Syria, west of Euphrates, obeyed Amenoph III., and a very great part of Ethiopia; and that the latter was the case is proved by monuments and their inscriptions in that country, and records of his successes in the inscriptions of Egypt. It is remarkable that he seems from his physiognomy to have been partly of Ethiopian origin. His long reign of nearly forty years, at the least, was marked by the construction of magnificent temples. Of these the greatest were two at Thebes; one on the west bank, of which scarce anything remains but the two great colossi which stood on each side of the approach to it, and one of which is famous as the Vocal Memnon. On the opposite bank he likewise built the great temple now called that of El-Uksur, which Rameses II. afterwards greatly increased in size. It is almost needless to remark that the identification of this king with Memnon by the Greeks, apart from the circumstance that other Pharaohs were so called by them, is of no historical value. The tomb of Amenoph III. yet remains at Thebes in the Western Valley near that of the tombs of the kings.

Rule of Sun-worshippers.

After the reign of Amenoph III., the tranquillity of Egypt was disturbed by the rule of the chiefs of stranger settlers, foreign princes, who were allied to the Egyptian royal family. Whatever may have been their title, it is evident that the Egyptians regarded them as usurpers, and that they were unable to maintain themselves but by a rigorous military despotism. Their monuments have been found in all parts of Egypt, but much defaced or entirely ruined by the enmity of the Egyptians. We learn, however, that they abandoned the Egyptian religion, and set up in its place sun-worship; that they built a city in Middle Egypt, near the modern village of Tel-el-'Amarineh; and raised temples at Thebes and elsewhere. Manetho appears to have noticed their rule, for Eusebius, in the second part of his chronicle, mentions that during the reign of Amenophis (Amenoph III.) "the Ethiopians, migrating from the river Indus, came and dwelt near to Egypt;" and in the catalogue of kings of Egypt by an anonymous author, given by Syncellus, we find the following passage immediately before the mention of Oros, Amenoph's son and legitimate successor:—"The Ethiopians, coming from the river Indus, settled near to Egypt." It is highly probable that this statement was originally derived from Manetho, though evidently altered by misapprehension. Our finding that Egypt and Ethiopia were under the power of foreign chiefs at about the time indicated does not permit us to doubt that the statement was founded on fact. These sun-worshippers appear therefore to have belonged to the race which may be called that of the Eastern Ethiopians, a people who, in the time of the Greek geographers, dwelt between Persia and the Indus, and whom Herodotus describes as lank-haired to distinguish them from the Ethiopians of Africa.[1] Bunsen and Lepsius suppose their rulers to have been heretical Egyptian princes, but it is plain that both chiefs and people were of a race far different from that of the Egyptians, although their chiefs were allied with the Egyptian royal family. Sir Gardner Wilkinson, not without strong reason, assigns Amenoph III. to this foreign race; but if he be right in this opinion we may notwithstanding date the commencement of their rule from the end of his reign, as then began that change of the state religion which was the great peculiarity of the foreign domination. Several kings of this race ruled after Amenoph III., of whom the most important was Amenoph IV., or Bekh-en-atenra. They have not as yet been classed in order, although much has been done towards effecting this desirable object by Sir Gardner Wilkinson and also by M. Prisse. The duration of their power probably did not much exceed thirty years. The religion of these foreigners is a matter of great interest, as it presents us with a very ancient example of pure sun-worship. The sun is represented as adored by them under the form of a disk whence issue numerous rays, each terminating in a human hand, one of which presents to the worshipper the symbol of life. It appears that they adored one god, whom they supposed to be resident in the sun, and operating through its rays; and that they worshipped this god through the medium of the sun and its rays. These particulars may be compared with the "Chaldean Oracles of Zoroaster," as given by Cory in his *Ancient Fragments*.[2] Although many of these "Oracles" must be of late origin, and others must have suffered by translation into Greek, they certainly contain many principles of the old religion of Zoroaster, and it is not therefore surprising that we should find in them remarkable agreements with the records of the sun-worshippers. The following couplet reads like a description of the representation of the sun worshipped by the foreigners as described above:

Their religion.

"It becomes thee to hasten to the light and *rays* of the Father,
From whence was sent to thee a *soul*, endued with much mind."

Χρὴ σε σπεύδειν πρὸς τὸ φάος καὶ πατρὸς αὐγὰς
Ενθεν ἐπέμφθη σοι ψυχὴ, πολὺν ἑσσαμένη νοῦν.[3]

Har-em-heb.

Precisely how and when the sun-worshippers were expelled from Egypt or destroyed, does not appear; though it can scarcely be doubted that Oros, the Har-em-heb of the monuments, who succeeded them, was the prince by whom they were overthrown.[4] Har-em-heb was a son of Amenoph III., and with him was continued the legitimate line of Diospolite sovereigns. The records of his reign are comparatively unimportant; and if Manetho be right in assigning to him a rule of between 36 and 37 years, as the best readings inform us, it must be supposed that for the greater part of this period he did not rule, or governed but a portion of the country, but that, counting from the close of his father's reign, he included the time that the sun-worshippers held the supreme or chief power during his own nominal or contemporaneous reign. The sculptures of a rock temple at Silsilis, Gebel-es-Silsileh, commemorate a successful expedition against the negroes.[5]

Rameses I. Nineteenth Dynasty. Sethee I.

Oros was succeeded by Rameses I., of whose very short reign no important details have reached us. After him his son, Sethee I., one of the greatest of the Pharaohs, ascended the throne. The exact duration of his reign, which must have been long, is uncertain, and probably for part of it he ruled jointly with his son Rameses II. His accession may be placed about B.C. 1340, which is therefore the approximative date of the commencement of the Nineteenth Dynasty; for Manetho makes him head of that line, a position which should rather, one would think, have been assigned to his father Rameses I. The most important architectural work of his reign yet remaining is the magnificent hypostyle hall in the great temple of El-Karnak, on the outside of the north wall of which is a highly interesting series of sculptures representing the great achievements of his arms.[6] His tomb, which is generally known as "Belzoni's," from its discoverer, is the most beautiful of those in the valley of the tombs of the kings; and its size shows that his reign must have been a long one, for it is well known that the sepulchre of an Egyptian king was usually commenced at or not long after his accession, and thus indicated the duration of his reign. The most important of the military exploits of Sethee I. appears to have been the conquest of the Kheta or Hittites, and the capture of their great stronghold Ketesh, or Ashteroth-Karnaim. It should also be noticed

[1] Herod. vii., 70.
[2] *Ancient Fragments*, p. 239, *et seqq.*
[3] *Id.*, p. 272.
[4] For the history and religion of the sun-worshippers, see Sir Gardner Wilkinson's *Modern Egypt and Thebes*, ii., 71, &c.; *Ancient Egyptians*, pl. 30; Lepsius, *Denkmäler*, abth. iii., bl. 91, *et seqq.*
[5] Rosellini, *Monumenti Storici*, No. xliv. *bis*, *et seqq.*
[6] *Id.*, No. xlvi., *et seqq.*

that he expelled certain foreigners of the race of the "Shasu" from the city of the Lion, or Leontopolis, near the eastern frontier of Lower Egypt.[1]

Rameses II.

Rameses II., who succeeded his father, Sethee I., probably after having ruled jointly with him for some time, was the most illustrious of the ancient kings of Egypt. It is he who is generally intended by the Sesôstris of the Greek and Roman writers. His reign lasted, according to Manetho, if we follow what seem the best readings, a little above sixty-six years, and was marked by great success in war and by the construction of magnificent edifices. Among the latter may be mentioned at Thebes the great temple, commonly called the Memnonium, but more appropriately the Rameseum of El-Kurneh, on the western bank, one of the most beautiful of Egyptian monuments, and a great part of the temple of El-Ūksur on the opposite bank, as well as additions to that of El-Karnak. Throughout Egypt and Nubia are similar memorials of the power of Rameses II., one of the most remarkable of which is the great rock temple of Aboo Simbel, not far north of the Second Cataract. The temple of Ptah at Memphis was also adorned and enlarged by this Pharaoh, and its site is chiefly marked by a very beautiful colossal statue of him, fallen on its face, and partly mutilated. The numerous monuments of Rameses II. and a hieratic papyrus[2] commemorate the successful wars in which he was engaged.[3] The most important of these was waged against the Hittites, called by the Egyptians the Kheta, and their allies, and was decided late in the fifth year of the king's reign. A powerful confederacy had been formed by the Hittites, the Khilibu, or people of Aleppo, the people of Karkamish, or Carchemish, and other tribes, some of which had been tributary to the crown of Egypt, and a great army collected to support their avowal of independence. The strongest of the confederates were the Kheta led by several chiefs. The king of Egypt marched against them, and the contending armies met in the plain of Ketesh, or Ashteroth-Karnaim, a strong city which formed the basis of the confederates' operations. The generals of the latter had made a skilful disposition of their forces. Having drawn up their infantry in a large and deep phalanx before Ashteroth-Karnaim, and behind the moat which surrounded that city, they posted their chariots on the other side of the moat. The chariot force had an open plain in which to manœuvre, while the infantry, placed on rising and wooded country, and protected by the moat, was ready to support the retreat of the rest of the army, or follow up its advance. The Egyptian chariots, led by the king and four of his sons, met and broke the charge of the Hittites; and notwithstanding that their infantry, having crossed the fosse by a bridge, endeavoured to maintain the day, they were put to the rout, and many of those who escaped the arrows of the chariot force and the swords of the infantry were drowned in attempting to recross the moat. Negotiations were in consequence commenced, which resulted in a treaty favourable to the king of Egypt. The war appears to have broken out again some years afterwards, for we find in an inscription of the temple of El-Karnak the record of peace having been concluded with certain chiefs of the Kheta, in the twenty-first year of the reign of Rameses II. The foreigners were compelled to pay tribute by this treaty, whence they must be supposed to have been previously worsted. Many other nations were subdued by Rameses II., but his chief exploit was the overthrow of the confederates. His great expeditions seem almost all to have been conducted in the earlier part of his reign, and its later portion appears to have been chiefly spent in advancing the welfare of the country by a promotion of the arts of peace.

War with the Hittites.

Menptah.

Menptah, the thirteenth legitimate son of Rameses II.,[4] reigned in his father's stead. Of his rule the records are few and of little importance; and a story is told by Manetho, who does not vouch for its accuracy, that then great troubles befel Egypt. He relates that, according to this account, the foreigners and unclean people who were in the country, having been sent to work in the quarries by order of the king, revolted, and, in alliance with a force of Shepherds of the race of those who had been previously expelled, called in by them from Palestine, effected the subjugation of Egypt, which they held for thirteen years, while the king was a fugitive in Ethiopia; and that at the end of that time he returned with Sethos his son, and drove them out with great slaughter. The leader of the rebels is said to have been Moses, and the people the Jews, but neither the time nor the circumstances are favourable to this view, which, nevertheless, is that of some eminent modern scholars. The monuments cannot be denied to afford corroboration to the story, by indicating that about this time there was intestine trouble in Egypt, and that at least one king ruled who was not afterwards regarded as legitimate by the Egyptians. The usurper was Siptah, who married Queen Ta-seser, a daughter of Rameses II.; and Amenmeses, whose place is not certainly known, probably succeeded him, being in that case likewise a usurper.

Siptah and Ta-seser. Amenmeses.

Twentieth Dynasty.

The head of the Twentieth Dynasty was Sethee II., who was probably the son of Menptah. His accession, and therefore the commencement of the dynasty, may be placed about B.C. 1220. The next date to this which may be regarded as certain is that of the beginning of the Twenty-second Dynasty, B.C. 1008 or 1009. The chronology of the intervening period is obscure, for Manetho assigns to the Twentieth Dynasty a duration of either 135 years, if we follow Africanus, or 178 or 172, if we take the authority of Eusebius. To the Twenty-first Dynasty, which was of Tanite kings, a duration of 130 years is assigned by both the chronologers above mentioned as that stated by Manetho. If these sums be at all near the truth, the two Dynasties must have ruled contemporaneously for upwards of forty or of eighty years. That such was the case is rendered probable by our finding at El-Karnak the names of only three of the latest kings, the fifth, sixth, and seventh, or last of the Twenty-first Dynasty, by whom a temple commenced under the Twentieth was continued.

Sethee II. Merer-ra. Rameses III.

The monuments tell us nothing important respecting the reigns of Sethee II., and of his successor Merer-ra: of the latter it can only be said that he evidently ruled but a short time, leaving the kingdom to his son Rameses III. With that sovereign the glories of the Theban line revived, and a series of great victories by land and sea raised Egypt to the place which it held under Rameses II., to whom alone he may be considered second as a warlike prince. In a stately temple, now called that of Medeenet-Haboo, which he raised on the western bank at Thebes, are sculptures and inscriptions commemorating the exploits of his reign, which are not, for the most part, elsewhere recorded. A small edifice, which was evidently a royal residence, and has been called his pavilion, and an extensive tomb in the Valley of the Tombs of the Kings, are the only other striking monuments of a reign which seems to have been much occupied in the prosecution of foreign wars. Of these, one of the most important, if not perhaps the most important, was that which he waged against "the Khairetana of the Sea," and the "Tokkaree," whom his fleet defeated in a sea-fight, which he beheld from the shore like Xerxes at Salamis. This sea-fight is the subject of one of the most remarkable battle-scenes which adorn the great temple of Medeenet-Haboo;[5] and it

[1] Both these events are recorded in the sculptures and inscriptions of the north wall of El-Karnak. Rosellini, *Monumenti Storici*, *loc. cit.*

[2] Select Papyri, pl. xxiv., *et seqq.*

[3] See his monuments in Rosellini, *Monumenti Storici*, No. lxii., *et seqq.*; and Lepsius, *Denkmäler*, abth. iii., bl. 142, *et seqq.*

[4] *Id.*, text, tom. i., *Nome e titoli dei Re d'Egitto*, &c., xii., 13.

[5] *Id.*, Nos. cxxxi.

Egypt.

is interesting to endeavour to ascertain who were the defeated peoples. The Shairetana, or Khairetana, are seen among the forces of Rameses II., as auxiliaries or mercenaries, distinguished for bravery, wearing crested helmets, and having short swords. Their name is identical, if we make allowance for the difference of the languages, with that of the Philistine tribe of "Cherethim," which furnished faithful mercenaries to King David. The same Khairetana we see in the army of Rameses III., in the expedition in which he overcame the Kharetana of the Sea and the Tokkaree. The Khairetana of the Sea would thus correspond to the Cretans, who are allowed to be of the same origin as the Cherethim, the former being the inhabitants of Crete, and perhaps of other islands, and the latter settled on the coast of Palestine. The identification of the Tokkaree does not seem so easy; yet it must be considered that the Carians are the only maritime nation having a name resembling that of the Tokkaree, who could, with any probability, have been associated with the Cretans, and that Herodotus relates, on the authority of the Cretans, that in the old days of the maritime power of Crete, the Carians inhabited the islands, and served in the ships of Minos, being "*by far the most famous of all nations in those times,*" and, moreover, bore another name, being called, he says, Leleges.[1] This war of Rameses III., as before remarked, is very agreeable with the Greek traditionary account, which tells of the great kings of Crete who held the empire of the sea until not long before the siege of Troy, that is, about the time of Rameses III., whom we may hence conclude to have been the cause of the overthrow of their maritime supremacy. Among the other nations whom Rameses III. conquered, were the Pelesatu, or Philistines, who have the same physiognomy and costume as the Tokkaree, thus indicating a common origin, the Rebu, a powerful people, and other uncertain races. Nine kings, all bearing the name of Rameses, succeeded Rameses III., but their rule was not (as far as we know) marked by great events, and scarcely any monuments but their tombs remain to commemorate it.

Rameses IV., V., VI., & VII.

Rameses IV., V., VI., and VII. were all sons of Rameses III.; and it is most probable that they supplanted one another, and thus weakened the country by their dissensions.

Rameses XII.

At the close of the reign of Rameses XII., the supreme power fell into the hands of a ruler of the Twenty-first Dynasty, three kings of which have left records at Thebes.

Twenty-first Dynasty. Amense Pahor. Piankh. Pisham.

The first of these was Amense Pahor, whom Manetho calls Osochor, and makes the fifth king of the Dynasty; the second, Piankh, who is, according to Manetho, Psinachês, the sixth king of the same line; and the third Pisham, Psusennês, the seventh and last. Pahor and Pisham are represented as priests, though receiving the titles of kings, a custom which was continued, but not so exclusively, under the next dynasty.

Twenty-second Dynasty.

Manetho calls the Twenty-second Dynasty, which next occupied the Egyptian throne, of Bubastite kings; and this statement receives some support from the circumstance, that the name of one of them has been found among the sculptured remains of the temples of Bubastis. These sovereigns cannot, however, have been of unmixed Egyptian origin, for Mr Birch has shown, from their names and those of princes of their family, that they must have been partly at least of Assyrian or Babylonian race.[2] Their policy, also, was rather that of those peoples than of the Egyptians, if we may judge from Sheshonk's war with Rehoboam; for

Sheshonk I., or Shishak.

Sheshonk I. is the Shishak mentioned in the Bible.[3] From this we are enabled to fix, with great probability, both the date of his accession, and the commencement of the dynasty of which he was the first king, as well as to establish a synchronism in the chronology of the kingdom of Egypt and that of Judah. The accession of Sheshonk I. may therefore be placed in the year B.C. 1008 or 1009, and his march against Jerusalem in that B.C. 988, his 21st or 22d year.

War with Rehoboam.

Among the sculptures of the great temple of El-Karnak is a list of nations and towns conquered by Sheshonk I., among which Champollion discovered the name of the kingdom of Judah, and of various cities, of which some appear to have been in the territories of Jeroboam I., to whom the king of Egypt seems therefore to have acted faithlessly.

Osorkon I.

Osorkon I., the next king, is supposed to have been the Zerah whom Asa king of Judah defeated in the year B.C. 962, or somewhat later;[4] but if Manetho's numbers have been rightly preserved, this king could not have been Zerah, though by that name might be intended a later Osorkon. Of the other kings of this dynasty, the monuments tell us scarcely more than the names. After having ruled 120 years, according to Africanus's version of Manetho's lists, it was succeeded by the Twenty-third Dynasty of Tanite kings, about B.C. 889.

Twenty-third Dynasty.

From this period until the accession of the Twenty-fifth Dynasty, the chronology and history is obscure. Of the Twenty-third Dynasty we know nothing of importance, and we cannot determine its duration. It is probable that the hieroglyphic names of some of its sovereigns occur on the monuments, but this is not certain.[5] With the end of the Twenty-second Dynasty, the fortune of the brightest period of Egyptian history deserted the Pharaohs; and except under the vigorous rule of the Ethiopians, and then of certain of the kings of the Twenty-sixth Dynasty, never returned. When Egypt had been united under a single head at the commencement of the Eighteenth Dynasty, those great expeditions soon began which made the Egyptian name famous in after ages. The countries lying to the east of Egypt, as far as the Euphrates, were overrun by the forces of the Pharaohs, and their inhabitants compelled to render allegiance, and make tributary presents, to those sovereigns. But no attempt seems to have been made to bring the strangers under Egyptian government, although alliances were entered into with some, in order to bind them in friendship with the conquering power. Notwithstanding their aversion to foreigners, there is abundant evidence that the Egyptians treated such allies with respect, unlike the Assyrians and Babylonians, who enslaved and transplanted the nations which they subdued. Constantly, however, the tributaries rose in revolt against the Egyptians, and caused many long and fierce struggles before they were reduced to their former condition; and they seem to have been supported in these contests by some great power seated on the Tigris or Euphrates. Ethiopia was, at least nearly as far as the junction of the White and Blue Niles, a province of Egypt, having the same religion and laws, and governed by a prince, called "the Prince of Kush." From the accession of Aah-mes, the head of the Eighteenth Dynasty, until the time of Rameses II., the power of Egypt gradually increased: under the latter king it attained its greatest height, and having apparently waned somewhat after his reign, it rose again through the vigour of Rameses III. Under the kings that followed him, the kingdom of Egypt fell into an insignificant condition; and in Solomon's time seems scarcely to have possessed anything in Syria. Sheshonk I., however, taking advantage of the divisions which followed the reign of Solomon, rendered the kingdom of Judah, and doubtless that of Israel also, tributary to him. But not long after his time, probably in consequence of the power of the Assyrian empire, Egypt again declined, and did not rise until the rule of the Ethiopians.

Twenty-fourth Dynasty. Bocchoris the Wise.

The Twenty-fourth Dynasty consisted of a single king, Bocchoris the Wise, a Saïte, the period of whose rule was 6 years, according to Africanus's version of Manetho, but

---

[1] Herod. i., 171.
[2] *Transactions of the Royal Society of Literature*, New Series, vol. iii.
[3] 1 Kings xiv., 25, 26; 2 Chron. xii., 2, *et seqq.*
[4] 2 Chron. xiv., 9, *et seqq.*; xvi. 8.
[5] Bunsen's *Egypt's Place*, vol. ii., pp. 594, 595.

44 according to that of Eusebius. He was celebrated as a lawgiver. His reign was brought to a disastrous termination by Sabaco the Ethiopian, who, having taken him captive, burned him alive.

Twenty-fifth Dynasty.

Thus was established the Twenty-fifth Dynasty of Ethiopian kings, which can scarcely be considered a foreign line, since Ethiopia was so thoroughly Egyptian at that time; and the transfer of supreme power cannot, therefore, though effected by armed force, be regarded as very different from the earlier changes of one native dynasty for another.

Shebek I., or Sabaco.

The accession of Sabaco may be assigned to about the year B.C. 749. His hieroglyphic name, Shebek (I.), is found on some monuments of his reign, to which we may assign, with Eusebius, a duration of twelve years.

Shebek II., or Sebichus.

Sebichus, his son, succeeded him, and ruled, on the authority of Africanus, fourteen years. He likewise bears the name of Shebek (II.) on the monuments.

Treaty with Hoshea.

The most important event that we know of his reign is the treaty which he concluded (*cir.* B.C. 725) with Hoshea, the last king of Israel; who, nevertheless, was overpowered by Shalmaneser, the potent king of Assyria, soon afterwards. In the Bible he is called So or Sewa, after the manner in which Egyptian names are often abbreviated in Hebrew.

Tehrak or Tirhakah.

The last king of this dynasty—called by Manetho Tarcus or Taracus, in the Bible Tirhakah, and in the hieroglyphic inscriptions Tehrak—was one of the greatest sovereigns who ruled Egypt, insomuch that Megasthenes mentions him with Sesôstris as having carried his arms as far as Europe. Monuments in Egypt and Ethiopia, particularly at Gebel-Berkel, the ancient Napata, commemorate his piety and his success in war. He came to the throne *cir.* B.C. 723, and ruled twenty years, according to Eusebius' version of Manetho's Lists. In the year *cir.* B.C. 710 he advanced against Sennacherib to support Hezekiah, king of Judah. It does not appear whether he met the Assyrian army, but it seems probable that its miraculous destruction occurred before any engagement had been fought between the rival forces. Perhaps we may conclude that Tirhakah availed himself of this opportunity to restore the supremacy of Egypt west of the Euphrates.

Twenty-sixth Dynasty.

With the reign of Tirhakah the Twenty-fifth Dynasty closed; but, according to Eusebius, an Ethiopian, Ammerês, commenced the next line, the Twenty-sixth Dynasty of Saïte kings. The earlier part of that dynasty presents many difficulties, and it is not until the reign of Psammitichus, or Psametik I., that the history and chronology become clear.

Psametik I., or Psammitichus.

This king was, according to Manetho, either the fourth or fifth king of the dynasty, having succeeded Nechao I. Herodotus tells us that before his reign the country was ruled by a dodecarchy of which he was a member; and that, by the help of Ionian, Carian, and Phœnician mercenaries, he overthrew his colleagues, and rendered himself sole king of Egypt.[1] Psammitichus came to the throne in this manner, B.C. 664,[2] and reigned for fifty-four years. He was generally successful, and under him the arts began to show a marked revival. The sculptures of his time, and that of his successors in the same dynasty, are often not much inferior to those of the Nineteenth Dynasty, and far superior to those of the Twenty-second and Twenty-fifth. He did not forget the services of his mercenaries, especially the Greeks, and in addition encouraged their fellow-countrymen to trade with Egypt, and caused his subjects to be instructed in their language. In this manner, and by showing a preference to the Greek troops above the native Egyptian soldiers, he offended the latter, of whom a great force (said by Herodotus to have comprised 240,000 men) rebelled, and, notwithstanding the king's remonstrances, left their country, and established themselves in Ethiopia, far south of Egypt.[3] Even if the number stated by Herodotus be much exaggerated, this defection must have contributed to weaken Egypt, no less than the establishment of a mercenary force, which alienated the affections of the Egyptians, particularly the soldiery.

War in Palestine.

Psammitichus carried on a successful war in Palestine, and took Ashdod or Azotus, after a twenty-nine years' siege, or twenty-nine years after his army had first sat down before it.[4] Probably the town was held by an Assyrian garrison, for Tartan, the Assyrian general, had taken it from the Egyptians in the preceding century.[5] Towards the close of his reign Psammitichus averted an invasion of Egypt by the Scythians, who had gained possession of the kingdom of the Medes and the dominion of Asia. They advanced to Palestine on their way to Egypt, but Psammitichus, having met them, stayed their progress with presents and prayers.[6]

Neko.

His son—called in the inscriptions Neko, by Manetho Nechao II., and in the Bible Pharaoh-Nechoh—succeeded him in the year B.C. 610. His reign was marked by great events. In his first year he advanced into Palestine, marching along the sea-coast on his way to Carchemish on the Euphrates, and was met by Josiah, king of Judah, who, although he remonstrated, opposed his passage.

Battle between Neko and Josiah.

Their armies joined battle at Megiddo, called by Herodotus Magdolus, and Josiah was slain and his forces put to the rout. It is probable that Neko was successful in the object of his enterprise, and that he speedily returned to Egypt in triumph, having on his way back deposed Jehoahaz, Josiah's son, and set up Jehoiakim, his elder brother, in his stead. The expedition was apparently intended to strike a blow at the failing power of the Assyrians, whose capital soon after fell a prey to the combined forces of the Babylonians and Medes. The army, however, which was stationed on the Euphrates by Neko, met with a signal disaster three years subsequently, being routed by Nebuchadnezzar at Carchemish. The warlike king of Babylon pushed his success, and we read in the Bible, after the mention of Jehoiakim's death, that "the king of Egypt came not again any more out of his land; for the king of Babylon had taken from the river of Egypt unto the river Euphrates all that pertained to the king of Egypt."[7] But although warlike affairs occupied so much of his reign, Neko was not inattentive to the welfare of commerce, for he either commenced the canal from the Nile to the Red Sea, or attempted to clear the course of one previously dug; but in either case, the work was not completed.[8] He likewise maintained a fleet both in the Mediterranean and in the Red Sea; and Phœnicians, by his command, attempted and accomplished the circumnavigation of Africa.[9] He was an enlightened and wise prince, who encouraged foreigners without incurring the jealousy of the Egyptians, and whose dealings with neighbouring nations evince both moderation and policy.

Psametik II., or Psammis.

Psametik II., called by Herodotus Psammis, who succeeded his father B.C. 595, does not seem in his short reign of 6 years to have done anything worthy of record. Egypt, however, prospered under his rule, for the splendid tombs of his subjects, and those of his successors, show the wealth of the country from this time to its subjugation by Cambyses.

Uahphrah or Apries.

The next sovereign was Uahphrah, called Pharaoh-Hophra in the Bible, and by Herodotus Apries. He began to reign B.C. 589, and at first was eminently successful, for he entered Palestine and Phœnicia, taking Gaza and Sidon, and defeated the king of Tyre in a sea-fight.

Wars in Phœnicia and Palestine.

He also worsted the Cyprians.[10] Having thus restored the influence of Egypt, he succoured Zedekiah, the king of Judah, in his rebellion against Nebuchadnezzar, and when Jerusalem was

---

[1] Herod. ii., 147, *et seqq.*

[2] The dates of this dynasty are in each reign placed one year earlier than Lepsius's computation (*Monatsbericht der Königl. Preuss. Akad. der Wissen. zu Berlin.* Aug. 1854, p. 496), for reasons which there is not room to state here.

[3] *Id.* ii., 30; Diod. i., 67.

[4] Her. ii., 157.

[5] Isaiah xx.

[6] Herod. i., 105.

[7] Kings xxiv., 7.

[8] See *supra*, section i.

[9] Her. iv., 42.

[10] *Id.* ii., 161; Diod. i., 68.

Egypt.

besieged by the Chaldeans the advance of his army compelled them to raise the siege.[1] The city nevertheless fell, and the power of Egypt in Palestine was crushed by the campaigns of Nebuchadnezzar. The fugitive Jews were kindly received by Pharaoh-Hophra,[2] and seem henceforward to have formed an important part of the population. At the fall of the kingdom of Israel many Hebrews had taken refuge in Egypt,[3] and this was not the only occasion on which their numbers were increased by other emigrants. Greater calamities than the loss of his influence to the east of Egypt befel Apries at a later time, for an army which he sent against the Greeks of Cyrene was cut to pieces, and a consequent military revolt placed the crown on the head of Amasis. Apries was deserted by all except the Ionian and Carian troops (30,000 in number), and a few Egyptians, but nevertheless he marched to meet the rebel. At Momemphis, near the lake Mareotis, a decisive battle was fought, and Apries was made prisoner by Amasis. At first the new king treated his captive with consideration, but afterwards yielding to the importunities of the people, who hated him, he gave him up to them, by whom he was strangled. Nevertheless he buried him royally.[4] Thus was fulfilled the prophecy spoken by Jeremiah: "I will give Pharaoh-Hophra, king of Egypt, into the hand of his enemies, and into the hand of them that seek his life."[5] There seems little doubt that at the time of this rebellion, and perhaps in conjunction with the advance of Amasis, Egypt was invaded and desolated by Nebuchadnezzar. It should be observed, however, that the remarkable prophecies of Ezekiel[6] may refer for the most part to the invasion by Cambyses.

Dethronement and death of Apries.

Aah-mes, or Amasis.

Amasis or Aah-mes came to the throne in the year B.C. 570, and ruled with great credit for nearly half a century. He endeavoured rather to consolidate the power of Egypt than to make extensive conquests, and thus he strengthened the country against its dangerous neighbours on the east. He was not regardless of the welfare of commerce, and the efficiency of his navies is shown by his having subjugated Cyprus and made it tributary. The Babylonian kingdom became so weak in his days, that he joined Nabonidus its king, and Crœsus the sovereign of Lydia, in an alliance to oppose Cyrus.[7] Nevertheless Babylon fell, and with it the remains of the great empire founded by Nebuchadnezzar, and the defeat of Crœsus followed the fall of his ally. Xenophon says that Crœsus was aided by a strong force of Egyptians, 120,000 in number, who in a great battle near Thybarra maintained themselves unbroken until Cyrus granted them honourable terms, and that he settled them in the cities of Larissa and Cyllene, on the coast of Asia Minor. From the manner in which this is narrated, and particularly from the evident appeal to the truth of the narrative on account of the cities being called those of the Egyptians, this seems to be, notwithstanding that it occurs in the *Cyropædia*, a genuine fragment of history. If so, we could well understand why Egypt was unable to offer a vigorous resistance to the Persian invader a few years later, since it would have thus been deprived of a great part of the army. Monuments were raised by Amasis throughout Egypt, of which some remains are yet to be seen, but his works were probably chiefly in Lower Egypt and at Saïs;[8] and hence there are no very remarkable ruins of his time, since the temples of Upper Egypt are the best preserved. Towards the close of his long reign Amasis found himself obliged to make great preparations to resist the threatened invasion of Cambyses, and at length died a little before that calamity befel his country. His son, Psammenitus, most probably the Psametik III. of the monuments, ascended the throne B.C. 525, and prepared to meet the advancing enemy. The king of Egypt, at the head of a native and Greek army, awaited the invader at Pelusium, which was long regarded as the key of the country, and is therefore called in the Bible "Sin, the strength of Egypt."[9] After an obstinate battle the Persians gained the day, and Cambyses advanced against Memphis. Thither he despatched a herald in a Mitylenian vessel; but the Egyptians, exasperated against the unjust invader, destroyed all on board. Cambyses then laid siege to the city, whose ancient fort, the White Wall, offered a protracted resistance, but at length fell into the hands of the invader, with Psammenitus the king. Thereupon Cambyses signalized his victory by characteristic acts of cruelty, rendered more odious by being partly enacted under a show of justice, and insulted the conquered king by the humiliation of his daughter to the rank of a poor slave, and the execution of his son as a low malefactor. Moved by shame rather than pity, he ordered the king's son to be spared when it was too late, but afterwards he was not able to refrain from the meanness of dragging forth and burning the mummy of Amasis[10] and that of his queen.[11] This queen was called Ankh-nes, her sarcophagus is now in the British Museum. Near it was discovered her burnt mummy. One cannot but regret that a desire to put a historical subject in a new light, which has worked so much mischief of late, should have raised up an apologist for a despot of whom no one good act stands recorded. The unhappy Psammenitus, having been led captive to Susa, was after a time put to death by drinking bull's blood, for having plotted against Cambyses. It is believed that Cambyses did not at first insult the Egyptian religion; indeed, there is evidence that he began by showing reverence, or a pretence of reverence, towards their gods; but having failed in his disastrous expeditions to Ethiopia and the Oasis of Jupiter Ammon, he became exasperated against the unfortunate Egyptians, and destroyed their temples and statues, and even wounded the bull Apis. After four years spent in Egypt, he left the country to quell the rebellion which had placed the Magi at the head of affairs, and shortly after perished from the effects of an accidental hurt.

Psammenitus.

Memphis taken by Cambyses.

Twenty-seventh Dynasty.

Darius Hystaspis.

Darius, the son of Hystaspes, having overthrown Smerdis, the Magus, early applied himself to the improvement of his great empire, and, whether from policy or goodness, strove to conciliate the various nations that composed it. During his visit to Egypt he gained the favour of the inhabitants,[12] and hieroglyphic inscriptions show that he caused the temples to be adorned with additional sculptures.[13] Notwithstanding, the Egyptians, unwilling to continue in servitude to a foreign power, revolted in the last year but one of his reign[14] (B.C. 486), but were reduced by Xerxes, his successor, in his second year (B.C. 484). Xerxes made his brother Achæmenes satrap of Egypt,[15] and the province remained quiet until his death, shortly after which Egypt again rose against the foreign rulers. Inaros, the son of Psammitichus, who was sovereign of some of the Libyans, and Amyrtæus, the Saïte, headed the insurrection. The Persians were driven out; and the insurgent leaders prepared to resist their return, by raising a native and mercenary force, and securing the assistance of the Athenians. Artaxerxes, as soon as he was firmly established on the throne, took measures towards regaining the lost province. An enormous army, said to have consisted of 400,000 men, and a fleet, were despatched under the command of Achæmenes, the late satrap. Inaros and Amyrtæus, instead of awaiting the advance of the Persians at the eastern frontier, wisely stationed their army in the western part of the Delta, where, if defeated, they could retire into Libya; and, if successful, they could place their enemies in

Xerxes. Egypt subdued.

1 Jer. xxxvii., 5, 7, 11.
2 *Id.* xliii., 7, &c.
3 Comp. Hosea viii., 13; ix., 3, 6.
4 Herod. ii., 161, *et seqq.* Diod. i., 68.
5 Jer. xliv., 30.
6 Ezek. xxix., xxx., xxxi., xxxii.
7 Herod. i., 77.
8 Comp. Herod. ii., 175, 176.
9 Ezek. xxx., 15.
10 Herod. iii., 16.
11 A burnt mummy was found with this queen's sarcophagus.
12 Diod. i., 95.
13 *Ancient Egyptians*, vol. i., p. 199.
14 Herod. vii., 1.
15 *Id.* vii., 7, 8.

Egypt.

Battle of Papremis.

a most dangerous position. They joined battle near Papremis, the city of the Egyptian Mars, and the Persians were disastrously routed. The Athenians rendered great services, but the fortune of the day was decided by the valour of Inaros, who mortally wounded Achæmenes in single combat. The Athenians pursued the fugitive Persians by water, and blockaded them in the castle of Memphis.[1] Artaxerxes then despatched a second expedition, under Megabyzus, the son of Zopyrus and Artabazus, which, with the remains of the army of Achæmenes, appears to have exceeded in magnitude that unfortunate force. The Egyptians and Greeks advanced from Memphis, where they were still engaged in the siege of the castle, and were routed by the Persians in a battle, in which Inaros was wounded by Megabyzus. Having retreated to the island Prosopitis, the defeated forces maintained themselves for more than a year, until the Persians, having, partly at least, cut off the water which formed their best defence, forced them to capitulate. Inaros surrendered, on condition that his life should be spared—an engagement that was broken after he had been five years a captive, and he was crucified to gratify the revenge of Amytis, the mother of Achæmenes.[2] Amyrtæus, more fortunate than his colleague, escaped to the fens, where, in the island of Elbo, he defied all attempts of the Persians to reduce him. The warlike inhabitants of that part of Egypt warmly supported his cause, and their maritime position ensured them the succour of the Athenians.[3] Artaxerxes Longimanus granted some privileges to the conquered; and, in particular, made Thannyris, the son of Inaros, and Pausiris, the son of Amyrtæus, governors; thus in a manner causing them to succeed their fathers.[4] Early in the reign of Darius Nothus, after a long interval of rest, Egypt became again disturbed, and in his tenth year (B.C. 414) successfully asserted its independence. The details of the struggle are not known to us; all that can be said with certainty is that Amyrtæus, the Saïte, was proclaimed king, and was the first of a short series of Egyptian monarchs. Some maintain that this could not have been the same as he who fled to the marshes, and that such was the case cannot indeed be proved; yet there is nothing improbable in the supposition that he had never been subdued, especially as we hear of him as late as B.C. 450,[5] and sixty-four years of active life cannot be regarded as unparalleled in history.

Expedition of Megabyzus and Artabazus.

Artaxerxes Longimanus.

Darius Nothus.

Twenty-eighth Dynasty. Amyrtæus the Saïte. Twenty-ninth Dynasty.

The rule of Amyrtæus, the sole king of the Twenty-eighth Dynasty, does not seem to have been marked by events of importance. After having governed six years,[6] he was succeeded by the first king of the Twenty-ninth Dynasty. From this period until the final extinction of the Egyptian kingdom considerable difficulties beset our inquiries from the conflicting statements of historians. There will not be space in the present article to do more than indicate the most probable view of these questions, which do not affect the few great events of the period.[7] The first of the Mendesians (B.C. 408), Neferites or Nephreus, ruled tranquilly for six years, unmolested by the Persians, whom he opposed by aiding their enemies the Greeks. His name, written Nefâurut, is found in hieroglyphics. Achoris or Ackoris, the Hakori of the monuments (B.C. 402), governed for 13 years or more prosperously. He made great efforts to repel the advance of the Persians, and raised a force of mercenaries, of which he gave the command to the Athenian general, Chabrias.[8] Many sculptures attest the happiness of Egypt during this time of peace. Two kings, of whom nothing is known, followed Achoris, ruling for a year and four months; and with the second of them the dynasty came to a close, unless Eusebius be right in adding a third king, with a rule of one year.[9]

Nefâurut or Neferites.

Thirtieth Dynasty. Nekht-nebf, or Nectanebes I.

A new line, the Thirtieth Dynasty, of Sebennyte kings, succeeded to the supreme power. The first of this dynasty was Nectanebes I., called in the hieroglyphic inscriptions Nekht-nebf. His accession may be probably placed in the year B.C. 380, and he at once began to take vigorous measures to defend the kingdom against the Persians, who, under the powerful satrap Pharnabazus, were making formidable preparations to reduce it. The Athenians, with characteristic baseness, deserted his cause; and having sent for Chabrias from Egypt, despatched another eminent general, Iphicrates, to command the Greeks who served under the Persians. The king of Egypt, unaided by foreign troops, made the best disposition of his forces, and strengthened all assailable points. In the year B.C. 373, the Persians entered Egypt, led by Pharnabazus and Iphicrates, and finding Pelusium too strong for them, landed a force at the Mendesian mouth of the Nile, and captured the fort which defended it. But this success did not endure. The generals differed as to the plan of campaign, and Nectanebes worsted the enemy in several skirmishes and also in a battle. The difficulties of their position were increased by the overflow of the Nile. Iphicrates fled secretly thence by sea, and Pharnabazus was compelled to make a disgraceful retreat. This expedition is of no little importance, as it shows that the Egyptians, without foreign aid, on at least one occasion, both outmanœuvred and defeated a powerful Greek force, acting with a great Persian army; and serves to warn us against believing what the Greek historians, with the inordinate vanity of their nation, tell us on so many occasions, that the preservation of the Egyptian kingdom was owing to the bravery of their mercenary troops.[10] During the rest of the reign of Nectanebes Egypt remained unmolested, and the king repaired or beautified the temples.

Tachos or Teos.

Tachos, or Teos, succeeded Nectanebes I. in about the year B.C. 361. His first care was to take advantage of the distracted state of the Persian empire, and to raise an army and fleet by which to recover the influence of Egypt in Syria. The command of the fleet he gave to Chabrias, the Athenian, and that of the Greek mercenaries he intrusted to the celebrated Agesilaus, king of Sparta, while he himself was general-in-chief. Agesilaus was displeased that such a subordinate command had been bestowed upon him, and his enmity had no little share in the subsequent misfortunes of Tachos, which were as much owing to the friendly counsels of Chabrias. In order to raise money for the prosecution of the war, it became necessary to tax the inhabitants of Egypt heavily; and this, combined with the obnoxious character of the taxes, and the unfair extortion practised towards the priests, aroused the national discontent. When the king was already in Phœnicia, his brother Nectanebes, whom he had left to govern Egypt, plotted against him; and persuaded his own son, of the same name as himself, who was at the head of some forces in Syria, to try for the supreme power. Agesilaus was gained over by the usurper, and Chabrias was probably recalled by the Athenians, while the Egyptian forces deserted their king. Tachos could only flee, but his true character is shown by his immediately repairing to Artaxerxes Mnemon. The king of Persia, following the national policy, both received the fugitive well, and projected an expedition against Egypt under his command; but neither lived to see this design carried out, and Tachos is said to have died a victim to the consequences of the luxury of the Persian court.[11]

Rebellion, and dethronement of Tachos.

Nectanebes II.

In the meantime Nectanebes II. (B. C. 359) established

[1] Diod. xi., 71, 74, 75. Ctesias *in Persicis*. Thucyd. i., 104.
[2] Diod. xi., 75, 77. Ctesias *in Persicis*. Thucyd. i., 109, 110.
[3] Thucyd. i., 112. Plut. *Cim*. 18. Herod. ii., 140.
[4] *Id*., iii. 15.
[5] Thucyd. *loc. cit*.
[6] Manetho in *Ancient Fragments*, pp. 130, 131.
[7] Comp. *Ancient Egyptians*, vol. i., p. 203, *et seqq.*; and Kenrick's *Ancient Egypt*, vol. ii., p. 494, *et seqq*.
[8] Diod. xv., 29. Corn. Nep., *Chabrias*.
[9] *Anc. Frag*. pp. 130–133.
[10] Diod. xv., 29, 38, 41–43. Corn. Nep., *Iphicrates*.
[11] Diod. xv., 90, 92. Plut., *Agesilaus*, 36, 37. Ælian, *Var. Hist*. 5, 1.

himself on the throne by the aid of Agesilaus. A Mendesian leader, whom Tachos had chosen for his successor, had raised a large though unwarlike force and proclaimed himself king; but after a sanguinary contest, the king of Sparta and Nectanebes put him to the rout, and Egypt was thus tranquillized.[1] These intestine struggles, however, had greatly contributed to the fall of Egypt, and may be partly, at least, ascribed to the turbulent mercenaries, whose policy must be condemned, even if we judge, as alone we can, from the partial accounts of their countrymen, the Greek historians, and those who drew their information from them. Had it not been for this civil war, although the expedition into Syria might have been unsuccessful, Egypt would have retained strength enough to withstand the Persians for the few years of weakness that preceded the fall of their empire. The early part of the reign of Nectanebes II. was prosperous, and he resisted with success the efforts which Artaxerxes, or Darius, Ochus, made to reconquer the country, and aided the Sidonians and other Phœnicians in throwing off the Persian yoke. The indolent king of Persia, roused by these disasters, collected a great army and fleet, took Sidon, subdued all Phœnicia, and reduced Cyprus. Mentor, the Rhodian, a leader of Greek mercenaries in the service of Nectanebes, who had been sent by him to aid the Phœnicians in their revolt, deserted to Ochus, and the route to Egypt lay open to the victorious army. Nectanebes prepared to make a vigorous resistance, by strengthening every defensible position and collecting an army of Egyptians, Libyans, and Greeks. Pelusium was successfully defended by a Greek garrison against the Thebans in the service of Ochus, until Nicostratus, the leader of his Argive mercenaries, having learnt by treachery a means of getting to the rear of the main Egyptian force under Nectanebes which was encamped near by, not only executed the manœuvre but maintained himself by defeating the Greek garrison of a fortress which sallied forth to oppose him. Then the king of Egypt, menaced by a superior army, partly in front of his position and partly in its rear, retreated with his whole field force to Memphis. The Greek garrison of Pelusium surrendered on terms to their fellow-countrymen, and the garrisons of the other strong places of Lower Egypt followed their example. Nectanebes, believing that he could not effectually oppose the invader, fled to Ethiopia by the river.[2] Thus Egypt again fell into the power of Persia in about the year B.C. 350, according to the best authorities. From that time until our own days, a period of twenty-two centuries, no native ruler has sat on the throne of Egypt, in striking fulfilment of the prophecy, "there shall be no more a prince of the land of Egypt."[3]

Invasion and subjugation of Egypt by Artaxerxes Ochus.

Causes of the decline and fall of Egyptian independence.

At this memorable point we must pause a moment to review the causes which led to the decline and ultimate fall of the native rulers of Egypt, after their power had been maintained, with little interruption, for more than 2300 years. The apparent chief cause of their ruin was the hostility of the three empires which successively governed the East. Under Rameses II. Egypt had attained its highest glory, under Rameses III. its position was maintained, but shortly after him its power suddenly failed. This is about the time at which Herodotus places the beginning of the Assyrian Empire. The kingdom of Egypt again acquired importance under Sheshonk I., a prince, partly at least, of Assyrian or Babylonian origin. His successors do not seem, for the most part, to have retained what he had acquired, and the country again lost its importance until the accession of the Ethiopian Dynasty. The princes of that line bringing with them a large and powerful territory, and being warlike and vigorous rulers, were enabled to check the advance of the Assyrians, and the third of them, Tirhakah, lived to the time of the first of those disasters which ruined the enemy, the miraculous destruction of Sennacherib's army. Had not a period of anarchy followed the Ethiopian rule, the ascendancy of Egypt might perhaps have been recovered. The establishment of Psammitichus was the beginning of an active line of native princes, who regained much of the former power of their crown, until Nebuchadnezzar, the head of the Babylonian empire, overthrew the army of Egypt, and destroyed its influence in Asia. Weakened by this contest, Egypt could not oppose a successful resistance to the pushing force of Persia, and fell almost at once into the hands of Cambyses. For nearly two centuries the history is but a record of the unequal struggle of the patriotic Egyptians against the overwhelming power of despotic Persia, and of the establishment of native princes, who latterly succeeded in maintaining the kingdom for almost seventy years against all the forces which could be brought against their enfeebled country. While such were the apparent causes of the downfall of this ancient power, others may be traced which, though less manifest to a superficial reader of history, seem mainly to have occasioned the success of Egypt's enemies. Until the time of Psammitichus the Egyptian soldiers had held the post of honour, but that king not only introduced Greek mercenaries into the army but treated them with especial favour, so that many of the native soldiers revolted and all became discontented. This course of conduct, which was mainly pursued by his successors, destroyed the old military system without substituting anything stable in its stead, and placed the defence of the kingdom in the hands of untrustworthy though brave men. The adoption of Greek manners by the great separated them from the sympathies and support of the lower classes, and at a time when unity alone could render the country strong enough to resist the aggressions of Persia, disunion everywhere prevailed.

Ochus, having gained possession of Egypt, signalized his success by outrages which it is needless here to relate. He did all in his power to insult the religious feelings of the unhappy Egyptians, and seems to have gone beyond Cambyses in his furious acts of barbarity. After a few years of Persian rule which are a blank in the history of Egypt, that country passed into the hands of Alexander the Great in the course of his conquest of the empire whereof it was a province.[5]

Greek kings, Alexander the Great.

From the time of Alexander commences a brighter period of Egyptian history, although its annals are those of Greek sovereigns and it witnessed the decay of Egyptian nationality. As the enemy and vanquisher of the Persians, Alexander was received in Egypt (B.C. 332) as a deliverer. The Persian governor had not forces sufficient to oppose him, and the cities opened their gates to him without even a show of resistance. Alexander visited Memphis, founded Alexandria, and went on pilgrimage to the oracle of Jupiter Ammon, manifesting on every occasion the greatest respect for the Egyptian religion. He then organized the govern-

[1] Plut., *Ages.* 38. [2] Diod. xvi. 40, *et seqq.* [3] Ezek. xxx., 13. [4] *Ancient Egyptians*, vol. i., pp. 212, 213.

[5] The chief ancient authorities for the history of Egypt under the Greek rule, from the conquest by Alexander, are the following: Ælian, Agatharchides, Ammianus Marcellinus, Appian, Arrian, Athenæus, Cæsar, and Hirtius; Cicero, Diodorus Siculus, Dion Cassius, Josephus, Justin, Livy, the first and second books of Maccabees, Pausanias, Pliny, Plutarch, Polybius, Porphyry, Quintus Curtius, Strabo, and Vitruvius. Scattered notices occur in the works of many other writers; and there are some historical inscriptions both in hieroglyphics and in Greek. The dates of accession of all the Ptolemies, except the first, have been taken from Ideler's Memoir *Uber die Reduction ägyptischer Dater aus den Zeiten der Ptolemäer* (Konigl. Akad. der Wissenschaften, Berlin, 1834). It should be remembered that it is meant that the accession fell within the Vague Year, commencing in the Julian Year specified: thus Ptolemy Philadelphus came to the throne in the year Nov. 285, Nov. 284, which was his first year. Reference has been also made for chronology to Lepsius's Memoir *Ueber einige Ergebnisse der ägyptischen Denkmäler für die Kenntniss der Ptolemäergeschichte* (Königl. Akad. der Wissenschaften, Berlin, 1852); and to Fynes Clinton's *Fasti Hellenici, &c.*

Egypt.

ment of the country, and departed to complete his subjugation of the Persian empire. For the remainder of his short reign, Egypt continued undisturbed, and though not well governed in his absence, enjoyed greater happiness and security than it had for a long antecedent period.

Ptolemy, governor in Egypt.

On the division of Alexander's empire, the government of Egypt fell to the share of Ptolemy, the son of Lagus, afterwards surnamed Soter, one of his favourite generals (B.C. 323). He was content for the present to govern in the name of Philip Arrhidæus or Aridæus, the feeble successor of Alexander, but did not neglect to get together an efficient army by which to maintain his position. Not long after he reached Egypt, the intestine troubles of Cyrene enabled him to annex it to his government, and about the same time he made another stroke of policy. The regent Perdiccas having despatched the body of Alexander from Babylon in order that it should be buried in Macedonia, Ptolemy met the important charge in Syria, and having gained to his side the general who escorted it, carried it to Memphis, until a tomb should be fit for its reception at Alexandria. Perdiccas, irritated at Ptolemy's having thus gained possession of Alexander's body, which was in this manner a source of war after it had ceased to contain the ambitious soul, marched against Egypt to punish the governor. After an encounter near Pelusium, in which Ptolemy had the advantage, Perdiccas outmanœuvred him by a night march towards Memphis, but was afterwards worsted in endeavouring to cross the Nile near that city. Many of the officers and men of the invading force now deserted to Ptolemy, and Perdiccas was assassinated by his officers. On this the army, with which were not only Philip Arrhidæus, but Alexander Ægus, the heir-presumptive to the throne, submitted to Ptolemy, who allowed it to depart to Macedonia, having appointed two guardians for the king and prince. The governor of Egypt pursuing his advantage, sent an army which (B.C. 320) reduced Phœnicia and Cœle-Syria; and probably it was at this time that he subdued Palestine. After a period of prosperity which was spent in adorning the new city of Alexandria with magnificent buildings, and settling the details of government with a view to the benefit of the country, Ptolemy was called upon to defend Egypt against the threatened invasion of Antigonus. Syria and Phœnicia were subjugated by the King of Asia (B.C. 315–314), but in the next year Ptolemy quelled an insurrection in Cyrene, and reduced Cyprus, in which he had before established a footing (B.C. 315). Having sailed from Cyprus he made a hasty inroad in which he inflicted some loss on Antigonus by taking cities on the coasts of northern Syria and Cilicia, and returned by sea to Alexandria. In the following year (B.C. 312) he advanced into Palestine and routed the forces of Demetrius, the son of Antigonus, at Gaza. Ptolemy thus regained Phœnicia; and Seleucus, who had been forced to flee to him, was restored to his government of Babylonia. Antigonus now marched against Ptolemy from Asia Minor, but the latter retired into Egypt, leaving his opponent the dangerous task of invading that country. After having failed in two attacks on Petra, Antigonus retreated, and a peace was concluded by which Ptolemy resigned Palestine to him (B.C. 311). The death of Alexander Ægus in the same year rendered Ptolemy altogether independent, although he did not assume the title of king, except on the Egyptian monuments, until B.C. 306. All his earlier sculptures bear the names of Philip Arrhidæus and Alexander Ægus, and the rest his own as king, none having been found with an inferior title; and it is therefore reasonable to conclude that he assumed in the hieroglyphic inscriptions the regal style immediately on the death of Alexander Ægus. Ptolemy soon after that event led an army against the territory of Antigonus, from whom he took many places in Syria and Caria, as well as the island of Cos; but he soon met with a signal reverse, for Demetrius engaging his fleet with an inferior force, off Salamis of Cyprus, almost annihilated it, Ptolemy himself escaping, though his son Leontiscus, as well as his brother Menelaus, thus fell into the enemy's hands. By this victory Cyprus came into the possession of Demetrius (B.C. 306). Elated by this success, Antigonus marched against Egypt with a large army, but was repulsed, and retired as before without having effected anything. Ptolemy then assumed the offensive, regained Cœle-Syria, and having united his forces with those of Lysimachus, Cassander, and Seleucus, joined battle at Ipsus with the forces of Antigonus and Pyrrhus. The latter were routed, and Antigonus, the most formidable opponent of Ptolemy, fell in the battle (B.C. 301). Having ruled in comparative peace for several years after this decisive victory, Ptolemy abdicated in favour of his son Philadelphus. His character was that of a prudent prince, generally merciful, of moderate ambition, and rarely guilty of political injustice. He warmly patronized literature, the sciences, and the fine arts, and showed an enlightened disposition by granting the Jews privileges which induced them to settle in great numbers at Alexandria.

War with Antigonus.

Ptolemy becomes king.

Ptolemy II., Philadelphus.

Ptolemy, surnamed Philadelphus (B.C. 285), inherited a kingdom that comprised not Egypt alone, but the south coast of Asia Minor, much of Syria, Palestine, and Cyprus, which had been recovered in B.C. 295. But after his father's death, which occurred B.C. 283, the first of those internecine struggles that disgrace the history of the Ptolemies broke out. The king's half-brother Magas, governor of Cyrene, revolted, and a war commenced, which after some years' continuance, was concluded by a treaty by which the daughter of Magas was to marry the son of Philadelphus, and to receive as a dowry the reversion of the possessions of her father, to whom she was sole heir. The death of Magas soon followed, and Cyrene was after a time restored to Egypt. Two other brothers of Philadelphus were subsequently put to death on different occasions by him on the ground of treason, of which one of them was certainly guilty. In the eleventh year of Philadelphus (B.C. 274) he sent an embassy to Rome to congratulate the republic on having repelled Pyrrhus, and to make a treaty; and an embassy from the People visited Egypt in return. Except the struggle with Magas, the rule of Philadelphus was almost unmarked by war. A contest with Antiochus II., king of Syria, ended in a treaty by which he took to wife Berenice the daughter of Philadelphus, who acquired no military renown. His long reign was rather distinguished by the erection or completion of magnificent buildings, and the advance of trade by the formation or repair of ports and stations, and the completion of the celebrated Pharos of Alexandria. He followed his father's example in patronizing men of letters, painters, sculptors, and the professors of science, and continued to favour the Jews. Nevertheless his private character cannot claim our admiration. Without being warlike, he was cruel, as towards his unfortunate brothers, and in the destruction of his Gaulish mercenaries, which, however politic, was most barbarous. He was luxurious and licentious in his manners, and seems to have owed his reputation of a great king rather to circumstances than to character. In no sense did he ever show himself heroic, and had his dominions been seriously endangered he would probably have left us little cause to respect him as a warrior or a statesman. Having ruled thirty-eight years he left his kingdom to his eldest son Ptolemy, surnamed Euergetes.

War with Magas.

Ptolemy III., Euergetes.

Ptolemy Euergetes was at the beginning of his reign (B.C. 247) called to take an active part by the trouble that befel his sister Berenice, the wife of Antiochus II., king of Syria. That sovereign having repudiated her, and taken back his first wife Laodice, was murdered by the latter, whose eldest son, Seleucus II., assumed the reins of power. By his, or rather his mother's, orders Berenice and her son were slain, before Euergetes could afford them succour.

Egypt.

Euergetes, however, avenged his sister in a brilliant expedition, by which he secured much of Syria and Asia Minor.

War with Seleucus II.

Afterwards Seleucus attacked Ptolemy, but was routed by his forces and those of his rebellious brother Antiochus Hierax. The latter, however, when fortune deserted him, sought refuge with Ptolemy, by whom he was kept in custody until he made his escape, and perished in his flight. The king of Egypt next conducted an expedition into Ethiopia, where he made extensive conquests. But notwithstanding these warlike actions, Ptolemy continued the generous patronage which his predecessors had extended to literature and science, and was especially attentive in improving the great temples of Egypt, or adding others to them. These, like all the edifices of the country, excepting those of Alexandria, were in the native style of architecture, which, although it had undergone some changes, was still that of the time of the Pharaohs. His temples and those of the other Ptolemies and Cæsars, excel many of the more ancient in size, though far inferior to them both in architectural beauty and in the execution of their sculptures. But they were not wholly raised by royal munificence, for large contributions from various cities, and even from foreign countries, aided in their construction. This circumstance, however, affords a strong evidence of the wealth of the subjects, and the freedom which they enjoyed.

Ptolemy IV., Philopator.

The reign of Ptolemy Philopator (B.C. 222), the eldest son and successor of Euergetes, commenced with an act of infamy, in the murder of his mother Berenice, his brother Magas, and his uncle Lysimachus.

War with Antiochus the Great.

Antiochus (III.) the Great soon attempted to break the power of Egypt in Syria, and reduced, by treachery and by force, the chief possessions of Ptolemy in that country, Phœnicia, and Palestine. Philopator having collected his forces, marched with 75,000 men against the enemy who now threatened Egypt. A battle, before which the soldiers of Ptolemy had been encouraged by the exhortations of Arsinoë the queen, was fought at Raphia, on the boundary, and the army of Antiochus was signally defeated (B.C. 217). A treaty was soon concluded, by which the king of Syria resigned his newly acquired territories.

Persecution of the Jews.

At Jerusalem, and after his return to Egypt, Ptolemy treated the Jews in a cruel manner, but afterwards stayed the persecution. Towards the close of his reign, he murdered Arsinoë, his sister and queen, and died, worn out by his vices, and unregretted by his subjects. With no good quality but a respect for letters and science, Philopator's character was marked by cruelty of the basest description, and by the greatest debauchery, and with him began the decline of the Greek kingdom of Egypt.

Ptolemy V., Epiphanes.

Ptolemy Epiphanes, the son of Philopator, was yet a child when he succeeded his father (B.C. 205). His reign was ushered in by a serious riot, in which the guilty minister and favourites of the late king fell victims to the vengeance of the people. This disturbance was followed by a graver danger, for Antiochus the Great, the king of Syria, and Philip IV. of Macedonia, formed an alliance in order to strip the young king of his possessions. Antiochus defeated the forces of Ptolemy, and speedily acquired Cœle-Syria and Phœnicia, as well as Judea, being supported by the Jews, who had hitherto been governed by the kings of Egypt. In this juncture those who ruled Egypt for the young king requested the Roman people to become his guardians, now that the very existence of the kingdom was threatened by such formidable enemies. The senate of Rome did not hesitate to accept a trust which promised so greatly to forward their ambitious views, and having recently overthrown Hannibal and crushed the power of Carthage, they felt able to support their client against the kings of Syria and Macedonia. Accordingly, they despatched messages to those sovereigns commanding them to abstain from attacking Ptolemy's dominions, and Marcus Lepidus, one of their ambassadors, became Ptolemy's guardian (*tutor regis*). Antiochus did not, however, desist from his enterprise; but being at length intimidated by a second warning of the displeasure of Rome, he entered into a treaty with Egypt, promising his daughter to the young king with the conquered territory as a marriage portion (B.C. 199). Before Epiphanes had attained his majority, the native Egyptians revolted, and were not reduced without a severe contest. They stood a siege in the town of Lycopolis, in the Delta, but the place was at length captured and the rebels subdued. In the year B.C. 196, the king was declared to be of age, and was crowned at Memphis.

Coronation of Ptolemy

To commemorate this event, as well as the privileges which had been granted by the king to the people, and particularly to the priesthood, the priests issued a decree, of which copies, carved on stone, were placed in the temples. One of these copies was fortunately discovered during the French occupation; and, bearing an inscription in Greek as well as in hieroglyphic and enchorial, it furnished European scholars with the means of interpreting the ancient characters of Egypt.

Rosetta Stone.

This tablet, which is now in the British Museum, bears the name of the "Rosetta Stone." Three years after his coronation, Cleopatra the daughter of Antiochus was married to Ptolemy, in fulfilment of the treaty previously concluded; but her promised marriage-portion of Judea, Cœle-Syria, and Phœnicia, was never given up by the king of Syria, who appears to have warred against Ptolemy as soon as he became his son-in-law. The king of Egypt made scarcely an exertion to recover his provinces, and at length fell a victim to poison, having reigned 24 years with indolence, incapacity, and cruelty.

Ptolemy VI., Philometor.

Ptolemy Philometor came to the throne of his father while yet a child (B.C. 181), and Egypt had again a minor for its sovereign. His mother Cleopatra, who was worthy of her father Antiochus the Great, governed the country for the young king, and maintained peace with her brothers Seleucus IV. and Antiochus (IV.) Epiphanes, kings of Syria. Ptolemy, after a few years, had the misfortune to lose his mother (B.C. 173), and then, through the headstrong policy of his ministers, to become involved in a war with the king of Syria. Antiochus soon marched against Egypt, routed the army of Ptolemy near Pelusium, took Memphis, and gained possession of the person of the king. His younger brother assumed the sovereignty at Alexandria, taking the name of Euergetes (II.), although he was usually known afterwards as Physcon, an appellation which he received on account of the bloated appearance which his intemperate habits had given him. Antiochus besieged the new king in Alexandria, but ambassadors from Rome having arrived during the siege compelled him to withdraw, retaining nothing but Pelusium, which he garrisoned with a strong force. He took away great spoil, so that the expedition cannot be regarded as having been wholly fruitless.

Ptolemy VI., Philometor, with VII., Physcon.

On the departure of the invader, Philometor and Euergetes made peace with one another, determining to rule jointly, and Cleopatra their sister, who had taken part with Euergetes, became the queen of Philometor (B.C. 169). In the following year (B.C. 168) the restless Antiochus again invaded the kingdom of his nephews, while his fleet subjugated Cyprus, but after penetrating into the heart of Egypt, was forced to retreat as before by the Roman ambassadors. Not long after this, strife again arose between the brothers, and Physcon having expelled Philometor, the latter carried his case before the Roman senate (B.C. 164). That council decided to restore Philometor to all his dominions excepting Cyrene, which they assigned to Physcon.

Ptolemy VI., Philometor alone.

In the ensuing year, however, Physcon went to Rome to request the senate to reconsider their decision, and grant him Cyprus which was now in his brother's hands, and to this petition they assented. Philometor, however, would not obey this order, and the Romans ultimately renounced their alliance with him, and commanded his ambassadors to leave the city in five days.

Egypt.

In the meantime Cyrene had risen against Physcon, and when he had subdued the people with difficulty, he again visited Rome to prosecute his cause (B.C. 154). Strengthened by a fresh decision of the senate, and otherwise aided by that body, Physcon, having raised an army, attempted to subdue Cyprus. His brother opposed him in person, leading the Egyptian forces, and having defeated him, forced him to surrender. Philometor most generously restored Cyrene to Physcon, and granted him other territories in the place of Cyprus: thus showing extraordinary clemency to which the history of the times scarcely affords a parallel, not less remarkable than the courage with which he refused to obey an unjust decision of the Roman senate.

War in Syria.

Philometor was next involved in war with Demetrius (I.) Soter, the king of Syria, and lent his support to Alexander (I.) Balas, who slew his adversary in battle. Having, however, discovered that Alexander was engaged in plotting against him, Philometor aided Demetrius (II.) Nicator in overthowing his father's enemy. In a decisive battle Ptolemy fell, having been carried by his horse into the midst of the enemy's forces, and thus terminated his long and chequered reign. If not a great king, he was certainly a good one, brave without cruelty, and merciful without weakness. Literature and science flourished under his protection, and magnificent temples were raised, or partly built, during his rule. Not the least remarkable proof of his enlightenment was the favour he showed the Jews, one event in whose history must not be passed by without notice. When Judea passed from the hands of the Ptolemies into those of the Seleucidæ, certain of the Jews continued to hold with the former, not forgetting the favours they had received from some of the kings of Egypt. Onias the high priest, and many others, having been expelled Jerusalem for this partiality, took refuge with the king of Egypt, who granted them land near Heliopolis, and permitted them to raise there a temple for their own worship. This contributed greatly to strengthen the Egyptian Jews as a party, and their importance did not cease until the temple was closed, not long after the destruction of that of Jerusalem.

Ptolemy VII., Physcon.

The reign of Physcon (B.C. 146) presents a dark contrast to that of his predecessor. He immediately took the crown from his brother's son and rightful successor, who had been proclaimed king by his mother Cleopatra. Having married her, Physcon put her son to death on the very day of the nuptials; and the greatest barbarity was shown towards his subjects. He next repudiated his wife, to marry his niece and stepdaughter, her younger daughter, Cleopatra Cocce. At length, the people, indignant at his cruelty and oppression, rose and forced the tyrant to take refuge in Cyprus

Cleopatra.

His repudiated queen, Cleopatra, was set up in his stead, and he revenged himself by murdering the son he had by her. The queen and the Egyptians sent an army to oppose one which Physcon had despatched against them, but their force was defeated on the eastern border of Egypt. Cleopatra sought aid of Demetrius II., king of Syria, who had married her eldest daughter; but that prince was unable effectually to assist her, being recalled after he had marched to Egypt by a revolt at Antioch. The queen had no resource but to flee to Syria, and Physcon recovered his throne

Ptolemy VII., Physcon, again.

(B.C. 127). He soon found occasion to punish Demetrius, by setting up an impostor, Alexander (II.) Zebina, who defeated and put to death the king of Syria. Ptolemy then made peace with Cleopatra, who came again to Egypt, and was honourably treated as the sovereign's sister and former queen. He then supported Antiochus Grypus in regaining his father's kingdom by the overthrow of Alexander. At last his long reign came to a close, to the great joy of his subjects; and Egypt was relieved from one who was perhaps the worst sovereign who ever ruled that unhappy country. He was ambitious, extremely cruel, intemperate, and debauched; and, though not an enemy to literature, could not pardon the political offences of its professors.

Ptolemy VIII., Lathyrus, and Cleopatra Cocce.

Ptolemy Lathyrus succeeded his father (B.C. 117), ruling jointly with his mother, the ambitious and cruel Cleopatra Cocce. The kingdom of Cyrene had been already given by Physcon, at his death, to his natural son Ptolemy Apion; and the island of Cyprus was given to Ptolemy Alexander, the younger brother of Lathyrus, who afterwards made it a monarchy. Cleopatra next expelled Lathyrus, because he would not be governed by her, and he took possession of the kingdom of Cyprus, while Alexander gained the throne of Egypt (B.C. 107).

Ptolemy IX., Alexander I., and Cleopatra Cocce.

Lathyrus was soon invited to support cities on the coast of Palestine against Alexander Jannæus, the king of Judea, and he conducted a successful campaign, in which he defeated the army of Jannæus in a sanguinary conflict. His mother Cleopatra, however, having taken vigorous measures, and accompanied one of her armies into Palestine, checked the successes of Lathyrus, and ultimately both sovereigns retired to their own dominions. The armies of Cleopatra were led by two Jewish generals, Chelcias and Ananias. Ptolemy Alexander, finding that he possessed nothing but the shadow of sovereignty, fled from Egypt. Cleopatra endeavoured to persuade him to return, while she laid a plot for his life, which he met with a counter-plot, and, as he arrived in Egypt, his mother was murdered (B.C. 90). After a brief rule the parricide was driven out by the Alexandrians, and at length slain in a combat with the fleet of Chæreas, an admiral of Lathyrus. Little need be said of the character of Cleopatra Cocce, and that of her younger son Alexander I., but that the former was as strong in character as the latter was weak, while both excelled in wickedness. The history, indeed, of the later Ptolemies and Seleucidæ presents an appalling picture of cruelty and vice, to which we can scarcely find a parallel.

Ptolemy IX., Lathyrus, restored.

Ptolemy Lathyrus was recalled from Cyprus to fill the throne left vacant at his brother's flight (B.C. 89). The most memorable event of this part of his reign was the revolt of Upper Egypt. The misrule of the preceding sovereigns had aroused the natives to make a fresh effort for their independence. Ptolemy marched against them, defeated them in battle, and laid siege to the ancient city of Thebes, their stronghold. The insurgents offered a desperate resistance, and for three years was the city beleaguered in vain. At last it was taken, and the bravery of its defenders punished by its being sacked and destroyed. Even the temples were not spared; and while we deplore the damage that they sustained during the siege and at the razing of the town, we are not displeased to find such records of a noble resistance in structures commemorating the ancient glories of the race. Nothing else worthy of notice marked the later years of Lathyrus, who left the reputation of an able and warlike, but cruel king.

Cleopatra or Berenice.

The daughter of Lathyrus, and widow of his brother Alexander, Cleopatra or Berenice, succeeded her father (B.C. 82); but her rule was of very short duration, for her step-

Ptolemy X., Alexander II.

son, Ptolemy Alexander II., was sent from Rome by Sylla to assume the crown and marry Cleopatra. On the day of the nuptials he murdered the unhappy queen, after she had governed about half-a-year. This crime aroused the indignation of the king's guards, who deservedly punished it with death. It is most probable that this was the Ptolemy who left his kingdom to the Roman people, whose patronage he had enjoyed, by his will; but motives of policy prevented their grasping at once at the prize.

Ptolemy XI., Auletes.

Ptolemy Neus Dionysus, commonly known by the surname which was given him of Auletes, or the Flute-player, next ascended the throne (B.C. 81). The first part of his rule was passed in tranquillity, but he earned the dislike of his subjects by a vicious and disorderly life, until, in the twenty fourth year of his reign, he found himself obliged to flee from Egypt (B.C. 58). The immediate cause was perhaps

Egypt.

the seizure of Cyprus by the Romans, who dispossessed his brother Ptolemy, king of that island, and made his dominions a Roman province. The Egyptians, incensed at this exercise of grasping ambition, pressed Auletes to demand the island, which had been ruled by the preceding kings of Egypt or a prince of the family, and, in the event of a denial, to declare war against the Romans. On the king's refusal to adopt this line of policy, a revolt was excited, and he fled to Rome from Alexandria. Immediately that the king had left, his wife and daughter, Cleopatra Tryphæna and Berenice, were chosen to succeed him as joint sovereigns. After having ruled for a year, Cleopatra died, and Berenice married Seleucus, surnamed Cybiosactes, or the Scullion, the son of Antiochus Grypus. He was soon murdered, by his wife's orders; and she took a second husband, Archelaus, who pretended to be a son of Mithradates[1] the Great, king of Pontus. Having reigned two years more, she lost her power and her life on her father's restoration, which thus happened: Auletes had previously learned by experience that the great Roman aristocrats were not insensible to the effects of bribery, and on reaching Rome he occupied himself in securing by this means the interest of the chief senators. Although he was thus far successful, various difficulties arose which prevented his gaining the assistance of a Roman army until his exile had lasted for three years, which he spent at Rome and Ephesus. He then went to Syria, being strongly recommended by Pompey to the proconsul Gabinius, and supported his proposals with an enormous bribe of ten thousand talents. Gabinius, taking the king with him, marched against Egypt, defeated the army which opposed his passage, subjugated the country, and restored Auletes (B.C. 55), who at once put his daughter to death. In this expedition, Mark Antony served as an officer of Gabinius, and thus visited the country which was to witness his future greatness and fall. From this time Ptolemy Auletes ruled without opposition until his death, which occurred in the year B.C. 51. He left his kingdom to the joint government of his eldest children, Cleopatra and Ptolemy, whose rights he trusted to the protection of the Roman people. Pothinus, the governor of Egypt, did not, however, scruple to set aside Cleopatra, and make Ptolemy sole sovereign under his tutelage. Cleopatra, although but about twenty years of age, acted at once with a vigour that was worthy of the better times of the Ptolemies; and having fled into Syria, succeeded in bringing together an army, with which she advanced to Egypt in the second or third year after her father's death. Ptolemy's army was sent to Pelusium to oppose her entrance, and, at this important juncture, Pompey, fleeing from the fatal field of Pharsalia, landed on the Egyptian shore, and put himself in the hands of Ptolemy's ministers. Forgetful of the benefits which Auletes had received from the great Roman in his exile, and in defiance of their plighted words, they murdered the guest—affording by this crime one of the many instances of the utterly corrupt state of the ruling class at that period. Cæsar had lost no time in pursuing his vanquished rival; and not long after, disembarked with a small but efficient force of four thousand men at Alexandria. Being now rid of his fears of Pompey, he set himself to arrange the affairs of Egypt. The army led by Achillas, which had been sent against Cleopatra, returned to Alexandria, and closely invested that part of the city which was held by Cæsar's force. A sanguinary contest ensued, in the course of which the famous Library perished by fire, and thus the learning which had formed the chief ornament of the capital received a fatal blow. Notwithstanding the smallness of his army, Cæsar was able to maintain his position, and was strengthened by the arrival of Cleopatra, who reached Alexandria in disguise, having left her army near Pelusium. The attractions of the young queen had at once engaged Cæsar in her favour, and he had determined to make her sole ruler, to the prejudice of her brother. Ptolemy, feeling himself to be unjustly used, determined to regain the throne by arms; and a war ensued, which lasted for several months, until, on the arrival of reinforcements to Cæsar's army, the young king was vanquished, and perished by drowning in an engagement, probably near the sea-coast (B.C. 48 or 47). Not long after this, Cæsar left Egypt, having established the power of Cleopatra, with whom he associated in the government her young brother Ptolemy, who was then betrothed to her at a tender age. Egypt was so thoroughly reduced to order by these measures that Cleopatra did not fear to leave the country, and reside for a time at Rome with Cæsar, whence she returned subsequently to his murder. Shortly afterwards, it is believed—but this is not certain—she put young Ptolemy, her brother and nominal husband, to death, fearing that he would become too powerful for her. Cleopatra did not take any decided part in the struggle for power which followed the murder of Cæsar, and on the fall of Brutus and Cassius, Antony summoned her to Tarsus, to explain this ambiguous course (B.C. 41). Mark Antony was as easily vanquished as Cæsar had been by the captivating queen of Egypt. Thenceforward Antony and Cleopatra ruled together, and the events of this period belong rather to Roman history than to Egyptian. The chief part of this time, in which a great empire might have been consolidated, was spent by Antony in pleasure and vice; and by degrees he lost his influence over his fellow-countrymen, which passed into the hands of the politic Octavianus. Defeated in the one naval fight at Actium (B.C. 31), Antony was forsaken by his former courage, and fled with Cleopatra to Egypt. When Octavianus invaded the country, they offered no adequate resistance; and both, in despair, perished by their own hands—Antony, partly because Cleopatra had given out that she was dead, Cleopatra, partly because Antony had perished; but both, also, to escape that treatment which they knew they would receive at the hands of their heartless conqueror. So ended the great Dynasty of the Lagidæ, after having endured for nearly three hundred years. Cleopatra was not unworthy to be the last of that great line, whose virtues and faults she combined in a high degree. In person she does not seem to have been very beautiful, but rather excelling in grace of manner and every winning art. Busts and coins would lead us to the former supposition, and the latter would naturally follow. Her knowledge was extensive, and she was acquainted with many languages. Literature and science met with her encouragement; and she endeavoured to restore the Library of Alexandria, by having transported thither the rival collection of the kings of Pergamus. Ambition was her ruling passion, and to it she sacrificed her maidenly honour and the ties of relationship. Although she was famous for the luxury of her court, it is most probable that she maintained that manner of life rather to govern those who governed the world, and to display her magnificence, than for pleasure's sake. The princess who ruled, not alone the affections, but the fierce wills of Julius Cæsar and Mark Antony; who upheld a tottering monarchy, and made those who subdued it raise it to an empire; who fell at last through the strange weakness of Antony, and the treachery of his followers, and feared not to die by her own hand, must take rank among the greatest of historical characters. The Ro-

Marginal notes: Cleopatra Tryphæna, and Berenice. — Ptolemy XI., Auletes, restored. — Cleopatra and Ptolemy XII. — Murder of Pompey. — Cæsar at Alexandria. — Cleopatra and Ptolemy XIII. — Cleopatra alone. — Rule of Antony and Cleopatra. — Battle of Actium.

[1] It is much to be regretted that the carelessness of ancient historians, or their copyists, should have introduced a false orthography of this name, which is now almost always written Mithridates. The inscriptions of ancient coins, for example, of the silver tetradrachms of Mithradates the Great, some of which bear a wonderfully fine portrait of this king, as well as the etymology of the name, warrant the adoption of Mithradates as the true form.

mans, who are ever ungenerous to their enemies, paint her character in dark colours, hating her because she governed their fairest provinces and their most renowned generals. But if we remember in what court she was trained, and consider the manners of that time and country; if we extend to her faults that indulgence that many have granted to those of Cæsar and Antony; if we recollect her love of learning, and have paced the stately temples which she raised, we shall acknowledge her one of the greatest sovereigns of the ancient world, not inferior to Catherine of Russia, who, in a Christian country and an enlightened age, committed the same crimes, but met not with the same condemnation. Her death itself, praiseworthy according to the religion of those days, was

> ———"well done, and fitting for a princess
> Descended of so many royal kings."[1]

Egypt under the Romans. Augustus.

When Egypt thus fell into the power of Augustus (B.C. 30), its condition may be likened to what it was when Alexander acquired possession of the country. The internecine wars and misrule of the later Ptolemies had gradually lessened the good which their predecessors of the same line had effected. Taxation had increased, commerce had dwindled; and in one particular the future of Egypt was yet darker, for the three centuries of Greek rule had tended to weaken Egyptian nationality, by making the natives either Greeks or slaves. If Greeks, they scarcely looked to Egypt as their country; if slaves, they had no higher hopes than for a mild ruler. The system of government which Augustus introduced was not one tending to better the province and its inhabitants. It seems to have been framed so as to crush national feeling among either the Egyptians or the Greeks settled in Egypt, and to prevent the Roman prefect who governed the country from making use of its resources to render himself independent; and, at the same time, so as to carry out these objects without, as far as possible, diminishing the productiveness of the province. The prefecture and the most important of the inferior offices were given to Romans alone, the rest were held by Greeks or Egyptians. The country was garrisoned and protected by two legions, part of which was stationed beyond the frontiers, and by a small force of German horse. The new rulers at first imitated their predecessors, in causing temples to be built, or in adding to those which were already raised; but after the second century of Roman government, these and other public edifices were comparatively neglected.[2]

Ælius Gallus, the prefect.

Ælius Gallus, a prefect of Egypt under Augustus, made an unfruitful expedition against Arabia Felix, but was afterwards more fortunate in punishing an inroad of the Ethiopians. Gallus not only defeated the invaders, but in his pursuit penetrated to Napata, the capital of Candace, their queen, and captured that city. From this time no events of interest mark the history of the province until the reign of Vespasian.

Vespasian.

Under him the Jews of Egypt met with several persecutions. They had previously been embroiled with the Greeks at Alexandria, and had been on one occasion cruelly treated for refusing to worship the statue of Caligula. But in the reign of Vespasian their temple, which Onias had founded, was closed, and they did not escape some share of the treatment which their fellow-countrymen in Judea received at the hands of the Romans.

Trajan.

In Trajan's reign they revolted (A.D. 115-117), and were not subdued until much blood had been shed. Hitherto they had held equal privileges with the Greek inhabitants, but at this period they forfeited these advantages, and were afterwards considered to be no better than the native Egyptians. In the next reign the Emperor Hadrian, during his inspection of the provinces, visited Egypt (A.D. 130), as well as on a subsequent occasion (A.D. 134).

Hadrian visits Egypt.

He endeavoured to benefit the people by (as he himself says) renewing their old privileges and granting new ones.

Antoninus Pius. A Sothic Cycle commences.

In the reign of Antoninus Pius a Sothic Cycle commenced in the year A.D. 138, an event which is commemorated on the coins of Alexandria. The preceding great period had commenced B.C. 1322, when the kingdom of the Pharaohs was, under Sethee I., in its most prosperous state; and now, when the unchanged cycle again began its course, how changed was Egypt! The country was a province ruled by a race whose traditionary history ascends only to a time after Egypt had already declined, the people were enslaved, the religion was on its wane, the priestly learning well nigh gone, the arts and sciences forgotten by them who had taught them to the western world. The few who knew of the earlier cycle must have watched with a melancholy interest the birth of the present one, fearing that it would live to witness the ruin of all they revered, and the fulfilment of that prediction which has come down to us under the name of Hermes Trismegistus, describing the state of Egypt for many centuries past with a painful truthfulness. Another Sothic cycle began A.D. 1598, not long after the independence of Egypt had received its last blow, and that crushing despotism of Turkey had commenced which was to destroy not only the memory of the past and the happiness of the present, but the hope for the future.

Rebellion in reign of Marcus Aurelius.

After various troubles, principally occasioned by the turbulence of the Alexandrians and the inroads of barbarous tribes, a serious rebellion distinguished the reign of Marcus Aurelius. The prefect of Egypt, Avidius Cassius, having suppressed a serious revolt, assumed the purple (A.D. 175), and was acknowledged as emperor by the armies of Syria and Egypt. On the approach of Marcus Aurelius, the usurper was slain by his adherents, and his party at once gave way, and were treated by the emperor with the utmost clemency.

Pescennius Niger.

Not many years afterwards, Pescennius Niger, who commanded the forces in Egypt, was proclaimed emperor in the place of the murdered Pertinax (A.D. 193); but, after a short rule, was overthrown by his rival Severus.

Septimius Severus.

The new emperor, perhaps because Niger was chosen by the Roman army rather than by the Egyptian people, did not use severity towards the province; on the contrary, when he visited it he bestowed great privileges upon the Alexandrians.

The Christians persecuted.

Nevertheless, his reign was marked by the first persecution of the Christians of Egypt, the prelude to many others. Although we cannot be sure when Christianity was introduced into Egypt, it early obtained a numerous body of followers there, and by this period included among their number many of the learned and the powerful. The schools of Alexandria had gradually declined from the days of the earlier Ptolemies, until they had become the homes of sophistry and magic arts; but now the doctrines of the new religion raised a fresh class of learned men, and the very pagans gained knowledge by endeavouring to oppose them.

Caracalla.

In the next reign a great calamity befel the Alexandrians, for Caracalla, in revenge for an affront which they had offered him, signalized his visit by a wholesale massacre of the unfortunate citizens, and by other acts of tyranny.

Trajanus Decius.

Another persecution of the Christians occurred in the reign of Trajanus Decius (A.D. 250); and about the same period commenced those theological disputes which henceforward form the most remarkable subjects of the history of Egypt until the Muslim conquest. During

[1] *Antony and Cleopatra*, act 5, scene 2.

[2] The materials for the history of Egypt under the Romans are principally found in the works of the following writers: Abu'l Faraj (or Abulfaragius), Ammianus Marcellinus, St Athanasius, Cassiodorus, Epiphanius, Dion Cassius, Eusebius, Eutychius, Herodian, St Jerome, Josephus, Lampridius, Leontius, Lucian, Nicephorus, Philo Judæus, Pliny, Plutarch, Porphyry, Procopius, Ptolemy, Rufinus, Seneca, Socrates the ecclesiastical historian, Sozomen, Spartianus, Strabo, Suetonius, Tacitus, Tertullian, Theodoret, Theophanes, Flavius Vopiscus, and Zosimus, and in the *Chronicon Alexandrinum*.

Egypt.

Æmilianus.

the troublous reign of Gallienus, Æmilianus was proclaimed emperor by the troops at Alexandria; but after governing a short time with decision and activity, he was defeated and taken prisoner by the general of the forces of Gallienus. At the close of his reign, Zenobia, the ambitious queen of Palmyra, attempted to wrest Egypt from the Romans; but, although successful in a battle with the emperor's forces, her army was unable to gain possession of the country. Two years subsequently, Zenobia reduced Egypt to her rule, a little before her overthrow by Aurelian. Not long afterwards Egypt rose against Aurelian, and Firmus, who seems to have been elevated to the dangerous dignity by the native population, was proclaimed emperor (A.D. 272). In order to subdue this powerful rival, Aurelian led an army against him; and succeeded in accomplishing his overthrow. Probus, who had governed Egypt for Aurelian and Tacitus, was chosen by the troops in Egypt, at the death of the latter sovereign, as his successor, and speedily acquired the rest of the empire.

Zenobia conquers Egypt.

The reign of Diocletian ushers in a more prosperous period of Roman history, when stern military despots knew how to curb the turbulent soldiery, who had been so long used to make and unmake kings; but to Egypt the time of his rule was one of great misfortunes, marked by a serious rebellion and a terrible persecution. Early in his reign (A.D. 288) Egypt revolted, and Achilles was raised to the purple. A long struggle ensued, which was only terminated by the arrival of Diocletian, who took the strongholds of the rebels, and reduced the country, or at least the greater part of it, to obedience (A.D. 292). The chief of the insurgents, however, was not taken, and having again raised his standard after the emperor's departure, he gained possession of Alexandria. The revolt was of so important a character, that Diocletian returned to Egypt to quell it. Achilles having shut himself up in Alexandria, made a determined resistance; but at length the city was taken, and with his life he paid the penalty of his daring (A.D. 297). Several years after this, the cruel emperor published that famous edict against the Christians (A.D. 303), which caused one of the hottest of the persecutions that tried the faith and awakened the zeal of the early church. The events of that time of suffering belong to ecclesiastical history, but it should be mentioned here that from the commencement of this reign (A.D. 284), which they call the Æra of the Martyrs, the Copts reckon their chronology, looking back to this as the heroic period of the church in Egypt. Their traditions and history alike are full of narratives of the constancy of the holy men and women, of the monks and virgins, who suffered at this time, and of whom the world was not worthy. Would that the Coptic church—which has seldom fallen short of the early days of Christianity in steadfast adherence to its profession amidst many persecutions—had not lost the spiritual character of the primitive church. With the accession of the politic Constantine (A.D. 323) the persecution, which had continued until then with greater or less virulence, came to a close, and the Christians recovered their liberty, and were able even to hold themselves above the pagans. Then commenced the great Arian controversy, which was the means of bringing forward the zeal and abilities of St Athanasius, the greatest archbishop of Alexandria. Arius, who was a presbyter of the church of Alexandria, having first broached those doctrines which have since been known by his name, a controversy arose, which was referred to Constantine. The emperor wrote such a letter as one would write who adopted Christianity as a matter of expediency, and desired to use the church as a political weapon. He desired the disputants to cease from those questions, as though men of strong will or firm belief could thus keep their convictions to themselves, and refrain from propagating their opinions or defending their faith. The contest continued, and it became necessary to call a general council at Nicæa

Revolt of Achilles.

Edict against the Christians.

Constantine the Great.

The Arian controversy.

Council of Nicæa

(A.D. 325), where Arius and his party were condemned. Subsequently, however, Arius appealed to Constantine, who commanded St Athanasius (now archbishop of Alexandria) to re-admit him into the church. St Athanasius refused, and after some years was, by the emperor's influence, driven from his see and from Egypt. He returned after the death of Constantine (A.D. 338), being supported by Constantine II., but was afterwards again deposed by a council held by Constantius II. (A.D. 341). The feelings of the orthodox and the remonstrances of Constans induced Constantius to restore St Athanasius to the archiepiscopate (A.D. 349); but when that emperor had become monarch of all his father's dominions he determined to remove the obnoxious churchman, and forced him, after a manly resistance, to escape from a post where he could no longer continue without the prospect of being dragged thence by the soldiery. An Arian, George, was after a while forcibly installed in the vacant chair, and the orthodox experienced a cruel persecution. On the accession of Julian the Apostate, George fell a victim to the fury of a pagan mob, and St Athanasius returned to his see; but by an order of the emperor he was again banished. During the reign of Julian, the Christians of Egypt, although not actually persecuted, were treated with contempt, and all was done that could tend to weaken them and strengthen the pagan party. By Jovian St Athanasius was again recalled (A.D. 363), but in the following reign (that of Valens) he was once more deposed; but the emperor, probably yielding to the strong feeling of the people, who would have taken up arms to restore him, soon recalled him. At length he died in peace among his flock, and his memory is yet revered throughout Christendom, as that of one of the stoutest upholders of the faith in a time of great troubles. His firmness in refusing to obey the emperors against his conscience, his moderation in abstaining from maintaining himself by raising the people, his care for his flock whether among them or absent, and his patience when persecuted, all claim our admiration, and show us how it was that the Egyptians supported him with such an entire devotion. The emperor Valens appointed an Arian, Lucius, in his stead, and the orthodox again suffered a persecution at the hands of their opponents, supported by the authority of the state.

Egypt.

Julian the Apostate.

Death and character of St Athanasius

By Theodosius I. orthodoxy was not only restored, but paganism was abolished. The enforcement of the latter part of his celebrated edict caused disturbances at Alexandria, and the Christians seem to have exercised their power with somewhat of cruelty; but before we condemn them, we should remember what abominations had been practised under the name of religion by the Greco-Egyptians. At this time, however, it is very clear that much had already been done to corrupt the simplicity of the church in Egypt, and in particular monasticism had been carried to an extraordinary extreme. This is not the place in which to combat that institution, but it may be asserted, without fear of controversy, that when a large proportion of the population of a country take the monastic vows, and, fleeing from active life, establish themselves not as solitaries, but in settlements whether in the desert or in tracts otherwise uninhabited, we may fairly question the healthy condition of the church, and apprehend the injury to the state which has arisen from such practices in Tartary and China as well as other countries. During the weak reign of Arcadius, Egypt was agitated by religious strife, between those who held anthropomorphite doctrines, and the smaller party which maintained the opinions of Origen. In the next reign, that of Theodosius II., the archbishop Cyril and his adherents disgraced themselves by persecutions of the Jews and pagans. The former were expelled from Alexandria, and the latter maltreated, especially Hypatia the daughter of Theon, distinguished for her beauty as well as for her learning, whom the clergy inhumanly murdered, with, it

Theodosius the Great.

Monasticism.

Theodosius II. Cyril.

Egypt.

is said, Cyril's connivance or approval. To such lengths was intolerance carried by ascetic zeal.

Marcian. Separation of the Coptic church.

Under the Emperor Marcian, the serious religious dispute which caused the separation of the Coptic church attained its height. Dioscurus, the archbishop of Alexandria, supported a priest of the name of Eutyches, who had been excommunicated for asserting the Monophysite doctrine of the Egyptians. Indignant at this interference, the Greek bishops called an œcumenical council at Chalcedon, and not only condemned the Monophysites, but put Dioscurus and those who held the same opinions beyond the pale of the church (A.D. 451). A new archbishop of Alexandria, Proterius, was installed by force of arms and not without a vigorous resistance, but after the emperor's death he was murdered by the people of Alexandria. The Monophysites were, however, again put down, and for a time the orthodox party remained in undisturbed possession of the supreme authority. The Emperor Basiliscus, himself a Monophysite, restored the Egyptian party to power, but on his death, two years afterwards, troubles recommenced; after a time, however, the Alexandrians triumphed, and Zeno granted them the right of choosing their own patriarch.

Council of Chalcedon.

Basiliscus.

Zeno.

Byzantine empire.

The commencement of the Byzantine empire, which is rather a chronological epoch than a turning-point in history, caused no changes in the condition of Egypt. The first sovereign, Anastasius, did not disturb the ecclesiastical system which he found in force, and the Egyptian or Jacobite party were unmolested during his reign. Although thus exempt from ecclesiastical troubles of any magnitude, Egypt was a prey to the forces of an invader. The Persians (A.D. 501) ravaged the country and menaced Alexandria, but being manfully opposed, retired at length, leaving cruel traces of their pillage. In the reign of Justin I., troubles in the church again arose, the emperor desiring to establish an orthodox archbishop, and the strife thus kindled continued through his reign. Justinian I., although he showed himself in many respects an able sovereign, had not the wisdom to see that a tyrannical policy in religious matters could only tend to estrange his Egyptian subjects. Accordingly he appointed an orthodox or Melchite bishop, who was followed by another; but the latter was expelled by the Alexandrians. Upon this the emperor sent Apollinarius as patriarch and prefect, with an armed force by which to establish himself. By opposing violence to violence he succeeded in putting down his opponents, but his conduct would not have been justifiable in a governor and was atrocious in a churchman. The reign of Justinian I. is further marked by the final closing of the philosophic schools throughout the empire, and the departure of the last of that long line of learned men to whose industry we owe so much.

Anastasius.

Persian invasion.

Justin I.

Justinian I.

Closing of the philosophic schools.

The first event of great importance after this was the invasion and subjugation of Egypt by the forces of Chosroes, or Khusroo Parvez, in the reign of Heraclius. In the course of those brilliant campaigns by which the king of Persia stripped Heraclius of all his eastern provinces as far as the Bosphorus itself, one of his armies entered Egypt, and reduced the country without opposition[1] (A.D. 616). This success was owing no less to the enmity of the Jacobites for the Melchites than to the weakness of the empire, as was the subsequent Muslim conquest. The Persians had the good sense to perceive that their rule would be strengthened by favouring the native party, and, accordingly they raised a Jacobite, Benjamin, to the patriarchate, from the office of bishop of the Alexandrian Monophysites. After a few years of peaceful government, reverses overtook the Persians, and Egypt again fell under the dominion of Heraclius, who restored the orthodox party, but before the close of his reign the country was conquered by the Arabs, and was never again a province of the Byzantine empire.

Heraclius.

Condition of Egypt under the Romans, and causes of its decline.

A review of the history of Egypt under the Romans presents a melancholy prospect of rapid decline, with scarcely a single time of prosperity to enlighten its dreariness. The main cause of this must have been the national character of the Romans, who, although they conquered bravely, held firmly, and governed wisely, cared alone for the outward welfare of the provinces. They sought not to inquire into the early history and former greatness of a state they ruled, except to draw out its physical resources and increase its commercial activity. Thus they did nothing to raise the character of the native Egyptians, whose affections were still occupied with the story of their former power and the remains of their ancient religion. While the Romans thus neglected the Egyptians, policy made them treat the Greeks but little better, except that they allowed them somewhat greater privileges, probably to make their influence balance that of the far more numerous Egyptians, and thus aid in maintaining a divided interest in the country. In addition to this, Egypt was weakened by the exactions of the governors and other officials. Internal causes, moreover, had no little share in producing the decline of the country. The people of Alexandria, uniting the discontent of the inhabitants of a degraded capital, with the ambition of men of letters, and the restlessness of an active commercial population, were constantly involved in dissensions among themselves and with their rulers, which became graver with the decline of the empire; while the native Egyptians, more and more oppressed and subject to the incursions of nomad tribes, relapsed into barbarism, but regained somewhat of their ancient courage. Hence arose revolts which were quelled with difficulty, and which had they been directed by military genius, and supported by an undivided people, would have restored the independence of Egypt. When Christianity acquired the ascendancy, religious contests took the place of political strife, until they became intimately connected with politics in the resistance of the Egyptians to the doctrines of the orthodox. Then national spirit was aroused, and the Greek and Roman parties, now formed into one, had to oppose the feeling of the whole country. The emperors generally acted with a short-sighted policy, and supported the foreign minority by employing force. It was found necessary to intrust the protection of the country to Greek or Roman soldiers alone, and thus when first the army of Khusroo and then that of 'Omar invaded Egypt, hatred for the Greeks, and the inability to defend themselves, rendered its subjugation comparatively easy.

Conquest by the Arabs.

In the year 639 of our era, the eighteenth of the Flight,[1] Egypt was invaded by the Muslims under the celebrated 'Amr Ibn-El-'A's (or, as some of the Arabian historians write it, El-'A'see). Entering the country from Syria, at the head of only 4000 men, he besieged Pelusium, and took it after thirty days. This town was still considered the key of Egypt on the Syrian frontier, and its capture was therefore an important advantage which opened the country southwards to the Arab general. He marched thence to 'Eyn-Shems, the ancient Heliopolis, where he found the Greeks collected in force, and commanded by John Mukowkis, or rather John the Mukowkis, or Gureyg the Mukowkis,[2] the governor

Battle at Heliopolis.

[1] The years of the Muslim era are generally used in this portion of the history, as they are more convenient to oriental scholars, and are often impossible to convert with exactitude into the corresponding years of our era, when the month in which an event took place is not specified. The principal dates are, however, given according to both methods of computation.

[2] According to the Kámoos, "the Mukowkis is a certain bird having a ring of black upon white, like the dove or pigeon; also, Gureyg (in some copies Gureyh) the son of Meenè (in the printed edition "Meenee"), el-Kibtee (i. e., the Copt), the governor of Misr and Alexandria, and the surname of every one who held dominion over these two cities." Thus a kind of ring-dove seems to have been the symbol of the governor of Egypt under the Greeks, like as the hawk was the symbol of the Pharaohs. Gureyg may be written Jureyj; and it is necessary to remark here that as the Arabic letter corresponding to the English g and j is pronounced hard in Egypt, it has been so written in this article, except when occurring in foreign names.

of Memphis, a native Egyptian. They offered a vigorous defence, but were put to the rout, and 'Amr advanced to the banks of the Nile and laid siege to Egyptian Babylon, a fortress of great strength, and garrisoned by a Roman legion. Here he received a reinforcement of 4000 Muslims, and after a protracted siege of seven months, he took the place by assault.[1] In an enemy's country, and far from all supplies, the small army of the Arabs was still in a critical position, and unable to push on against the capital, Alexandria, when the enmity of rival Christians and the perfidy of Mukowkis decided the balance in their favour. The persecutions which the Copts had suffered had greatly embittered them against the Greeks; and, as Gibbon observes, had "converted a sect into a nation, and alienated Egypt from their religion and government." Mukowkis, who governed Memphis, was in heart a Monophysite, and had also withheld the tribute due at Constantinople; and both he and his Coptic brethren, after the first resistance, hailed the new invaders as their deliverers from the Greek yoke. On the fall of Babylon they entered into a treaty with the Arabs, engaging to pay to them a poll-tax of two deenârs on every adult male, and agreeing to furnish them with supplies and assistance while completing the subjugation of the country. Having concluded this treaty, and founded the city of El-Fustât, on the site of his first encampment on the banks of the Nile, with the mosque known by his name, 'Amr marched against Alexandria; and after overcoming many obstacles, and disputing the whole way with the Greeks, who conducted their retreat, in the face of a victorious army, with great ability, in twenty-two days he appeared before it. Fresh warriors continued to arrive from Syria to strengthen the besieging force; but the defence was as obstinate as the attacks of the Muslims were brilliant, and was protracted for fourteen months. At length, on the 22d December 640,[2] the metropolis of Egypt, the first city of the East, capitulated; but it is said that this conquest was only achieved with the sacrifice of 23,000 Muslims. Abu-l-Farag relates that 'Amr, wishing, at the earnest request of John the Grammarian, to spare the famous Library, wrote to the Khaleefeh 'Omar, asking his instructions respecting it; and that he answered: "As to the books you have mentioned, if they contain what is agreeable with the book of God, in the book of God is sufficient without them; and if they contain what is contrary to the book of God, there is no need of them; so give orders for their destruction." The historian adds, that they were burnt in the public baths of the city, and in the space of six months were consumed.[3] The conquest of the rest of Egypt was soon effected, and the various strongholds successively fell into the hands of the conquerors. Bahnesè (Oxyrhynchus), a town of Middle Egypt, is stated to have withstood 16,000 Arabs for several months, and to have cost them 5000 of their number.[4]

Siege of Alexandria.

Arab lieutenants.

'Amr governed the country with much wisdom for four years, but was dismissed by 'Othmân, who appointed in his place Abd-Allah Ibn-Abee-Sarh. The latter reduced Alexandria, which had been retaken by the Emperor Constans II., and pushed his conquests beyond Africa Propria. He died at Ascalon, in the year 35, having governed eleven years.[5] His successor's rule was short, and the next viceroy, Mohammad, son of the Khaleefeh Aboo-Bekr, on assuming the reins of government, acted with such tyranny towards the followers of 'Othmân, that Mu'âwiyeh was compelled to despatch 'Amr to Egypt with a force from Syria, and a great battle was fought between the two armies of Muslims, in which Amr was again victorious. As a reward for this service, he was a second time appointed governor of Egypt, and he died there in the year 42.

From this time to A.D. 868, or for rather more than two centuries, Egypt was governed by a succession of viceroys, appointed by the Khaleefehs of Damascus and Baghdâd, Their period was distinguished by intestine troubles, and a constant change of rulers, resulting from the caprice of the Khaleefehs, or the vicissitudes of their fortunes. Here we may mention, that shortly after the overthrow of the Umawee Dynasty of Damascus, and the accession of the House of Abbâs, which ruled at Baghdâd, the city of El-Askar, immediately to the north-east of El-Fustât, was founded, and the seat of government removed thither. The site is without the walls of modern Cairo, and is marked by extensive mounds of rubbish.

Dynasty of the Benee-Tooloon. Ahmad Ibn-Tooloon.

In A.D. 868 (A.H. 254) Ahmad, the son of Tooloon, a Turkish slave who held a high office at Baghdâd, was appointed governor of the province of Misr by the Khaleefeh El-Moatezz, and not long after of that of Alexandria also, by his successor El-Muhtedee. After a rule of about a year as viceroy, in self-defence he threw off his temporal allegiance to the Khaleefeh and proclaimed himself sovereign of Egypt; but at the same time he endeavoured to avoid a complete rupture by continuing the prayer for the Prince of the Faithful in the mosques, and the mention of his name on the coins which he struck.[7] Later in his reign, however, he forbade the mention of the Khaleefeh's brother and colleague, El-Muwaffik, in the prayers and state-documents of Egypt, and El-Muhtedee, who was a weak prince, was prevailed on to denounce him publicly as a traitor from the pulpits throughout his dominions. Yet that he secretly favoured him is proved by his vain attempt to escape to Egypt from the tyranny of his warlike brother. Ahmad founded the Dynasty of the Benee-Tooloon, which lasted for a period of 37 years, and consisted of princes of his own family. He built the royal city of El-Katâë', between El-Askar and Mount Mukattam, enriched it with splendid buildings and constituted it the seat of his government. Its site is now covered with ruins, only his great mosque remaining, a proud example of his wealth and magnificence, still the largest mosque of Cairo, and curious as presenting the earliest specimens of the pointed arch. The reign of this vigorous and wise prince was remarkable for prosperity at home and conquests abroad. He took El-Barkah, and in Syria, in 264, captured Hims, Hamâh, and Aleppo; after which he proceeded to Antioch, and the governor refusing to surrender, he took that city by storm. He then advanced towards Tarsus, but his supplies failing, he was compelled to retire. About five years later Bedr-ed-Deen Lulu, his deputy, and governor of Aleppo, Kinnasreen, and Hims in Syria, and of Diyâr Mudâr in Mesopotamia, re-

[1] Abu-l-Fidà, *Annales Muslemici*, ed. Reiske. El-Mekeen (*Elmacin Historia Saracenica*).

[2] El-Mekeen. Eutychius, *Annales*.

[3] This tradition is, we believe, only mentioned fully by Abu-l-Farag, but he was a Christian, and Muslim writers would consider it an occurrence of no importance. Abd-el-Lateef merely says, "here was the library which 'Amr Ibn-El-'A's burned by permission of 'Omar;" and El-Makreezee, speaking of Pompey's Pillar, says, "it is said that this pillar is one of those which stood in the portico of Aristotle, who there taught philosophy, and that his academy contained a library which 'Amr Ibn-El-'A's burned by direction of 'Omar." See the *Englishwoman in Egypt*, vol. i., p. 40, *et seqq*.

[4] Aboo-Abd-Allah Ibn-Mohammad El-Makkaree, MS. in the possession of Sir Gardner Wilkinson, cited in his *Modern Egypt and Thebes*, vol. ii., p. 473.

[5] El-Is-hâkee, MS.

[6] El-Makreezee in his *Kitâb el-Mawâ'idh wa-l-Iatibâr fee Dhikr el-Khitat wa-l-A'thâr*, MS.

[7] For an account of his coinage, and that of his successors, as well as of the Ikhsheedeeyeh, see a paper in the *Numismatic Chronicle*, vol. xvii., No. lxv., p. 116, *et seqq.*, July 1854; and plate in No. lxvi.

volted and entered into a league with El-Muwaffik. It was apparently in an expedition against this rebel that Ahmad died, at Antioch, in the year 270.

Khumâraweyh.

Khumâraweyh, on the death of his father, was appointed his successor by the army, he being then twenty years old, in the days of El-Moatemid bi-llâh, and he inherited a kingdom extending from the Euphrates to Nubia. He fought a battle with the forces of the Khaleefeh, commanded by a son of El-Muwaffik (afterwards the Khaleefeh El-Moatedid), between Damascus and Ramleh; in which his army gained the victory, although, if we may believe Abu-l-Fidâ, he himself fled the scene of action in a panic, and his troops continued the fight without him. Ibn-Khallikân says that, when El-Moatemid died and El-Moatedid succeeded him, Khumâraweyh hastened to him with presents and asked him to marry his daughter, Katr-en-Nedâ, whose name was also Asmá, to El-Muktefee bi-llâh, son and appointed successor of El-Moatedid; but that El-Moatedid said, "Nay, but I will marry her to myself;" and, the biographer adds, this, they say, he did to impoverish Khumâraweyh, in which he succeeded.[1] In 281 he made an incursion into the Greek territory, and died in the following year. It is said that he was fearful of assassination; to avoid which he had trained a lion to guard him when asleep.[2] His fears were justified; for he was put to death by his women, or, according to some, by his eunuchs, at Damascus.

Geysh.

His son, Geysh Abu-l-Asâkir, succeeded him. This prince was killed in about eight months; his youth, which rendered him unfit to govern, occasioned his fall; for he had discarded from his society those who were in favour with his father, and associated with none but worthless men. He was succeeded by his brother, Hâroon, the principal events of the period of whose rule were a great tempest and earthquake in Egypt in 286, and a treaty which he concluded with the Khaleefeh, by which the provinces of Awâsim and Kinnasreen were ceded to him.[3] He reigned upwards of eight years, but gave himself up to pleasure, and was put to death by his uncles Sheybân and 'Adee, sons of the founder of the dynasty, the former of whom usurped the government.[4] In the meantime, at the instigation of the generals of Hâroon, Mohammad Ibn-Suleymân, a scribe of Lulu, advanced against him with a numerous and heavily-equipped army. Sheybân went forth to meet him with all the forces he could muster, but numbers of his troops deserted to the invader, and he was soon overthrown.[5] Mohammad Ibn-Suleymân burned El-Katâe' and sacked El-Fustât, reducing the women to slavery, committing many atrocities, and exiling the family of Ahmad Ibn-Tooloon, with all their adherents[6] (A.H. 292.)

Hároon.

Egypt subjugated by the Abbásees.

Arab lieutenants.

Having thus completed his conquest, and restored the province of Egypt to the House of Abbâs, Ibn-Suleymân yielded the government to 'Eesâ Ibn-En-Nósharee, appointed by El-Muktefee. He died in 297, and was followed by Tekeen El-Gezeree, under whose rule Egypt was invaded by the forces of Abd-Allah El-Mahdee, first prince of the Dynasty of the Fâtimees (or Fawâtim, that being thé plural of Fâtimee), which had succeeded the Benee-Aghlab in the dominion of Northern Africa. His general, Hubâsheh, having taken El-Barkah, advanced with an army of 100,000 men to Alexandria, where Tekeen, reinforced with troops from El-Irâk, give him battle, and defeated him in a sanguinary conflict.[7] In the following year he was succeeded by Abu-l-Hasan Zekee El-Aawar Er-Roomee, in whose time El-Mahdee again attempted the conquest of Egypt with an army under the command of his son, Abu-l-Kâsim Mohammad; Alexandria fell into his hands in 307; its inhabitants fled to Misr, and the governor entrenched himself in El-Geezeh, on the opposite or western bank of the Nile, and shortly afterwards died. In this emergency Tekeen was reinstated in his office. He immediately strengthened El-Geezeh with a second moat, and intercepted the forces of El-Mahdee by the river; and being reinforced by 3000 men from Baghdâd, under Moonas the Eunuch, he gave battle to Abu-l-Kâsim in the Feiyoom and at Alexandria, and drove him back to El-Barkah.[8] After rendering this important service, Tekeen was again recalled, and Hilâl Ibn-Bedr appointed governor; but the troops revolting, and much sedition and rapine ensuing, he was once more despatched to Egypt, where he remained until his death in the year 321.[9]

Unsuccessful invasion by El-Mahdee.

He was followed by Mohammad El-Ikhsheed Ibn-Taghag Aboo-Bekr El-Farghânee, afterwards the founder of the Dynasty of the Ikhsheedees, who was almost immediately superseded by another governor; and for one year more Egypt continued to be a province of the Khaleefehs of Baghdâd. In the year 323 El-Ikhsheed again succeeded to the government. About this time little remained to the Khaleefeh of his once broad empire beyond the province of Baghdâd, and even there his power was but nominal, for Er-Râïk there, as well as in Wâsit and El-Basrah, held the entire authority. Khoozistân, Persia, Kermân, Rei, Ispahân, El-Mosil, and the provinces of Mesopotamia, were either in a state of revolt, or nearly or wholly lost to him. Spain was governed by the Dynasty of Umeiyeh, and Africa by that of El-Mahdee; and we have seen the distracted state of Egypt since the fall of the Benee-Tooloon. El-Ikhsheed availed himself of these circumstances to throw off his allegiance, and possess himself of Egypt and Syria; continuing, however, to acknowledge the spiritual supremacy of the Khaleefeh. Shortly after he defeated the forces of El-Mahdee, who had again made an inroad into the country: and in 327 he was confirmed in his government by Er-Râdee.[10] In the following year Er-Râïk subdued a great part of Syria, and, having taken Damascus, advanced to the frontier of Egypt, where, after a very severe engagement, he was utterly routed, and pursued by the troops of El-Ikhsheed as far as Damascus. There, however, the fortune of war turned against El-Ikhsheed, and for a time he was deprived of the province of Syria, though he subsequently regained possession of it. During his reign, the Khaleefehs of Baghdâd were daily losing power, and, in the year 333, El-Muktefee wrote to him lamenting his miserable state; whereupon El-Ikhsheed immediately repaired to him at Rakkah with valuable presents, and offered him assistance, and an asylum in Egypt. About this time, also, he conducted a war with various success against Seyf-ed-Dowleh of Hamadân, who had attacked Syria. He died at Damascus in 334, in the 66th year of his age,[11] and was buried, as were

Dynasty of the Ikhsheedees. Mohammad El-Ikhsheed.

[1] Ibn-Khallikân, *Kitâb Wefâyet el-Aayân wa-Anbâ Abnâ ez-Zemân*, *voce* Khumâraweyh; ed. De Slane, Paris.

[2] El-Is-hâkee.

[3] El-Mekeen, Abu-l-Fidâ.

[4] El-Is-hâkee, El-Mekeen.

[5] According to Abu-l-Fidâ, Sheybân only assumed the command of the army when Hâroon fell in the battle endeavouring to rally his troops.

[6] El-Is-hâkee. El-Makreezee's *Khitat*.

[7] El-Is-hâkee. Of this expedition, Abu-l-Fidâ relates (in the events of the year 301) that it was commanded by Abu-l-Kâsim, who took Alexandria and the Feiyoom, but was repulsed by Moonas the Eunuch, whom El-Muktadir had despatched against him; and, in the events of the year 302, he says that El-Mahdee sent another expedition to Egypt by sea, that Alexandria was taken, and that he was again defeated by Moonas, and driven back with great loss.

[8] Abu-l-Fidâ says that this expedition was commanded by El-Kâïm, who, having proceeded to El-Geezeh, passed on to El-Ashmooneyn and subdued a great part of Upper Egypt, and being well supplied by sea, kept up the war with vigour; but that reinforcements having reached Egypt of twenty-five sail from Tarsus, Moonas gave him battle by sea and land on the same day, and completely routed his forces.

[9] El-Is-hâkee.

[10] *Id.*

[11] Abu-l-Fidâ.

Egypt.

all the princes of his dynasty after him, in the mosque of 'Omar at Jerusalem.[1]

Abu-l-Kásim and Abu-l-Hasan 'Alee.

Of El-Ikhsheed's two sons and successors, Abu-l-Kásim and Abu-l-Hasan 'Alee, little is known; their wezeer Káfoor, a black eunuch, being the actual ruler. In the reign of the former, in the year 343, a great fire occurred in El-Fustát, which destroyed 1700 houses and much merchandise. Káfoor succeeded to the throne in 355, and was acknowledged throughout Egypt, Syria, and the Higáz. He ruled with great ability, and was a patron of literature: his name is celebrated by the poet El-Mutanebbee, who was his boon companion, and whom, as well as other learned men, he rewarded with magnificent presents. On his death internal dissensions respecting the succession of Abu-l-Fowáris, a son of 'Alee, presented a favourable opportunity to the Fátimee Khaleefeh to renew the often-repeated invasions of Egypt.

Káfoor.

Hitherto, with few exceptions, the most notable of which are the reigns of Ibn-Tooloon, Khumáraweyh, El-Ikhsheed, and Káfoor, the Muslim rulers of Egypt had not much benefited the country, or rescued it from the anarchy and troubles in which it had become involved under the Lower Empire. But the incidents of the time are so little known as to have been deemed worthy of more mention in this article than perhaps their importance would otherwise warrant. From the period at which we have now arrived, however, the annals of Egypt contain much important matter, and are so closely interwoven with the events of the Crusades as to render them deeply interesting to the student of European history. The rise of the schismatic Khaleefehs of Africa is a remarkable episode in the early days of El-Islám, and most of the princes of that dynasty were not unworthy of their successors, the renowned Saláh-ed-Deen and his family, or of the Memlook Sultáns.

Conquest by El-Mo'izz.

In the year 358 El-Mo'izz li-deeni-lláh, the fourth Fátimee Khaleefeh, equipped a large and well-armed force, with a formidable body of cavalry, the whole under the command of Abu-l-Hoseyn Góhar el-Káïd, a native of Greece, and a slave of his father El-Mansoor. This general, on his arrival near Alexandria, received a deputation from the inhabitants of El-Fustát, charged to negotiate a treaty. Their overtures were favourably entertained. and the conquest of the country seemed probable without bloodshed. But, while the conditions were being ratified, the Ikhsheedees prevailed on the people to revoke their offer, and the ambassadors on their return were themselves compelled to seek safety in flight. Góhar lost no time in pushing forward. Before El-Geezeh a partial combat took place: several days were passed in skirmishes, and at length he forced the passage of the Nile a few miles south of that town, at the head of his troops. Here the Ikhsheedees offered a brave resistance; the greater part were left dead on the field, and the remainder, taking what valuables they could carry off, fled from El-Fustát. The former mediators were now brought to intercede for the inhabitants and the women of the fallen dynasty, and, to the honour of the African general, it is related that they were pardoned, and the city was peaceably occupied. The submission of the rest of Egypt was secured by this victory; and all the Higáz, including the holy cities, and El-Yemen, speedily acknowledged the authority and supremacy of the Fátimee El-Mo'izz. In the year 359 Syria was also added to his dominions, but shortly after was overrun by the Karmatees; the troops of El-Mo'izz met with several reverses, Damascus was taken, and those lawless freebooters, joined by the Ikhsheedees, advanced to 'Eyn-Shems. In the meanwhile Góhar had fortified El-Káhireh[2] (the new capital which he had founded immediately north of El-Fustát), and taken every precaution to repel the invaders: a bloody battle was fought on Friday, the 1st of Rabeea el-Owwal, in the year 361, before the city walls, without any decisive result. On the following Sunday, however, Góhar obtained a great victory over the enemy, who experienced a reverse more complete than any he had before suffered, and the camp and baggage fell into the hands of the conqueror.

Foundation of El-Káhireh. Battle with the Karmatees.

At the earnest solicitations of his lieutenant, who had ruled Egypt both ably and justly, with almost absolute authority, El-Mo'izz at length determined to remove his court to his new kingdom. In Ramadán 362, he entered El-Káhireh, bringing with him the bodies of his three predecessors, and vast treasure. El-Mo'izz reigned about two years in Egypt, dying in the year 365. He is described as a warlike and ambitious prince, but, notwithstanding, he was especially distinguished for justice, and was fond of learning. He showed great favour to the Christians, especially to Severus, Bishop of El-Ashmooneyn, and the Patriarch Ephrem; and under his orders, and with his assistance, the church of the Mu'allakah, in Old Misr, was rebuilt. He executed many useful works (among others rendering navigable the Tanitic branch of the Nile, which is still called the canal of El-Mo'izz), and occupied himself in embellishing El-Káhireh. Góhar, when he founded that city, built the great mosque named El-Azhar,[3] the university of Egypt, which to this day is crowded by students from all parts of the Muslim world. The principal event of his reign in Egypt was the second irruption of Hasan the Karmatee. The enemy, as on the former occasion, reached 'Eyn-Shems; but now he gained more advantage over the African troops. Although twice defeated in different parts of Egypt, and constantly harassed in his advance, the capital was closely besieged by him, and its defenders were driven across the fosse. Thus straitened, El Mo'izz had recourse to stratagem, and succeeded in bribing Hasan Ibn-El-Garráh (who, with a body of the tribe of Tei, fought with the Karmatees) to desert them in the heat of the next battle. The result of this plan was successful, and again Hasan was defeated and compelled to flee. This event, which occurred in the year 363, relieved Egypt of another invader, an ally of Hasan, by name Abd-Allah Ibn-'Obeyd-Allah (formerly governor of Syria under Káfoor), and obtained for the arms of El-Mo'izz various successes in Syria.[4]

Foundation of the Azhar. Second invasion of the Karmatees.

El-'Azeez.

El-'Azeez Aboo-Mansoor Nizár, on his coming to the throne of his father, immediately despatched an expedition against the Turkish chief El-Eftekeen, who had taken Damascus a short time previously. Góhar again commanded the army, and pressed the siege of that city so vigorously that the enemy called to their aid the Karmatees. Before this united army he retired by little and little to Ascalon, where he prepared to stand a siege; but, being reduced to great straits, he purchased his liberty with a large sum of money. On his return from this disastrous campaign, El-'Azeez took the command in person, and, meeting the enemy at Ramleh, was victorious after a bloody battle, while El-Eftekeen, being betrayed into his hands, was with Arab magnanimity received with honour and confidence, and ended his days in Egypt in affluence.[5] El-'Azeez followed

War in Syria.

[1] El-Is-hákee.

[2] Modern Cairo. It was originally called El-Mansooreeyeh; El-Mo'izz, however, changed its name to that of El-Káhireh, by reason of an omen at its foundation. The *Khitat* contains a long account of the foundation of El-Káhireh, and of the three successive walls with which it was at different times encompassed. For details respecting this and the other capitals of Egypt under the Muslims, see the sketch in the *Englishwoman in Egypt*, vol. i., p. 124, *et seqq.*, in which the author has availed herself of the valuable MS. notes of Mr Lane.

[3] El-Is-hákee.

[4] For a detailed account of the reign of El-Mo'izz, see *Vie du Khalife Fatimite Moezz-li-din-Allah*, par Quatremère, Paris, imp. roy., 1837.

[5] Abu-l-Fidá. In 372 El-'Azeez again sent an army to Syria, and quelled a serious rebellion excited by El-Mufrig-Id.

his father's example of liberality. It is even said[1] that he appointed a Jew his wezeer in Syria, and a Christian to the same post in Egypt. These acts, however, nearly cost him his life, and popular tumult obliged him to disgrace both these officers. After a reign of twenty-one years, of great internal prosperity, he died (A.H. 386) in a bath at Bilbeys, while preparing an expedition against the Greeks, who were ravaging his possessions in Syria.[2]

El-Hákim. His cruelty and extravagances.

Though El-'Azeez was distinguished for moderation and mildness, his son and successor rendered himself notorious by very opposite qualities. El-Hákim bi-amri-lláh Aboo-'Alee Mansoor began his reign, according to Muslim historians, with much wisdom,[3] but afterwards acquired a character for impiety, cruelty, and unreasoning extravagance, by which he has been rendered odious to posterity. He is described as possessing at once "courage and boldness, and cowardice and timorousness, a love for learning and vindictiveness towards the learned, an inclination to righteousness, and a disposition to slay the righteous;"[4] and this character is fully borne out by his many extravagances. Of his cruelty numerous anecdotes are told us, especially in the discharge of his functions as Mohtesib, or "regulator of the markets and of the weights and measures," an office which he assumed, and in which he became the terror of the inhabitants.

His impiety.

But his cruelty was surpassed by his impiety. He arrogated to himself divinity, commanded his subjects to rise at the mention of his name in the congregational prayers (an edict which was obeyed even in the holy cities Mekkeh and El-Medeeneh[5]), and altered his name, which signifies "governing by the command of God," to El-Hákim bi-amru, or "governing by his own command."

The Druses.

He is most famous in connection with the Druses, a sect which he founded, and which still holds him in veneration, and believes in his future return to the earth. He had thus made himself obnoxious to all classes of his subjects, when,

Invasion.

in the year 397, he nearly lost his throne by foreign invasion. Hishám, surnamed Aboo-Rakwak, a descendant of the house of Umeiyeh in Spain, took the province of El-Barkah, with a considerable force, and subdued Upper Egypt. The Khaleefeh, aware of his danger, immediately collected his troops from every quarter of the kingdom, and marched against the invader, whom, after severe fighting, he defeated and put to flight. Hishám himself was taken prisoner, paraded in El-Káhireh, with every aggravation of cruelty, and put to death. El-Hákim having by vigorous measures thus averted this danger, Egypt continued to groan under his tyranny until the year 411, when he fell by domestic treachery. His sister, Seyyidet-el-Mulook, had, in common with the rest of his subjects, incurred his displeasure; and, being fearful for her life, she secretly and by night concerted measures with the Emeer Seyf-ed-Dowleh,

His assassination.

chief of the guard, who very readily agreed to her plans. Ten slaves, bribed by 500 deenárs each, having received their instructions, went forth on the appointed day to the desert tract south-east of El-Káhireh, where El-Hákim, unattended, was in the habit of riding, and waylaid him near the village of Hulwán, where they put him to death.

Edh-Dháhir.

He was succeeded by his son, Edh-Dháhir (commonly pronounced Ez-Záhir) bi-lláh Abu-l-Hasan 'Alee, who ruled with justice and moderation for nearly sixteen years.

Disturbances in Syria.

In 414 Aleppo was taken by Sálih son of Mardás; and although he was defeated and slain by an Egyptian force sent against him, a son, Shibl-ed-Dowleh Aboo-Kámil Nasr, yet retained possession of that city. At this time also Hasan, of the tribe of Tei before mentioned, had made himself master of Ramleh;[6] and indeed from this Khaleefeh's reign we may date the decline of the Fátimee power, especially in Syria.

El-Mustansir.

In the year 427, El-Mustansir bi-lláh Aboo-Temeem Ma'add came to the throne at the age of seven years. His reign occupied a long period, rendered memorable by the unparalleled troubles which befel Egypt. It commenced prosperously with the defeat and death of Shibl-ed-Dowleh. Aleppo was taken, the submission of the rest of Syria followed; and the general who had conducted the expedition against that province assumed its government. On his death, Mo'izz-ed-Dowleh, a brother of Shibl-ed-Dowleh, retook Aleppo;[7] but the various fortunes of this prince and his nephew Mahmood, from this time, and during the calamities of Egypt, are too complicated and subordinate to claim a place here. In the western provinces, the rebel El-Mo'izz (the third successor of Yoosuf Ibn-Zeyree, who was appointed governor on the conquest of Egypt), was punished by an irruption of wild Arab tribes in the pay of El-Mustansir.

War between the Fátimees and Abbásees.

In the year 450, the Fátimee Khaleefeh was publicly prayed for in Baghdád; a remarkable event, of which the immediate cause was briefly as follows: Abu-l-Hárith Arslán El-Besaseeree, a powerful Turkish chief exercising unbounded authority in that city, had fallen into disgrace, and received supplies of men and money from the Khaleefeh of Egypt; and while Togrul-Beg espoused the cause of the Abbásee Khaleefeh, his brother Ibraheem Eynál revolted, joined El-Besaseeree, and defeated Togrul-Beg. El-Besaseeree entered Baghdád, in which the combat continued to rage; and the unfortunate city was devastated by massacre and pillage. El-Mustansir was solemnly declared Prince of the Faithful, and the insignia of the legitimate Khaleefeh were sent to Cairo. The success of El-Besaseeree, however, was but transient: Togrul-Beg had, in the meantime, defeated and killed his brother Ibraheem; he then entered Baghdád in Dhu-l-Kaadah 451; and having despatched a force against El-Besaseeree, the latter fell in a battle near El-Koofeh.

Persecution of the Christians. Intestine troubles.

A persecution of the Christians of Alexandria occurred about this time; and in 454 commenced a desolating struggle between the Blacks and the Turks, both of whom had become numerous in Egypt. The former were succoured by the mother of El-Mustansir, herself a negress, while the command of the latter was taken by Násir-ed-Dowleh Ibn-Hamdán, a general of El-Mustansir, more than once governor of Damascus, and at this period governor of Lower Egypt. To this man's unscrupulous ambition was due much of the trouble which ensued. After many battles the Turks succeeded in destroying the power of their adversaries, and their leader assumed almost absolute authority, while they not only extorted from the Khaleefeh immense sums of money and treasure, but even rifled the tombs of his predecessors for the valuables which they contained. At the same time the bulk of the valuable library of the Fátimees was dispersed by these brigands. But the very power of Násir-ed-Dowleh threatened his overthrow. His sense of security in his position rendered him regardless of the support of the Turks; and when at length his schemes for the deposition of El-Mustansir brought matters to a crisis, a large portion of the army declared against him. Defeated and driven from the metropolis, he succeeded in possessing himself of Lower Egypt, and a terrible civil war raged between the contending parties.

Famine of El-Mustansir.

But an even heavier calamity afflicted Egypt. For seven successive years the inundation of the Nile failed, and with it almost the entire subsistence of the country, while the rebels intercepted supplies of grain from the north. El-Makreezee informs us that El-Askar and El-Katáë were depopulated, and that half the inhabitants of El-Fustát perished, while in El-Káhireh itself

---

[1] Abu-l-Mahásin.

[2] El-Is-hákee; Abu-l-Fidà.

[3] This may well be doubted from the fact that early in his reign he began to persecute the Jews and Christians, ordering the latter to wear deep black garments and turbans, and forbidding both to ride on horses or mules, besides other grievous regulations.

[4] El-Is-hákee.

[5] Táreekh esh-sheykh Imad-ed-Deen Ibn-El-Ketheer, quoted in El-Is-hákee.

[6] Abu-l-Fidà.

[7] *Id.*

Egypt. the people were reduced to the direst straits. Bread was sold for 14 dirhems the lb. loaf; and all provision being exhausted, the worst horrors of famine followed. The wretched people resorted to cannibalism, and organised bands kidnapped the unwary passenger in the desolate streets, principally by means of ropes furnished with hooks, and let down from the latticed windows. In the year 462, the famine reached its height. It was followed by a pestilence; and in the midst of these horrors, Násir-ed-Dowleh advanced on Cairo at the head of an enormous army: he was induced to withdraw by the promise of large concessions, only to repeat the attack, and finally to make himself master of the city, after having inflicted a signal defeat on the Khaleefeh, who became only the nominal ruler of Egypt; a condition which lasted until the assassination of this powerful rebel in the year 465.

State of Syria. While these events were occurring in Egypt, Syria was in a continual state of anarchy and war. A distinguished general, the Emeer el-Guyoosh Bedr-ed-Deen El-Gemálee, held the government of Damascus during these times; and now El-Mustansir wrote, recalling him to assume the office of Wezeer of Egypt. On the condition of being allowed to bring with him a veteran force, he, happily for the country, obeyed the summons, and to his talents was owing the restoration of order, and even prosperity which followed. By a massacre of Emeers at a grand banquet shortly after his arrival, and by numerous executions, he subdued all opposition in the capital; and in a series of brilliant victories annihilated the savage hordes who infested the country throughout its whole extent, having either been called to the aid of the contending parties, or voluntarily taken advantage of the universal anarchy to commit their lawless ravages.

Invasion of Egypt. In concluding this necessarily extended notice of the reign of El-Mustansir, the invasion of Atseez with an army of Turkumáns, Kurds, and Arabs, in the year 469, must be just mentioned. Spreading devastation around them, they encamped near Cairo; and in the first engagement defeated the forces of El-Gemálee; but fortune favouring him in a second battle, the enemy was totally routed with immense carnage.

El-Mustansir reigned 60 years, and died in the year 487. He was a weak prince, solely given up to pleasure.[1] El-Gemálee had governed with almost absolute authority and great ability, for a period of 20 years, dying only a few days before the Khaleefeh. While admiring El-Gemálee's talents, we cannot but condemn his severity. He built the mosque which gives its name to the mountain immediately S.E. of the citadel of Cairo (Gebel-El-Guyooshee), and the second wall of El-Káhireh, with its three principal gates, Báb-Zuweyleh, Báb-en-Nasr, and Bab-el-Futooh. These gates, which are very fine specimens of architecture, are said to be the work of three Greek brothers.[2]

El-Mustaalee. El-Mustaalee bi-lláh Abu-l-Kásim Ahmad succeeded his father; but a son of El-Gemálee, El-Afdal, had the principal management of the affairs of the kingdom. This Khaleefeh's reign is memorable for the First Crusade. El-Afdal had taken Jerusalem from the Turks in the year 1098; and a few months later it yielded to the Crusaders, after a siege of 40 days. El-Afdal arrived shortly after its fall with a reinforcement of 20,000 men, but he was defeated in the battle of Ascalon. Later, an Egyptian army, commanded by Saad-ed-Dowleh, was worsted by Baldwin, Count of Edessa, and the general was killed in the action. From this period, with the exception of some efforts made in the next reign, to the time of Saláh-ed-Deen (the Saladin of the Crusades), Egypt was too much occupied with intestine troubles to equip expeditions against the various parties who now struggled for the possession of Syria. El-Mustaalee died in the year 495. He is stated to have been a Sunnee—a strange anomaly in a dynasty of Shiya'ees.

Jerusalem taken by the Crusaders.

El-A'mir. His son El-A'mir bi-ahkámi-lláh Aboo-'Alee Mansoor, came to the throne at the age of five years, and until his arrival at manhood, the government was conducted by El-Afdal. The first act of the Khaleefeh, however, on taking it into his own hands, was to put his minister to death, and appoint in his stead a man whose wickedness obliged him to imprison him and afterwards condemn him to death. The rule of El-A'mir was chiefly remarkable for his impiety and tyranny, and for the successes of the Crusaders, who, having reduced many of the principal coast-towns in Syria, meditated the conquest of Egypt, and crossed the frontier, but were deterred from the prosecution of their enterprise by the illness of Baldwin, whose death took place at El-Areesh, on his way back to Jerusalem. El-A'mir was put to death in 524, at the town of El-Geezeh, it is said by partisans of El-Afdal, whose son then usurped the entire government, setting up, as Khaleefeh, El-Háfidh li-deeni-lláh Abd-El-Megeed, a grandson of El-Mustansir (El-A'mir having left no male issue), but without the usual ceremonies of installation. This wezeer, Aboo-'Alee Ahmad, even forbade the mention of El-Háfidh in the public prayer, and inserted his own name in his stead. He perished in a popular tumult, roused by his extortions and arbitrary rule, and El-Háfidh was duly declared Khaleefeh, and received the oaths of allegiance. After the death of Ahmad, he successively appointed three other Wezeers; but these proving equally refractory, he at length dispensed with that office altogether. He reigned nearly 20 years. The licentiousness of his son and successor, Edh-Dháfir bi-aadáï-lláh Aboo-Mansoor Isma'eel, occasioned his death in four years and seven months at the hand of his Wezeer El-Abbás.

El-Háfidh.

Edh-Dháfir.

El-Fáïz. El-Fáïz bi-lláh Abu-l-Kásim 'Eesa Ibn-'Alee was, on his accession, only five years of age, and the history of his times presents merely the contentions of rival Wezeers, of whom the chief were El-Melik Es-Sálih Taláë Ibn-Ruzzeyk, and his competitor El-Abbás, before named. The latter finding his power failing, gathered together the wealth he had amassed, and fled to Syria, where he fell into the hands of the Crusaders, who stripped him of all that he had, and detained him a prisoner. Eventually he was given up to Taláë, and crucified over the gates of the palace.

El-'A'did. El-Fáïz died in the year 555, and El-'A'did li-deeni-lláh Aboo-Mohammad Abd-Allah, a grandson of El-Háfidh, and the last of the Fátimee Khaleefehs, was raised to what was then but the shadow of a throne, the entire power being in the hands of Taláë, who by his oppression and cruelty well-nigh rendered El-'A'did, by nature benevolent and wise, as tyrannical as himself. He was assassinated by the secret orders of the Khaleefeh, and the latter to conceal his agency in this act, installed his son El-'A'dil in his place. At this time the well-known Sháwir was governor of the Sa'eed (or Upper Egypt), a post next in importance to that of prime minister. During the last three reigns the Wezeers had been rapidly increasing in power; and the annals of the period are entirely occupied with the rise and fall of potent grandees, all eager for a post which conferred on its possessor the supreme authority. At length, in the reign of this unfortunate prince, they consummated the ruin of the dynasty, and overwhelmed themselves in its fall. In 555, El-'A'dil dispossessed Sháwir of his government, and the latter had immediate recourse to arms, marched against his enemy, and succeeded in putting him to death. He then constituted himself Wezeer, but in his turn was compelled to flee from a more powerful rival, Ed-Dirghám. Noor-ed-Deen, the sultan of Damascus, received the fugitive with

The Wezeer Sháwir.

[1] Quatremère, *Memoires Geographiques et Historiques sur l'Egypte* (Vie du Khalife Mostanser-billah), tom. ii., p. 296.
[2] El-Makreezee's *Khitat.*

Egypt.

favour; and in the course of the next year (559) despatched an army to Egypt, under the command of Asad-ed-Deen Sheerkooh, to reinstate him.

Shâwir invokes the aid of Noor-ed-Deen.

In the meantime Ed-Dirghâm had been busy putting to death the great men of the empire; and having thus weakened his power, he offered but a feeble resistance, was overthrown in a battle near the tomb of the seyyideh Nefeeseh, on the S. of Cairo, and Shâwir was restored.

He quarrels with Noor-ed-Deen, and forms an alliance with Amaury.

No sooner, however, was this effected, than he forgot the engagements into which he had entered with Noor-ed-Deen, and threw off his allegiance to him. Sheerkooh retired to the Sharkeeyeh, and occupied the town of Bilbeys, and thence threatened Shâwir. In this position of affairs the latter had recourse to the Crusaders, who willingly responded to his call, and Amaury, king of Jerusalem, arrived with a considerable force. With these allies, Shâwir besieged his former protector in Bilbeys, until hearing of Noor-ed-Deen's successes over the Franks in Syria, they negotiated a peace, and permitted Sheerkooh to withdraw from Egypt.

Invasion by Noor-ed-Deen.

About two years later, Noor-ed-Deen, determined on punishing the treachery of Shâwir, again sent Sheerkooh into Egypt with a great army, and accompanied by his nephew, the famous Salâh-ed-Deen. Shâwir again sought to strengthen himself by an alliance with Amaury, from whom he received the first intelligence of the meditated invasion. Apprised of their knowledge of his movements, Sheerkooh changed his course from Bilbeys, entered the valley of the Nile at some distance above Cairo, and, crossing the river, marched northwards to El-Geezeh. Here he endeavoured to raise the people against Shâwir and his infidel confederates; and had in some measure succeeded when the superior forces of the enemy compelled him to retreat southwards as far as El-Bâbeyn, near Ashmooneyn, where he risked an engagement, and gained a complete victory. This success opened to the invaders the greater part of Egypt, and Alexandria itself fell into their hands. Salâh-ed-Deen was placed in that city with a numerous garrison, and his uncle departed to subdue the rest of Egypt. The Crusaders, however, at once closely invested Alexandria, and so pressed the siege for three months, as to oblige Sheerkooh to come to its relief. An honourable compromise was effected, by which the Syrians agreed to resign their conquests and evacuate Egypt.

Egypt invaded by Amaury.

But fresh troubles were in store for this unfortunate country. Amaury, irritated at the result of a campaign in which he had only lost, determined on an expedition against his recent ally; and, entering Egypt, took Bilbeys, putting its inhabitants to the sword, and laid siege to El-Kâhireh, his course being marked by the most dreadful barbarities. On his approach, the ancient city of El-Fustât was set on fire by order of the Wezeer, to prevent it falling into the enemy's hands, and it continued burning somewhat more than fifty days.[1]

Alliance between the Khaleefeh and Noor-ed-Deen.

El-'A'did now earnestly sought the aid of Noor-ed-Deen; and that monarch, actuated by religious zeal against the Franks, who had already felt his power in Syria, and by the desire of conquest, once more despatched Sheerkooh. In the meantime negotiations had been opened with Amaury to raise the siege of El-Kâhireh, on payment of an enormous sum of money; while, however, the conditions were yet unfulfilled, the approach of the Syrian army induced him to retreat in all haste. Sheerkooh and Salâh-ed-Deen entered the capital in great state, were received with honour by the Khaleefeh, and with obsequiousness by the perfidious Shâwir, who was contriving a plot which was fortunately discovered, and for which he paid with his head. Sheerkooh was then appointed Wezeer by El-'Adid, but dying very shortly, he was succeeded in that dignity by Salâh-ed-Deen.[2]

Egypt.

Salâh-ed-Deen (Saladin) appointed Wezeer.

Of the short period which elapsed before Salâh-ed-Deen's assumption of the title of Sultân, a few words will suffice. One of his first acts was to put to death the chief of the Eunuchs, and a revolt of the Blacks resulted; a combat took place in El-Kâhireh, in the street called Beyn-el-Kasreyn; and the malcontents being worsted, the disturbances were quelled. Bahâ-ed-Deen Karâkoosh, a white eunuch, who afterwards played a prominent part in the reign of Salâh-ed-Deen, was appointed to the vacant post. This gave the Wezeer great influence in the palace, of which he judiciously availed himself. In 566 we hear of Amaury with Greek allies unsuccessfully besieging Damietta; and in the following year, Salâh-ed-Deen conducted an expedition against the Franks to Ascalon and Ramleh; after which, a year later, he took Eyleh.

Campaign against the Crusaders.

In 567, by order of Noor-ed-Deen, he suppressed the name of El-A did in the congregational prayers, and substituted that of the Abbâsee Khaleefeh; a masterly stroke of policy to secure the adhesion of the orthodox Muslims. The last of the Fâtimees was lying dangerously ill, and his relations concealed from him his degradation. He died without the knowledge of it, and with him perished an illustrious but unfortunate dynasty.

Salâh-ed-Deen was thus relieved of the most serious obstacle on his way to the throne; yet he dared not throw off his allegiance to the Sultân of Damascus, but prudently waited for a favourable opportunity. Noor-ed-Deen's suspicions were already aroused, and he died while secretly preparing to proceed in person to Egypt.

Salâh-ed-Deen proclaimed Sultân. Eiyoobee Dynasty.

Salâh-ed-Deen almost immediately proclaimed himself Sultan of Egypt, and inaugurated his reign with a series of brilliant successes. With the conquest of El-Mo'izz, Egypt again took an important place among the nations; and by the wars of Salâh-ed-Deen it became the nucleus of a great empire. But military glory was not the sole aim of that prince and his successors; and the patronage they continued to extend to letters and the arts had the most beneficial effect upon the civilization of the country.

Salâh-ed-Deen, whose full appellation was El-Melik En-Nâsir, Salâh-ed-Deen Yoosuf Ibn Eiyoob acquired his greatest renown by his campaigns against the Crusaders in Syria. As these belong, however, more properly to the history of those wars than to that of Egypt, they will be more briefly noticed in this place than would otherwise be necessary.

Subjugation of great part of Syria.

The youth of El-Melik Es-Sâlih Ismâ'eel, the son and successor of Noor-ed-Deen, and the consequent confusion which prevailed in his dominions, gave Salâh-ed-Deen a fair pretext to occupy Damascus, as the guardian of the young prince, and enabled him to wrest from him his kingdom. He thus considerably enlarged his territory, made himself master of a great portion of Syria, and continued to consolidate his power in those parts until the year 573 (A.D. 1178), when Philip, Count of Flanders, laid siege to Antioch, and Salâh-ed-Deen entered Palestine. The latter having encamped before Ascalon, his troops ravaged the neighbouring country, and set fire to Joppa, until at length Baldwin (surnamed the Leper), king of Jerusalem, issued from Ascalon and gave him battle.

Victory of Baldwin.

The result was disastrous to Salâh-ed-Deen; his army was totally routed, and he himself fled alone on a dromedary. After this, however, he gained some partial advantages over the Christians; and a terrible famine induced him, two years later, to conclude a truce with the King of Jerusalem, and retire to Egypt.

In the year 576 he again entered Syria and made war on Kilij Arslân, the Seljuk Sultân of Anatolia, and on Leon, King of Armenia—the Cilicio-Armenian kingdom,—both

---

[1] El-Makreezee's *Khitat.*

[2] Abu-l-Fidâ. Michaud, *Hist. des Croisades,* Liv. VII. The invasion of Amaury is related by Ibn-Shihneh in nearly the same words as by Abu-l-Fidâ.

Salâh-ed-Deen enters Anatolia and Armenia, and prosecutes the war against the Crusaders.

of whom he forced to make terms of peace. Not long after his return, Salâh-ed-Deen departed from Egypt (A.H. 578) to prosecute a war with the Crusaders in which neither side desired peace. Their hostility was aggravated by the following circumstances: a vessel bearing 1500 pilgrims had been wrecked near Damietta, and its passengers captured; and to the remonstrances of the King of Jerusalem, the Sultân replied by complaining of the constant inroads made by Renaud de Châtillon. At this time, the latter turbulent chief undertook an expedition against Eyleh, and for this purpose constructed boats at Karak, and conveyed them on camels to the sea; but his flotilla was repulsed and the siege raised by a fleet sent thither by El-'A'dil, the brother of Salâh-ed-Deen, and then his viceroy; and a second attempt was still more unfortunate—the Christian captives on that occasion were sacrificed in the valley of Mina. Having threatened Karak, Salâh-ed-Deen encamped at Tiberias, and ravaged the territory of the Franks: he then besieged Beyroot, but in vain; and thence turned his arms against Mesopotamia, and subdued that country, but the city of El-Mósil successfully resisted him. In the meanwhile, the Crusaders contented themselves with miserable forays across the enemy's borders, and made no serious preparations for the return of their redoubtable antagonist. The latter having been almost everywhere successful in Mesopotamia, took Tell-Khâlid, and 'Eyn-Tâb, in Syria, and obtained possession of Aleppo; he again besieged Karak, ravaged the territory of Samaria, and later received the fealty of the lord of El-Mósil, but not the keys of the city.

He subdues Mesopotamia.

Renewed hostilities with the Crusaders.

In the year 1186 of our era, war again broke out between Salâh-ed-Deen and the Crusaders. The Sultân had respected a truce into which he had entered with Baldwin the Leper, and Renaud, before named, was the first to break it. The capture, by the latter, of a rich caravan, enraged Salâh-ed-Deen, who despatched orders to all his lieutenants and vassals, summoning them to assist in the "Holy War;" and he marched (A.D. 1187) from Damascus to Karak, and there laid close siege to Renaud; at the same time a large body of cavalry under the command of his son, El-Afdal, advanced on Nazareth; and here a body of 130 knights hospitallers and templars, seconded by a few hundred foot-soldiers, and encouraged by the heroic Jacques de Maillé, marshal of the Temple, by their devotion, immortalized their memory. Only the grand master of the Temple and two of his knights escaped from the unequal struggle. Soon after, Salâh-ed-Deen approached in person, at the head of an army of 80,000 men; and the Christians with their whole force encountered him on the shore of the lake of Tiberias. The result of the battle which ensued was the heaviest blow which had yet fallen on the Crusaders. Weakened by thirst, shaken by the flight of a part of their troops on the second day of combat, and overwhelmed by numbers, the knights fought with desperate courage, but at length were forced to the hills of Hitteem. A multitude fell in this bloody fight, and among the prisoners were Guy de Lusignan (the King of Jerusalem and successor of Baldwin), with his brother and Renaud de Châtillon. The number of prisoners is almost incredible; and the massacre of many of them is an indelible stain on the glory of the generally merciful Salâh-ed-Deen. Tiberias, Ptolemaïs (Acre), Nâbulus, Jericho, Ramleh, Cæsarea, Arsoor, Joppa, Beyroot, and many other places, successively fell into the hands of the conqueror. Tyre resisted his attacks; but Ascalon surrendered on favourable terms, and the fall of Jerusalem crowned these victories. The great clemency of Salâh-ed-Deen on this occasion is chronicled by Christian historians, though it is but slightly mentioned by the Muslims, who took offence at the favour shown to the enemies of their faith.

Battle of Tiberias or Hitteem.

Fall of Jerusalem.

After these events Tyre was again besieged; and when about to capitulate, was fortunately relieved by the arrival of Conrad, son of the Marquis of Montferrat, and the valiant defence of the town wearied Salâh-ed-Deen, who turned his arms against Tripoli; but here he met with no better success. Bohemond, Prince of Antioch, and at that time possessor of Tripoli also, was, however, glad to obtain a truce of eight months; and some strongholds (among others Karak) were taken. But now the fortune of war turned against the Sultân. The ever-memorable siege of Acre, maintained with equal constancy by both Christians and Muslims, lasted upwards of two years, and attracted the attention of the whole Western World. At length the immense reinforcements received by the besiegers, and the presence of Richard Cœur de Lion of England, and of Philip II. of France, enabled them to overcome all resistance, and the standards of the Cross floated on the ramparts of the city. A horrible act of barbarity was here perpetrated, 2700 Muslim captives were massacred in cold blood, in consequence of Salâh-ed-Deen's having failed to fulfil the terms of the capitulation; and the palliative plea of the heat of an assault cannot be urged in extenuation of this enormity. Richard has been accused of being its author; but Michaud believes with reason that it was decided on in a council of the chiefs of the Crusade. On another occasion, however, that king was certainly guilty of similar cruelty.

Siege of Acre.

Advance of Richard on Jerusalem.

After a period of repose and debauchery, the army of the Crusaders, commanded by Richard, directed its march towards Jerusalem. Salâh-ed-Deen harassed his advance on every point, rendered the cities and strongholds defenceless, and ravaged the country. Richard, nevertheless, was ever victorious; his presence struck terror into the Muslims, and he gained a signal victory over the Sultân in the battle of Arsoor. But dissensions among the chiefs of his army, and the uncertain temper of the commander himself, debarred the Crusaders from the attainment of their great object, the deliverance of the holy city; and when all the coast from Joppa to Tyre was in the hands of the Christians, and the army of Salâh-ed-Deen was threatened with disorganization, a treaty was concluded, and Richard set sail on his return to England. The glory acquired by Salâh-ed-Deen, and the famous campaigns of Cœur de Lion, have rendered the Third Crusade the most memorable in history, and shed a lustre on the arms of both Muslims and Christians greater than they ever attained in these wars, either before or afterwards.

Battle of Arsoor.

A peace concluded.

Death of Salâh-ed-Deen. His character.

Salâh-ed-Deen died about a year after the conclusion of this peace (A.H. 589, or 1193 of our era) at Damascus, at the age of fifty-seven years. Ambition and religious zeal appear to have been his ruling passions; he was courageous, magnanimous, and merciful; possessed of remarkable military talents, and great control over himself. His generosity, on almost every occasion, to the vanquished, combined with his faithful observance of his passed word, are lauded by the historians of the Crusades; the former brought on him much obloquy among his own fierce soldiers, and is a trait in his character which is worthy of note in the annals of a time when this virtue was extremely rare. While engaged in the conduct of his continual wars, he was not unmindful of the welfare of Egypt, and during his reign many public works were executed. Of these we may mention especially the citadel of Cairo, with the magnificent buildings which, until very recently, it contained; the third wall of the city; and the repair of the great canal called the Bahr Yoosuf, a very important and useful work. From the year 578, until the period of his death, he had not entered Egypt; but his brother El-'A'dil, and other princes of his family, successively governed that country, and the Eunuch Karâkoosh, who also defended Acre, held a large share of authority.[1]

[1] The principal narratives of the life of Salâh-ed-Deen are, Bohadini *Vita et Res Gestæ Sultani Saladini*; Arab. et Lat., ed. Schultens,

Egypt.

El-'Azeez.

On the death of Saláh-ed-Deen, his extensive dominions were divided chiefly among his sons, and Egypt fell to the lot of one of them, El-Melik El-Azeez Imád-ed-Deen Abu-l-Fet-h 'Othmân. The grandees supported his claim to the throne, and he proved himself worthy of their choice. In conjunction with El-'A'dil, we find him warring against the leaders of the Fourth Crusade. He reigned five years and ten days, and was succeeded by his son El-Mansoor Mohammad; his uncle El-Afdal being compelled to relinquish the government of Damascus and assume the regency of Egypt. Disagreement among the sons of Saláh-ed-Deen had occurred soon after that monarch's death, and now hastened the rise of El-'A'dil, who, by his military talents and other remarkable qualities, had excited the fears of even his brother. With the view of checking his growing ascendancy, El-Afdal formed an alliance against him with Edh-Dháhir, the Lord of Aleppo, and besieged him in Damascus; but coming to strife, they raised the siege early in 596. This attempt proved fatal to the power of El-Afdal. He was pursued to Egypt, in his turn besieged in El-Káhireh, forced to flee, and El-'A'dil was proclaimed Sultân.[1] Having dethroned El-Mansoor, he speedily recovered Damascus from the hands of the confederate brothers, and Syria with Egypt acknowledged his supremacy. El-'A'dil is especially known by his opposition to the Fourth and Sixth Crusades, the former of which took place before his accession to the throne. He repulsed the Christians near Nábulus, captured Joppa, and encountered the enemy between Tyre and Sidon. He was there defeated with heavy loss, and Sidon, Laodicea, Gibleh, and Beyroot were taken. But the Crusaders wasted their strength before the fortress of Thoron. El-'A'dil raised the siege of that place, and although afterwards he met with a reverse near Joppa, his adversaries bought a dear victory; and, having come to terms of peace, they returned to Europe. In the year 600 (A.D. 1204) he departed to Syria with the object of securing Jerusalem against threatened attacks, and concluded a truce which he offered to renew when about to expire; and to prove his good faith, strengthened that offer by promising to cede ten castles to the Christians. These overtures were refused, and the Muslim army drove the newly arrived king of Jerusalem, Jean de Brienne, back to Europe. Those who remained then professed their willingness to accede to conditions of peace, and we do not again hear of El-'A'dil in Palestine until 614 (A.D. 1218), when he was once more called thither to oppose the Crusades; but a serious invasion of Egypt by these troublesome adventurers hastily recalled its king, and he died of grief, it is said, on hearing of the advantages gained by them.[2]

El-Man-soor.

l-'A'dil.

Egypt invaded by Jean de Brienne.

El-Kámil.

El-Kámil immediately came to the throne, and took the most energetic measures for the protection of his kingdom. In the meantime, the Franks[3] besieged Damietta both by sea and land; and notwithstanding every effort for the relief of the place, its garrison was forced to capitulate. El-Kámil summoned to his aid the princes of his family, and with every available man watched the enemy's movements. Flushed with success, Jean de Brienne commenced his march on the capital; and with the characteristic carelessness of the Crusaders, he took no measures to secure supplies. His advance was stopped at the junction of the canal of Ashmoon with the Nile, where he found El-Kámil in a very strong position. Encamped on the opposite shore, the invaders depended for supplies on Damietta and its immediate district; but the inundation of the Nile gradually obstructed land-carriage, and El-Kámil skilfully availed himself of this natural ally, caused boats to be carried overland to the enemy's rear, and, thus cut off by land and water, they were compelled to attempt a retreat. At Beyramoon, however, all further progress was found to be impossible—the inundation had covered the level country, and the Sultân's boats blockaded the Nile. They surrendered, and evacuated Damietta, but not before Egypt had suffered severely from the ravages they committed. The city of El-Mansoorah was founded on the site of El-Kámil's camp, and commemorates his energy and sagacity. The Seventh Crusade was invited by the same Sultân who had thus suffered by an invasion of the Franks. In A.D. 1228, El-Kámil invoked the aid of Frederick II. against his brother El-Muadhdham, Lord of Damascus, and, in consequence of this alliance, Jerusalem, with Bethlehem and the places between it and Joppa and Acre, Nazareth and the territory of Thoron and Sidon, with its dependencies, was ceded to Frederick on the 20th of Feb. 1229. Between these two monarchs existed the most friendly relations, presenting a curious spectacle in the midst of the intrigues and hatred of their subjects for each other, and endangering their popularity and even their lives. After various expeditions against his brother and his successors, El-Kámil gained possession of Damascus, and died there in the year 635[4] (A.D. 1238). He was distinguished by military talents, and rare moderation, and was also a learned man, a patron of the arts, and a good king.

Egypt.

Alliance with Frederick II.

El-'A'dil II.

His son El-Melik El-'A'dil the Younger, was declared Sultân of Egypt and Syria, with the consent of the nobles, and he speedily banished those ministers whose counsels he feared, and appointed creatures of his own. Oppressed by his tyranny, and impoverished by his extravagance, the people called his brother Es-Sálih Negm-ed-Deen Eiyoob to the throne; and he deposed and imprisoned El-'Adil in the year 637, and, to replenish his exhausted treasury, ordered all who had received presents from the late Sultân to restore them to his successor. In the next year serious disturbances broke out in Syria; Sálih 'Imád-ed-Deen, who had taken Damascus in the reign of El-'A'dil, formed an alliance with the Franks, and purposed the conquest of Egypt: the hostile armies met at Acre, and the Muslim soldiers of 'Imád-ed-Deen deserting to the banner of Es-Sálih Eiyoob, the Franks were routed. Negotiations for peace were then attempted, but these failing, the Franks were again induced to take the field by the cession of Jerusalem and other places. The king of Egypt, on his part, called to his assistance the Kharesmees, who took Jerusalem and overran Syria. In the next campaign they were joined by the army of Es-Sálih, under the command of his favourite slave Beybars, who was destined to play a conspicuous part in Egyptian history. The allied army met the Franks, eager to avenge themselves on the Kharesmees for the horrible atrocities of which they had been guilty in the preceding campaign, and willingly joined by the Muslim princes of Damascus, Hims, and Karak; on the first day the battle raged with unabated fury from daybreak to sunset, and was continued on the morrow until the prince of Hims, having lost 2000 men, gave way and fled towards Damascus. The Christians maintained the unequal fight

Es-Sálih.

A revolt in Syria aided by the Franks.

Alliance with the Kharesmees.

folio, Lugd. Bat., 1732; the account contained in Abu-l-Fidà, *Annales Muslemici;* ed. Reiske, Hafn., 1789-94, and in the MSS. of El Makreezee's *Kitáb es-Sulook fi-Maarifet Diwel el-Mulook*; of Ibn-El-Atheer's work entitled *Kámil et-Tawáreekh* (the continuation of the great work of El-Tabaree); and of the *Ródateyn* of Shiháb-ed-Deen Ibn-Mohammad 'Abd-Er-Rahmán Aboo-Shámeh, with the histories (also MSS.) of Ibn-El-Furát, El-Is-hákee, El-Suyootee (*Kitáb Husn el-Muhádareh*), and the *Khitat* of El-Makreezee. This famous Sultân is, however, mentioned in every Arabic history of note relating to this period. The reader will find extracts from many MSS. in Michaud, *Bibliothèque des Croisades.*

1 Abu-l-Fidà.

2 Michaud says that he had previously abdicated, but until his death continued to exercise great influence over his sons, and the other members of the family of Eiyoob; livre xii.

3 Michaud, livre xii.

4 El-Makreezee, *Kitáb es-Sulook*, MS.

Egypt.

with great constancy, and were only vanquished after the greater number had fallen. In these encounters 30,000 men (either Christians or Muslims) were either killed or taken prisoners. Various successes followed this victory, Jerusalem was taken by the Egyptians, and Es-Sálih laid siege to Damascus in person. The city having capitulated on favourable conditions, his fierce allies, enraged at the loss of pillage, quarrelled with him, and soon after joined his rebellious subjects. Damascus was reduced to the direst straits, but again fortune favoured Es-Sálih. He hastened from Egypt, whither he had returned, and totally defeated the enemy. Other advantages were gained by his commander Fakhr-ed-Deen over the Franks in the ensuing year.[1]

Crusade of St Louis.

Although attacked by illness, the Sultán was once more called to Syria to quell fresh troubles; but at Damascus news reached him of the threatened invasion of Egypt by the Crusaders under St Louis, and he travelled back in great suffering from his malady. Damietta, which he rightly judged would be the first point of attack, was strengthened and well stored, and its defence was intrusted to Fakhr-ed-Deen.

Capture of Damietta.

On Friday, June 4, A.D. 1249, the French anchored before the place, and the next day landed opposite the camp of the Egyptian general, who offered but slight opposition, and in the course of the next night betrayed his trust and retreated southwards. His army was precipitately followed by the entire population of Damietta, and thus this important town with its stores fell into the hands of the invaders without a blow. Fakhr-ed-Deen nearly lost his life for this act of cowardice, and 54 of his principal officers were put to death. In the meantime the Sultán's illness gradually increased, but nevertheless he caused himself to be removed to the town of El-Mansooráh, which he fortified, and there he expired on Nov. 21, at the age of forty-four, and after a reign of ten years.

Death of Es-Sálih.

He it was who introduced the Bahree Memlooks, a body of Turkish slaves, who composed his body-guard, and eventually usurped the supreme power. Their name *Bahree* (or "of the river") originated in their being trained and quartered on the island of Er-Ródah, where the Sultán had built a palace.

The French were advancing southwards, and, notwithstanding the precautions of Sheger-ed-Durr (the widow of Es-Sálih, who assumed the regency), were apprised of the death of the Sultán. Many partial actions took place on the march, and on Dec. 19, their army appeared before El-Mansooráh, the scene of the disaster of Jean de Brienne. Skirmishing continued until Shrove Tuesday, when, a traitor having shown the enemy a ford over the canal of Ashmoon, they surprised the camp and town.

Engagements at El-Mansooráh.

Very severe fighting ensued, Fakhr-ed-Deen fell early in the struggle, and the place was nearly lost, when the Bahree Memlooks led by Beybars furiously charged the assailants, and completely turned the fortune of the day. The morrow witnessed another battle, also disastrous to the Crusaders, and a succession of misfortunes followed.

Toorán Shah.

Toorán Sháh, on hearing of the death of his father, travelled in all haste from Mesopotamia to Egypt, and having reached the camp, assumed the command. He had recourse to the stratagem which had proved so successful under the direction of El-Kámil, and cut off the supplies of the enemy. This, coupled with disease, soon reduced St Louis to great straits, and he sent to propose a truce, but not coming to terms he determined on retreating to Damietta.

Surrender of the Crusaders.

A memorable conflict took place by land and water, and St Louis with his troops surrendered themselves prisoners of war.

Toorán Sháh now gave himself up to debauchery, offended his nobles by bestowing his favours only on certain creatures whom he had brought with him from Mesopotamia, and alarmed the queen by forcing her to render him an account of his father's wealth. Sheger-ed-Durr appealed to the Memlooks, a conspiracy was formed, and the Sultán was attacked in his palace.

Murder of Toorán Sháh.

He fled to a pleasure tower built on the banks of the Nile, which was set on fire in the presence of his army, the wretched king, from the summit, in vain promising to abdicate. He perished miserably, and his unburied corpse lay for many days on the bank. On his accession he had strangled a brother, and his fate deserves no pity.

Queen Sheger-ed-Durr, first sovereign of the Bahree Dynasty.

Sheger-ed-Durr (vulgarly called Shegeret-ed-Durr), herself a slave, and the first of the Dynasty of the Bahree, or Turkish Memlooks, succeeded to the throne; and 'Izz-ed-Deen Eybek was appointed commander of the forces. After many delays, St Louis agreed to pay 400,000 livres as a ransom for himself and his army, 200,000 to be paid in Egypt, and the remainder on the fulfilment of certain stipulations at Acre; Damietta was surrendered and Egypt evacuated. Thus ended the last invasion of Egypt by the Crusaders.[2] Sheger-ed-Durr, in order to strengthen herself on the throne, shortly after married the Emeer Eybek, and caused him to be proclaimed Sultán, with the title of El-Melik El-Mo'izz, in the year 648.[3]

El-Mo'izz-Eybek.

The followers of Es-Sálih, however, obliged him to associate with himself in the sovereignty a young prince of the family of Eiyoob, El-Melik El-Ashraf Mudhaffar-ed-Deen Moosa.

El-Ashraf Moosa.

En-Násir, Sálah-ed-Deen Yoosuf, a son of El-'Azeez, invaded Egypt, and after many combats was driven back to Syria; but the country continued in a very unsettled state. The chief of the adherents of the fallen dynasty was arrested by Eybek; and Beybars, with other leading men, having repaired to the citadel to demand satisfaction, his bloody head was thrown to them from the ramparts, and in terror they fled to Syria. El-Ashraf was then cast into prison, and there he died. But Eybek soon roused the jealousy of his beautiful and ambitious wife; and he was assassinated by her orders. In her turn she was beaten to death, not many days after, by the wooden clogs of the female slaves of another wife of Eybek, and her corpse was exposed for three days in the moat of the citadel.

El-Mansoor 'Alee.

El-Melik El-Mansoor Noor-ed-Deen 'Alee, son of Eybek, was now raised to the throne, and Beybars being apprised of the death of his rival attempted to regain his power in Egypt; but Kutz, the viceroy of Eybek and also of his son, attacked and routed him; and he soon after deposed El-Mansoor, and declared himself Sultán.

El-Mudhaffar Kutz.

El-Melik El-Mudhaffar Kutz began his reign by putting to death El-Mansoor, and Sharaf-ed-Deen, the able minister of the last Eiyoobee kings, and of the first of this dynasty. A reign thus cruelly commenced ended tragically. Kutz was diverted from these severe measures by the advance of Hulágú, grandson of Genghis-Khán, who, with a formidable army, overran El-'Irák and Syria. By great efforts Kutz raised a considerable force and marched to meet him. The intelligence of the death of the Mongol emperor had, however, in the meantime recalled Hulágú, who left Ketbughá to encounter the Egyptian Sultán. The battle declared in favour of the latter, and Syria was restored to his rule. Returning in triumph to Egypt, he was assassinated on the frontier by Beybars, in the year 658, and this Memlook (who had but recently fought under his banner against the Tatars) was forthwith chosen by the Emeers to be his successor.

The brilliant reign of El-Melik Edh-Dháhir Beybars

---

[1] El-Makreezee, *Kitab es-Sulook*, MS. Abu-l-Fidâ.

[2] Joinville's *Vie de St Louis* contains an exceedingly interesting and generally accurate account of this Crusade, and to it, with the histories of El-Makreezee and El-Is-hákee, we are indebted for this sketch of the period.

[3] *Hist. des Sultans Mamlooks par Makrizi* (*Kitab es-Sulook*), trans. Quatremère; Oriental Translation Fund, Paris.

Egypt.

Edh-Dháhir Beybars.

Campaign in Syria.

El-Bundukdâree is so perplexed and full of incident as to render a concise account of it very difficult. It commenced with the reduction of a revolt in Syria. The rebels were supported by a Tatar army under Hulâgû, but Beybars was everywhere victorious, and Damascus surrendered at discretion. Having subdued all opposition in this quarter, he endeavoured to improve the condition of Egypt, abolished the exorbitant imposts under which the people groaned, and welcomed to his court Ahmad, son of the Khaleefeh Edh-Dháhir, who was declared Prince of the Faithful with the title of El-Mustansir bi-llâh, and furnished with a small force, by which he hoped to establish himself in Baghdâd. He was, however, repulsed by the Tatars and put to death. The succeeding line of Khaleefehs, possessed of spiritual, but no temporal authority, remained at the court of the Memlook Sultâns until the Turkish conquest. From this time, Beybars continued to extend and confirm his rule. His first expedition was to Syria against the Christians, and the Church of the Nativity at Nazareth was destroyed. Thence he went to the fortified town of Karak, which had more than once resisted the attacks of Salâh-ed-Deen, but opened its gates to the Memlook conqueror, and its territory was added to his dominions. A great scarcity afflicted Cairo in 662, and Beybars threw open the government stores, and strove in every way to alleviate the sufferings of his subjects.

The Abbásee Khaleefehs in Egypt.

Beybars attacks the Christians.

Campaigns against the Christians.

In 663, he again entered Syria, and took Cæsarea and Ursoof; and in the next year he commenced a series of campaigns against the Christians, notwithstanding the earnest remonstrances of the kings of France, of Arragon, and of Armenia. To raise the necessary funds for the expenses of the war, he took occasion of the occurrence of many incendiary fires in Cairo, during his absence on this war, to mulct their co-religionists of the sum of 500,000 deenârs,[1] ostensibly to repair the damage caused by these fires. He threatened Acre, and took Safad; and relieved from the apprehensions caused by the advance of the Tatars by the death of Hulâgû, and the retreat of his army, Beybars despatched a force which effected the conquest of Armenia, and penetrated to the borders of Anatolia; a transient success which was speedily annulled by the advent of Abaka Khân, the son of Hulâgû. In the next war, Beybars again attacked the Christians, burning their churches and enslaving the people. He took Antioch, with horrible carnage, advanced to Hims, and Hamâh, and thence returned to Cairo. After a campaign against the Tatars, he ravaged the country around Acre (which place appears to have been the constant object of his attacks) and the "Assassins," so long the terror of dynasties, submitted to his power. About this time the Tatars renewed their inroads and besieged Beyrah; and in the year 671 Beybars took the field against them with two armies, one commanded by himself in person, the other by Kalâ-oon El-Elfee. In the battle of Beyrah the Sultân was completely victorious, and the Tatars fled to the mountains of Kurdistân. In consequence of this victory, Armenia again fell into his hands, and was given up to pillage. Abaka Khân afterwards was again repulsed at Beyrah. Nubia also about this time acknowledged the authority of Beybars. He died at Damascus in the year 676, after another expedition against Anatolia, attended with various success, in which the Tatars were leagued against him.[2] Great military talents, coupled with the most indefatigable activity, Beybars certainly possessed, but he used his conquests unmercifully; on many occasions he ravaged whole provinces, and sacked many towns, putting great numbers of the inhabitants to the sword. The melancholy annals of the Crusades bear ample testimony to this fact; and while the example of other monarchs, and of the Franks themselves, may be urged as some palliation, nevertheless his barbarity remains an indelible blot on his character. In Egypt he endeavoured to reform abuses and suppress vice; and numerous public works were executed by his orders. Damietta was razed and rebuilt farther inland; and the mouth of the Nile was protected by a boom against sudden invasion. He repaired the fortifications of Alexandria, and the Pharos, the mosque El-Azhar in Cairo, and the walls of the citadel, and built the great mosque known by his name to the north of the city.[3]

Fall of Antioch.

War with the Tatars.

Expedition in Anatolia.

Character of Beybars.

Es-Sa'eed Barakeh Khân.

El-'A'dil Selâmish.

El-Mansoor Kalâ-oon.

The son and successor of Beybars, El-Melik Es-Sa'eed Barakeh Khân, was exiled after a short reign, and a younger brother, El-'A'dil Selâmish, raised to the throne; Kalâ-oon El-Elfee acting as regent. This Memlook had married a daughter of Beybars, and was consequently nearly allied to the Sultân. He, nevertheless, conspired against him, and was soon proclaimed king by the title of El-Melik El-Mansoor. Distinguished in former wars, he achieved many successes during his reign of ten years. On his accession he despatched an army to reduce disturbances in Syria, and took Damascus. Peace was thus established in that province; and in the year 680,[4] he, in person, defeated a very superior force of Tatars, and raised the siege of Rahabeh. Later in his reign (in the year 688) he besieged Tripoli, which for nearly two centuries had been in the possession of the Christians, and was very rich and flourishing. The town was sacked, and its unfortunate inhabitants put to the sword.[5] His memory is still preserved in Cairo by his hospital and mad-house, adjoining his fine mosque in the principal street of the city. This charitable institution he is said to have founded for expiation of great severity towards the citizens, in enforcing an obnoxious edict. His son, El-Ashraf Khaleel, rendered himself famous by the siege and capture (in the year 690) of Acre, the last stronghold of the Crusaders in Syria. Many thousands of its inhabitants were massacred; and 10,000 who presented themselves before the Sultân and demanded quarter were slaughtered in cold blood.[6] He also took Erzeroom in 691, and two years after was assassinated in Egypt.

El-Ashraf Khaleel.

En-Násir Mohammad.

El-'A'dil Ketbugha

El-Mansoor Lágeen.

El-Melik En-Násir Mohammad, another son of Kalâ-oon, succeeded him at the age of nine years. The regent Ketbughâ, however, followed the example of Kalâ-oon, and usurped the sovereignty, with the title of El-Melik El-'A'dil. Pestilence and famine were followed by war with the Tatars, who again ravaged Syria. Ketbughâ despatched an army against them, but the valour of his troops was unable to withstand overpowering numbers, and Lâgeen Kalâ-oon's, governor in Syria, was driven into Egypt with an immense crowd of fugitives. Ketbughâ was deposed on the allegation that he had not commanded in person,[7] and El-Melik El-Mansoor Lâgeen was elevated in his stead. In little more than two years this king fell in a conspiracy. His character was amiable, and he deserved a better return for the equity and kindness he showed to his subjects.

A short period of confusion then ensued, during which an Emeer was proclaimed king. En-Násir Mohammad,

[1] El-Makreezee, trans. Quatremère tom. i., livr. ii., p. 150.

[2] *Ib.*

[3] For full details of this Sultan's reign, see Quatremère's *Hist. des Sultans Mamlooks*; and also Abu-l-Fidà.

[4] El-Makreezee, trans. Quatremère, tom. ii., livr. i., p. 36.

[5] Michaud says 7000 were put to death in the sacking of the town, and many more afterwards. *Hist. des Croisades*, livre 18.

[6] El-Makreezee, trans. Quatremère, tom. ii., livr. i., pp. 125–6. Abu-l-Fidà. Michaud, livr. 18.

[7] El-Makreezee merely says that Ketbughâ led an army to Syria; and that on his return his assassination was attempted by certain of his Emeers near Ramleh, but that he effected his escape. See Quatremère's translation, tom. ii., livr. ii., p. 35, *et seqq.*

Restoration of En-Násir.

Great victory over the Tatars.

however, was at length recalled from his exile at Karak, and elected Sultán in the year 698.[1] Having firmly established himself in Egypt, he led an army against the Tatars, but met with a severe reverse in the plains of Hims; a second expedition proved more fortunate, and this general, then only nineteen years of age, gained a bloody and decisive victory over the enemy near Damascus, in the year 702. The battle lasted three days; during the first two the result was not decisive, although En-Násir held the field; on the third day the Tatars were utterly routed and pursued for many hours.[2] The Sultán on his entry into Cairo after this achievement, was preceded by 1600 prisoners, each one carrying the head of a comrade slain in the combat, and 1000 other heads were borne on lances in the procession. En-Násir reigned until the year 708, when he went to Karak and voluntarily abdicated; he had long struggled against the control of two powerful Emeers, Beybars and Silár; and in despair of throwing off their ascendancy, he then openly yielded the reins of government to those who had long really held them. Since this prince's accession, the Christians and Jews of Egypt suffered the most severe persecution (excepting that of El-Hákim) which had yet befallen them. In the year 700, they were ordered to wear, respectively, blue and yellow turbans, and forbidden to ride on horses or mules, or to receive any government employment. The people took advantage of these measures to destroy many churches and synagogues. The churches continued shut for about a year; but some of those which had been destroyed were afterwards rebuilt at the request of Lascaris and other princes.[3] Another event of this period was a great earthquake which half ruined Cairo, giving it the appearance of a city demolished by a siege; Alexandria and other towns of Egypt, as well as Syria, also suffered from it considerably.[4]

En-Násir abdicates.

Persecution of the Christians and Jews.

El-Mudhaffar Beybars II.

On the abdication of En-Násir, El-Melik El-Mudhaffar-Rukn-ed-Deen Beybars was saluted Sultán; but ere long En-Násir recovered his courage, and having collected an army, marched to Damascus, where he was acknowledged, and thence to Egypt, entering Cairo without opposition. El-Mudhaffar had fled at his approach, and, never a favourite of the people, he was attacked, on his exit from the metropolis, by a crowd of the citizens, who loaded him with abuse, and pelted him with stones. En-Násir now for the third time ascended the throne of Egypt, and took the entire authority into his own hands. The remainder of his life was a period of profound peace, during which he occupied himself in improving his dominions, and in embellishing Cairo. But another persecution of the Christians occurred in 721, and all the principal churches in Egypt were destroyed by certain fanatical Muslims. The Sultán threatened a general massacre of the inhabitants of El-Káhireh and El-Fustát; the Christians, however, took revenge themselves by setting fire to very many mosques and houses in the metropolis; much tumult ensued, and many Christians and Muslims were executed. The threats of the mob compelled En-Násir to permit the people to murder and plunder any Christian whom they might meet in the streets; and the oppressive rules before enacted were rigorously enforced, and made even more degrading.[5]

En-Násir again restored.

Great persecution of the Christians.

El-Mansoor Aboo-Bekr. El-Ashraf Koojook.

The sons of En-Násir followed him in succession, but the reigns of most of them were short and troublous. El-Melik El-Mansoor Seyf-ed-Deen Aboo-Bekr, El-Ashraf 'Alá-ed-Deen Koojook, En-Násir Shiháb-ed-Deen Ahmad, Es-Sálih 'Imád-ed-Deen Ismá'eel, El-Kámil Zeyn-ed-Deen Sháabán, and El-Mudhaffar Zeyn-ed-Deen Hággee, were only raised to the throne to be either exiled or put to death. After these, the Sultán Hasan deserves notice. He was deposed by his brother, Es-Sálih Saláh-ed-Deen—whose minister was Sheykhoon, a man well known to students of Egyptian subjects; but he soon regained his authority, reigned seven years, and at length fell by the swords of his Memlooks in the splendid mosque which he built in the open space beneath the citadel of Cairo. Four more Memlook kings bring the history to the accession of a new dynasty, that of the Circassians. These were El-Mansoor Násir-ed-Deen Hággee (son of El-Mudhaffar), deposed in six months; El-Ashraf Sháabán (son of Hasan), an unfortunate prince, whose reign passed away amid the struggles of the now too powerful Emeers,[6] by whom he was ultimately strangled; his son, El-Mansoor 'Alá-ed-Deen, the victim of similar troubles, and in whose time the celebrated Barkook rose to the regency; and Es-Sálih Hággee, a brother of the last king. Exiled by Barkook, who was proclaimed Sultán, he unsuccessfully endeavoured to recover his throne in the year 784, and in 790 was restored, but he was soon once more dethroned, and this time with the loss of his life, by Barkook.

En-Násir Ahmad. Es-Sálih Ismá'eel. El-Kámil Sháabán. El-Mudhaffar Hággee. The Sultán Hasan. Es-Sálih Saláh-ed-Deen. El-Mansoor Hággee. El-Ashraf Sháaban. El-Mansoor 'Alá-ed-Deen. Es-Sálih Hággee.

Edh-Dháhir Barkook, founder of the Burgee Dynasty.

The Sultán Edh-Dháhir Seyf-ed-Deen Aboo Sa'eed Barkook was now undisputed master of Egypt. He was the first prince of the Dynasty of Burgee or Circassian Memlooks. As the preceding dynasty was founded by the Turkish Memlooks of Es-Sálih Eiyoob, so this dynasty was composed of the Circassian slaves whom those kings from time to time bought with the view of strengthening their power. They were originally placed in garrison-towns, and hence their name *Burgee*, signifying "of a tower or castle." It is worthy of remark, that, while many of the Sultáns of both these dynasties held an insecure tenure of power, many of the former met with a violent death, but few of the latter.[7] The reign of Barkook is memorable for his war with Teemoor, or Teemoor-lang, commonly called by us Tamerlane, who had extended his conquests towards his dominions, but found him not unprepared, for he had foreseen the threatened danger. In the year 795, Kará Yoosuf, lord of El-Medeeyeh, and Ahmad Ibn-Uweys, Sultán of Baghdád, fled to his court for succour. The inhabitants of Edessa had been put to the sword, and Aleppo was menaced with a similar catastrophe, when Barkook, at the head of his army, came to its relief. Ahmad was reinstated in Baghdád, as a vassal of Barkook, whose name appeared on the coinage; and soon after Báyezeed, commonly called by us Bajazet, conducted a treaty with the Sultán of Egypt. The conquest of India diverted Teemoor from his projects in Syria, but Barkook continued vigilant, and by every means sought to insure the safety of his kingdom. He died suddenly in 801, much beloved by his subjects, and regarded by less powerful chiefs as their strongest bulwark against the Tatar monarch. He was called "Sheykh" for his wisdom and learning, and combined with these qualities those of a skilful general and a good king. He was active, wary, and provident; and possessed the military talents of Beybars, without his severity. He seems to have been fond of riches and display, and he certainly left his treasury in a very flourishing condition, besides much wealth in stores, slaves, horses, and the like.[8]

War with Teemoor-lang.

En-Násir Farag.

His son, El-Melik En-Násir Abu-s-Sa'ádát Farag, fell a prey to intestine troubles and the inroads of the invader. He

---

[1] El-Makreezee, trans. Quatremère, tom. ii., livr. ii., p. 126. [2] *Id.*, tom. ii., livr. ii., p. 199, *et seqq.*

[3] See *Modern Egyptians*, supplement; El-Makreezee, trans. Quatremère, tom. ii., livr. ii., p. 177, *et seqq.*; and for further information on the persecutions of the Christians, Quatremère's *Mémoires sur l'Egypte*, tom. ii., pp. 220–266.

[4] El-Makreezee, trans. Quatremère, tom. ii., livr. ii., p. 215, *et seqq.* [5] *Modern Egyptians, loc. cit.*; and *Mémoires sur l'Egypte, ib.*

[6] Not a little of this turbulence was excited by the constantly intriguing Khaleefehs, who used their religious influence against their patrons, at whose court they were indeed but guests. [7] See *Englishwoman in Egypt*, vol. i., pp. 225–9. [8] Abu-l-Mahásin.

Egypt.

Teemoor-lang defeats Farag.

had overcome a revolt of the governor of Syria, when Teemoor again threatened that province. Karà Yoosuf and Ahmad sought refuge with the son of their former protector, and Farag's refusing to betray his guests gave occasion to the enemy to continue the war; a battle was fought, Farag was defeated, Aleppo and Hims fell into the hands of the victor, and the Egyptian forces returned and were concentrated in Egypt. Intimidated, however, by the fall of his ally Bâyezeed, Farag sent an embassy to Teemoor with presents and offers of amity, and at length concluded a peace at the sacrifice of territory. Teemoor died in the year 807 (A.D. 1405), and Farag was preparing an expedition to recover his Syrian possessions, when he was surprised in his palace by an insurrection, headed by his brother, 'Abd-el-'Azeez, and compelled to take to flight. The people, believing that he had perished, proclaimed El-Mansoor 'Abd-el-'Azeez his successor. In the space of less than three months, however, he was deposed in favour of Farag, who thenceforth reigned at Damascus, until the Khaleefeh El-Musta'een bi-llâh, at the instigation of the Emeer Sheykh El-Mahmoodee, who had raised an army, boldly declared himself Sultân, by an appeal to religion gained numbers to his side, instituted criminal proceedings against Farag on the plea of the exactions which he had been forced to levy for the conduct of the war against Teemoor, and accomplished his death. He was beheaded in the month of Safar in the year 815, and his corpse was left unburied. Abu-l-Mahâsin gives him the character of an extravagant, cruel, and voluptuous king.

El-Mansoor 'Abd-el-'Azeez. Farag restored.

El-Musta'een.

El-Musta'een bi-llâh, with the title of El-Melik El-'A'dil Abu-l-Fadl, began his reign well; but he had appointed El-Mahmoodee his Wezeer as a reward for his services, and this powerful and vigorous chief soon obliged him to abdicate, and eventually exiled him to Alexandria, where he passed the remainder of his days.

El-Mu-eiyad Sheykh. Campaigns in Syria.

El-Melik El-Mu-eiyad Abu-n-Nasr Sheykh El-Mahmoodee (originally a Memlook of Barkook's) waged three successful wars in Syria, in the first of which he was guilty of a breach of faith in putting to death the governor of Damascus and part of the garrison of that city, after they had surrendered on promise of safety. He reigned peacefully in Egypt, and his name is recorded as that of a king who studied the happiness of his subjects and favoured the learned, who counted him among their number. But he was avaricious; although we might judge the contrary from his beautiful mosque, and the elegant minarets over the Bâb-Zuweyleh, in Cairo, which are among the chief ornaments of the city.[1]

El-Mudhaffar Ahmad. Edh-Dhâhir Tatar. Es-Sâlih Mohammad. El-Ashraf Barsabây. Expedition to Cyprus.

Three kings followed in rapid succession: El-Mudhaffar Ahmad, a son of El-Mu-eiyad, under two years of age at his accession; Edh-Dhâhir Tatar and his infant son, Es-Sâlih Mohammad, who was deposed by Barsabây Ed-Dukmâkee. This Memlook assumed the title of El-Melik El-Ashraf, and worthily continued the prosperous reign of El-Mu-eiyad. In power and virtue he ranks second only to Barkook among all the kings of this dynasty.[2] He is known in European history by his expedition in 827 against John III., king of Cyprus, who became his vassal; and by the part he took, about seven years later, in the dissensions of the court of Savoy and the government of Cyprus. He ruled for seventeen years, with great clemency, and died in 841. El-'Azeez Yoosuf, his son, was deposed by El-Mansoor Aboo-Sa'eed Jakmak El-'Alâ-ee, a good prince, and a patron of the learned.[3] After a peaceful reign he abdicated at the age of about eighty years in favour of his son, El-Mansoor Abu-s-Sa'âdât 'Othmân, who was overthrown by the intrigues of the Khaleefeh El-Kâïm bi-amri-llâh, and was succeeded by an aged Memlook, El-Ashraf-Abu-n-Nasr Eynâl El-'Alâ-ee En-Nâsiree, followed by his son, El-Mu-eiyad Shihâb-ed-Deen Abu-l-Fet-h Ahmad. Edh-Dhâhir Seyf-ed-Deen-Khóshkadam, a Greek by birth, superseded him, reigning himself for seven years, with equity and benignity; presenting a contrast to the cruelty and oppression of his appointed successor, Edh-Dhâhir Aboo-Sa'eed Bilbây El-'Alâ-ee, which caused the latter's fall and the elevation of the Sultân Aboo-Sa'eed Temerbeg Edh-Dhâhiree, who, in his turn, was deposed to make room for El-Ashraf Kâït Bey, a prince who deserves especial notice for his struggles with the Turks, whereby the conquest of Egypt by that people was deferred for a few years. After a period of quiet which followed his accession, he was alarmed by the victory gained by Mohammad II. over his ally the King of Persia, and posted a considerable force on the frontier of Syria. The successes of the conqueror of Constantinople made him desire to abdicate; but the Emeers prayed him to defend his rights, and he consequently prepared for the war. The death of Mohammad, and the dissensions between Bâyezeed II. and Jem (or Zizim) temporarily relieved him of these apprehensions. The fall of Jem, however, and his arrival at the Egyptian court, implicated Kâït Bey in the quarrel; and on the final overthrow of this prince he made sure of a war with the more fortunate Bâyezeed, and himself began aggressive measures, intercepted the Turkish caravan of Pilgrims, and an ambassador from India who was on his way to Constantinople with presents, and took Tarsus and Adaneh. A remonstrance from Bâyezeed was answered by a successful attack on his Asiatic commander, 'Alâ-ed-Dowleh. In the meantime Tarsus and Adaneh were recovered from him; but the Emeer El-Ezbekee, to whom was entrusted the conduct of all future wars, being despatched against these towns, retook them, defeated an army sent to chastise him, and annexed Karamania. Another force was speedily equipped, and took the field in 893: conditions of peace were refused, and considerable success attended the Turkish arms. El-Ezbekee was, therefore, again ordered to Syria; a Turkish squadron conveying troops was dispersed, and at Tarsus he gave battle. The result was at first unfavourable to the Memlooks, whose commander, however, rallied them under cover of night, and succeeded in surprising and totally defeating the Turks. Long negotiations followed this victory; and at length Kâït Bey, who was always most anxious for peace, ceded the disputed towns of Tarsus and Adaneh, and secured repose during the rest of his days. He died in 901, having designated El-Melik En-Nâsir Abu-s-Sa'âdât Mohammad as his successor. This weak and barbarous king was put to death after four years, during which he was deposed, and Kânsooh, surnamed Khamsameeyeh, and Edh-Dhâhir Abu-n-Nasr Kânsooh were successively installed. The first reigned but eleven days, and the latter abdicated after five months of great difficulty and danger. On the death of En-Nâsir, El-Ashraf Kânsooh Jânbalât was elevated to the throne, but six months sufficed to accomplish his fall, and he was fortunate in preserving his life. The next Sultân, El-Melik El-'A'dil Toomân Bey, was acknowledged both in Egypt and Syria. He, however, was overthrown and killed in a few months.

El-'Azeez Yoosuf. El-Mansoor Jakmak. El-Mansoor 'Othman. El-Ashraf Eynal. El-Mu-eiyad Ahmad. Edh-Dhâhir Khóshkadam. Edh-Dhâhir Bilbây. The Sultân Temerbeg. El-Ashraf Kâït Bey. War with Bâyezeed. En-Nâsir Mohammad. El-Ashraf Jânbalât. El-'A'dil Toomân Bey.

El-Ghooree.

The Memlooks now compelled Kânsooh El-Ghooree to assume the dangerous dignity, with the title of El-Melik El-Ashraf. This prince very unwillingly yielded. His previous life shows him to have been both virtuous and learned; and he proved himself to be an able ruler. After an unsuccessful expedition against the Portuguese in the East, he reigned in peace until the year 915, when Kurkood, the father of Seleem I., the Turkish Sultân, obtained his protection and assistance. Events similar to those which accompanied the end of Jem followed; and Seleem

[1] Abu-l-Mahâsin. [2] *Ib.* [3] El-Is-hâkee bears similar testimony to the character of this king, and that of Barsabây.

Egypt.

War with Seleem.

availed himself of a pretext to declare war against Egypt. The first reverse which the Egyptians suffered occurred to an army commanded by 'Alá-ed-Dowleh, formerly defeated by Káït Bey, but now in the pay of El-Ghooree. The winter was passed by the latter in preparing energetically for the inevitable struggle, and in the spring he advanced in person. Seleem, on his part, reduced the last place in the hands of the Egyptians in 'Aladowleeyeh, and pretended to march towards Persia; but at the same time he sent to demand of El-Ghooree wherefore he opposed his passage, and commanded in person on the frontier. El-Ghooree replied, that his was merely an army of observation, and that he was desirous of mediating between Seleem and Ismá'eel Sháh. Seleem, however, rapidly advanced, refused to listen to an attempt at negotiation, and was met by El-Ghooree on the plain of Marj-Dábik, near Aleppo. A long and sanguinary battle ensued, and victory declared for neither side, until Kheyr Bey, commanding the right wing, and El-Ghazálee, over the left of the Egyptian army, basely deserted to the enemy with their troops. The centre then gave way and fled in utter confusion, notwithstanding the efforts of the Sultán to rally them. He was trampled to death by his routed cavalry, while (according to some) in the act of prayer. This event took place on the 26th of Regeb 922 (A.D. 1517). With his death Egypt lost her independence. The shattered remains of the army collected in Cairo. Toomán Bey, a nephew of the deceased king, was elected Sultán, and at once determined on every resistance to the conqueror. His general in Syria, El-Ganbardee, disputed the road with Seleem step by step, and Toomán Bey awaited his arrival near Cairo. Between El-Khánkah and the metropolis, at the village of Er-Reydáneeyeh, the opposing armies joined battle, on the 29th of Zu-l-Heggeh. The fall of a favourite general, Sinán Páshá, infuriated the Turks, and the brilliant bravery of the Memlooks availed them not. Immense numbers of them were slain by their enemies in the pursuit, and the survivors reunited in Cairo. El-Ganbardee, however, sacrificed his fame by joining the victor. The Turkish army paused for rest; and time was thus given to Toomán Bey to hire Arabs at a great cost to replenish his thinned ranks. Seleem now passed to the west of Cairo. A night surprise conducted by Toomán failed, but he succeeded in putting to the sword a great many Turks. He fortified himself in the city, and a house-to-house combat ensued, the Memlooks defending every foot with the energy of despair; the citadel fell by assault, and the unfortunate Toomán effected his escape towards Alexandria; but on the way he was taken by Arabs, given up to El-Ganbardee and another, and brought in chains to Seleem, who at first received him with honour, but afterwards falsely accused him of conspiring against him, and, with the cruelty and perfidy characteristic of his race, crucified him over the Báb-Zuweyleh, the place of execution for common malefactors. Thus miserably perished the last independent ruler of Egypt, who possessed the best qualities of his line, and whose noble defence of his kingdom would have secured to him the commiseration of any but a Turk.

Battle of Marj-Dábik, and death of El-Ghooree.

Toomán Bey.

The Turkish conquest.

In reviewing the period during which Egypt was governed by independent Muslim princes, it is necessary to consider the spirit of the times and the people over whom they ruled. They succeeded to the government of countries worn out by incessant warfare, overrun by savage hordes, and debased by the rule of the Lower Empire. Egypt had long struggled against the slavery to which it was condemned, and the history of the last three dynasties of Pharaohs evinces the patriotism which yet animated her people. But the successive tyranny of the Persians, the Greeks, and the Romans appears to have annihilated their nationality; and when the Arabs invaded the country, these causes, combined with religious strife, induced them to afford to the conquerors every assistance in their power. But the changeful rule of the lieutenants, and the troubles of the Khaleefehs, debarred Egypt (excepting during the reigns of some kings of the dynasties of the Benee-Tooloon and the Ikhsheedeeyeh) from profiting by the enlightenment of the race who held the dominion over it, until the conquest by the Fátimees. The Khaleefehs of that dynasty contributed in a great degree to restore to Egypt some portion of its ancient prosperity, and with the House of Eiyoob it attained its greatest military glory under the Muslims; but the edifices erected during the rule of the two dynasties of Memlook kings, the libraries collected in Cairo at that period, and the learned men who then flourished, would point to it as the age in which literature and the arts were cultivated with the most success; a sure evidence of the internal prosperity of any country. This is the more surprising when we consider the state of Syria, which had long before their accession fallen a prey to intestine wars, and the ravages of the Tatars, the Crusaders, and other invaders; and also bear in mind the constitution of their government, in which the more powerful chiefs were constantly aiming at the supreme authority; and the practice of purchasing Memlooks, and rearing them in the households of the great to enable their masters to maintain their ascendancy, augmented the number of these aspirants to the throne. These slaves were, unlike the Bahrees (who were the Turkish Memlooks of the Eiyoobee Sultán, Es-Sálih Negm-ed-Deen), chiefly Circassians, who afterwards composed the Second Dynasty, the Burgee. Many of the Memlook Sultáns rivalled in military achievements the great Saláh-ed-Deen, and even penetrated farther than he in their foreign expeditions. In Cairo are preserved the finest specimens of Arab architecture, almost all dating during the period comprised under the domination of the two Memlook Dynasties: the libraries of the mosques, and private collections of that city, though grievously injured since the Turkish conquest, are, or very recently were, the best and most considerable of those of Egypt or Syria;[1] and, as before remarked, the University El-Azhar is still, owing to the fostering care of these Sultáns, the principal seat of learning of the Eastern world. Some have endeavoured to give a history of Egypt after the European model, with accounts of the state of commerce, taxation, and the like, under the Muslims; but those only who have read the Arab histories of this and other countries can appreciate the general fallacy of these conclusions, and perceive in them that common failing of modern authors, a desire to throw a new light on history, rather than state only as much as the materials warrant.

Turkish Páshás.

It would be tedious and unprofitable to follow the details of Turkish misrule and tyranny which are from this time presented to the student of Egyptian history. Although Seleem destroyed the power of the Memlooks, he thought fit to appoint twenty-four Beys over the military provinces of that number into which he divided Egypt, subject to the supreme control of a Páshá, whose council was formed of seven Turkish chiefs (ójáklees), while one of the Beys held the post of Sheykh el-Beled, or Governor of the Metropolis; an officer who became an object of hatred to the other chiefs.[2] For nearly two centuries the successive Páshás were mostly obeyed; but the ambition of becoming Sheykh el-Beled was the fruitful cause of intrigue and murder. The Memlooks who then held power in Egypt were called the Ghuzz, that being the name of the tribe to which they are said to have at first generally belonged; and they continually bought slaves, of Circassian or Georgian race, to

The Ghuzz.

[1] It should, however, be mentioned that many of the most precious of their contents are plunder brought from the libraries of mosques in Syria, as is proved by seals which they bear.

[2] This system was commenced by Seleem, and completed by his successor.

supply the place of children, for they did not intermarry with natives of Egypt, and women of more northern climates are generally either barren or bear sickly offspring in that country. Thus they lacked the surest source of power; few possessed any family ties; but at the same time the slaves in general were remarkably faithful to their patrons. At the expiration of the period before mentioned, the Beys gradually increased in power, until the authority of the Páshá was almost nominal, and the government became a military oligarchy:[1] this brings us to the rise of the celebrated 'Alee Bey. He was created Sheykh el-Beled in the year 1177; but, having revenged himself on an old enemy who had assassinated 'Alee's master, to whom he owed his elevation to the rank of Bey, he shortly after fled to Syria, and took refuge with the governor of Jerusalem, and thence went to Acre, where the Sheykh Dháhir became his friend; and that same year he returned to Cairo in his former capacity of Sheykh el-Beled. In 1179 his enemies again compelled him to flee, and he betook himself this time to El-Yemen, once more to return to Egypt; after which he gained increased power. His favourite Memlook, Mohammad Aboo-Dhahab, proved ungrateful, and, while enjoying the highest power, entered into a conspiracy against his life; but after receiving the presents of the hostile Beys, he denounced them to his master, who would not listen to warnings of his meditated treachery.

'Alee Bey.

In the year 1182, the Porte demanded the assistance of 'Alee Bey in the Russian war; an order which he was about to obey, when he was apprised of the departure of a messenger with a firmán demanding his head, he having been falsely accused at Constantinople of intending to aid the Russians and throw off his allegiance. He caused the bearer of this order to be waylaid and put to death, and having possessed himself of the firmán, he convened the Beys, showed them the document, and aided by those of his own household,[2] persuaded the council to expel the Páshá, and declare Egypt independent. The Sheykh Dháhir took part in this rebellion, and the Páshá of Damascus was beaten by him between Mount Lebanon and Tiberias. A period of good but vigorous government and of tranquillity followed these events in Egypt, notwithstanding the very heavy imposts levied for the replenishment of the treasury; and 'Alee's generals gained for him extended power abroad. Mohammad Aboo-Dhahab was despatched to Arabia, and entered Mekkeh, where the Shereef was deposed, and another Bey traversed the eastern shores of the Red Sea. After the expedition to Arabia, Mohammad Bey marched into Syria to assist the Sheykh Dháhir against the Porte, and the co-operation of the Russians was demanded. A successful campaign terminated before the walls of Damascus, the siege of which was abandoned when nearly brought to a close, and Mohammad Bey returned with large forces to Egypt. This man, loaded with benefits by his patron, now openly rebelled; and being joined by 'Alee's enemies, at the head of whom was Ismá'eel, chief of the guard (who was sent against him and went over to his side), he advanced on Cairo, and 'Alee escaped to his steady ally, Sheykh Dháhir, the Prince of Acre. These events took place in the year 1186. Mohammad Bey was then declared Sheykh el-Beled. 'Alee Bey in the meanwhile, in conjunction with his ally, gained various advantages in Syria, and, on the information that his return was desired in Egypt, he collected a small force, assisted by Sheykh Dháhir and a Russian squadron, and determined on attempting to recover his power. He, however, fell into an ambuscade near Es-Sáliheeyeh, and was wounded by one of his Memlooks named Murád (afterwards Murád Bey),[3] carried to the citadel, and poisoned by Mohammad Bey. Thus terminated the career of the famous 'Alee Bey, a man whose energy, talents, and ambition bear a strong resemblance to those of the late viceroy Mohammad 'Alee.

Egypt declared independent.

Mohammad Bey Aboo-Dhabab continued Sheykh el-Beled, tendered his allegiance to the Porte, and was invested with the pashalic. He then entered Syria, and severely chastised Sheykh Dháhir, taking Gaza, Joppa, and Acre itself. Joppa was taken by assault, and suffered a massacre of its inhabitants, and Acre was pillaged. At the latter place the Páshá suddenly died. His mosque in Cairo is the latest fine specimen of Arab architecture, and is not unworthy of its better days.

Mohammad Bey.

The chief competitors for power were now Ismá'eel, Ibráheem, and Murád, the first of whom was speedily expelled, the contest continuing between the two latter Beys. Ibráheem at length succeeded in causing himself to be proclaimed Sheykh el-Beled, and Murád contented himself with the office of Emeer el-Hagg, or chief of the pilgrims; but this arrangement was not destined to be of long continuance; a violent quarrel resulted in a recourse to arms, and that again in a peace of three years' duration, during which the two Beys held an equal sway. In the year 1200 the Porte despatched Hasan Capitan (properly Kapoodán) Páshá (or High Admiral) with a Turkish force, to reduce the turbulent Memlooks to obedience, and to claim the annual tribute. Murád Bey was defeated at Er-Rahmáneeyeh, and the Turks advanced to Cairo, desolating the country, and acting according to their almost invariable practice on such occasions. The metropolis opened its gates to Hasan Páshá, who determined on pursuing the Beys to Upper Egypt, whither he despatched a large portion of his army, and a sanguinary conflict took place. But a war with Russia recalled this commander to Constantinople. Ismá'eel was again created Sheykh el-Beled, and he held that post until the terrible plague of the year 1205, in which he perished, and hence it is commonly called the "Plague of Ismá'eel." His death caused the return of Ibráheem and Murád; and eight years after intelligence of the arrival at Alexandria of a French army of 36,000 men, commanded by General Bonaparte, united these chiefs in a common cause.

Ibráheem Bey.

Ismá'eel Bey.

On the 18th May 1798 (A.H. 1212), this expedition, consisting of 13 sail of the line, 6 frigates, and 12 vessels of a smaller size, sailed from Toulon, and made the coast of Egypt on the 1st July. The troops were landed near Alexandria, and the city fell by assault on the 5th of that month. The French conquest and occupation of Egypt belong to European history; a recapitulation of the principal events of the period will therefore suffice in this place. The Memlooks affected to despise their antagonist, and hastened to chastise him: at Shibirrees they attacked the French, and were repulsed; but, nothing discouraged, they collected all their forces, exceeding 60,000 men, under the command of Murád, and entrenched themselves at Embábeh, opposite Cairo. Here was fought the battle which has been dignified with the name of that of the Pyramids. European tactics completely bewildered the Memlooks, their famous cavalry was received on the bayonets of the French squares, a galling fire of grape and musketry mowed down their ranks, and of this great army only about 2500 horse escaped with Murád Bey, while 15,000 men of all arms fell on the field of battle. Having made himself master of Cairo, Bonaparte despatched General Desaix to effect the conquest of Upper Egypt, and the success of the Eastern expedition seemed secured. But, ten days after the

The French invasion.

Battle of the Pyramids.

[1] See the *Englishwoman in Egypt*, vol. i., p. 229–231.

[2] 'Alee Bey had, ever since his attainment to the post of Sheykh el-Beled, endeavoured to appoint his own creatures to all places of dignity and trust; he had also greatly increased the number of his Memlooks, to the amount of 6000, and created eighteen of them Beys.

[3] This event is variously related. Marcel states that he was victorious over the advanced guard of Mohammad Bey, but defeated and wounded in a battle with the main body; he places the scene of the encounter at the same place, near Es-Sáliheeyeh.

Egypt. Battle of the Nile. victory of Embâbeh, the battle of the Nile annihilated the French fleet in Aboo-Keer Bay, and most materially influenced the future conduct of the war. On this point, Napoleon himself says, "La perte de la bataille d'Aboukir eut une grande influence sur les affaires d'Égypte et même sur celles du monde; la flotte Française sauvée, l'expédition de Syrie n'éprouvait point d'obstacles, l'artillerie de siége se transportait sûrement et facilement au-delà du désert, et Saint-Jean-d'Acre n'arrêtait point l'armée Française. La flotte Française détruite, le divan s'enhardit à déclarer la guerre à la France. L'armée perdit un grand appui, sa position en Égypte changea totalement, et Napoléon dut renoncer à l'espoir d'asseoir à jamais la puissance Française dans l'Occident par les résultats de l'expédition d'Égypte."[1] The disastrous expedition into Syria, undertaken for the purpose of frustrating the efforts of Sir Sydney Smith before Alexandria, and of Jezzâr Páshá, who was advancing from Acre, still further obscured Napoleon's prospects in the East, and the victory soon after obtained by him over the Ottoman army at Aboo-Keer, the second defeat of Murád Bey, and various successes over the Turks, enabled the French general Kléber (Napoleon having left for Europe after the first of these events) to set on foot negotiations for an honourable evacuation of the country. But when the convention was already signed, and the French were about to quit Cairo, Lord Keith signified to Kléber that Great Britain would not consent to the terms of the treaty; and although this refusal was afterwards rescinded, Kléber considered that the withdrawal came too late: he totally defeated 70,000 men under the Grand Vezeer at Heliopolis, and returned to Cairo to quell an insurrection of the inhabitants. This distinguished officer was about this time assassinated in the garden of his palace by a fanatic, who was impaled in the great square (then a lake) called the Ezbekeeyeh, in Cairo, and miserably lingered for the space of three days before death put an end to his sufferings. Under Kléber's administration, Egypt began to resume its former prosperity: by his conciliatory and good government, much prejudice against the French was overcome; by ceding a part of Upper Egypt to Murád, he gained the good will of that chief, who gave him no cause to regret this politic step; while under his auspices the "savans" of the Institute collected the valuable mass of information embodied in the "Great French Work."

On the death of Kléber, General Menou succeeded to the command, and although he afterwards conducted the defence of the country with much valour, yet, to his injudicious administration, and his want of military talent, we must mainly ascribe the determination of the British government to attempt the expulsion of the French from Egypt, and the rapid success of the campaign that ensued. On the

British expedition. 2d of March 1801 an army under Sir Ralph Abercromby arrived in Aboo-Keer Bay and made good a landing in the face of a well-disposed French force, which offered every possible resistance. The memorable battle of Alexandria, in which Abercromby fell, decided the fate of the war. A bold march, executed with talent, effected the capitulation of Cairo; Alexandria surrendered on the 1st of September, and the French sailed from the shores of Egypt in the course of that month.[2] General Hutchinson had taken the command of the English expedition, afterwards reinforced by a detachment from India under General Baird; and the army of the Grand Vezeer, and that of the Capitan-Páshá, with the troops of Ibráheem Bey (Murád having died of the plague), had co-operated in the measures which led to the evacuation of the country by Menou.[3]

Origin of Mohammad 'Alee. The history now requires that we should mention the early career of a man who subsequently ruled the destinies of Egypt for a period of nearly forty years. The late viceroy of Egypt, Mohammad 'Alee Páshá, was born in the year of the Flight 1182 (A.D. 1768–9) at Cavalla, a small seaport town of Albania. On the death of his father, in early life, he was brought up in the house of the governor of the town, who, as a reward for military prowess, gave him his daughter in marriage. By her he had, it is said, his three eldest sons, Ibráheem,[4] Toosoon, and Ismá'eel. Having attained the rank of bûluk-báshee (or head of a body of infantry), he became a dealer in tobacco, until, in his thirty-third year, he was despatched with his patron's son, 'Alee Agha, and 300 men, the contingent furnished by his native place, with the Turkish expedition against the French in Egypt; and soon after his arrival in that country he succeeded, on the return of 'Alee Agha, to the command, with the nominal rank of beeñ-báshee (or chief of a thousand men).

Soon after the evacuation of Egypt by the French, that unfortunate country became the scene of more severe troubles, in consequence of the unwarrantable attempts of the Turks to destroy the power of the Ghuzz. In defiance of promises to the English government, orders were transmitted from Constantinople to Hoseyn Páshá, the Turkish High Admiral, to ensnare and put to death the principal Beys. Invited to an entertainment, they were, according to the Egyptian contemporary historian El-Gabartee,[5] attacked on board the flag-ship; Sir Robert Wilson and M. Mengin, however, state that they were fired on, in open boats, in the bay of Aboo-Keer. They offered a heroic resistance, but were overpowered and made prisoners, while Mohammad Bey El-Menfookh, 'Osmân[6] Bey Et-Tamburgee, 'Osmân Bey El-Ashtar, Mohammad Bey El-Hasanee, Murád Bey the Younger, and Ibráheem Kikhya Es-Sennâree (a black), were among the killed. Some, including the afterwards-celebrated 'Osmân Bey El-Bardeesee, escaped in a boat, and sought refuge with the English, who at that time occupied Alexandria. General Hutchinson, informed of this treachery, immediately assumed threatening measures against the Turks, and in consequence, the killed, wounded, and prisoners were given up to him. Such was the commencement of the disastrous struggle between the Memlooks and the Turks.

Khusruf Pasha. Mohammad Khusruf was the first Páshá after the expulsion of the French. The form of government, however, was not the same as that before the French invasion; for the Ghuzz were not reinstated. The Páshá, and through him, the Sultân, endeavoured on several occasions either to ensnare them, or to beguile them into submission; but their efforts failing, Mohammad Khusruf took the field, and a Turkish detachment 14,000 strong despatched against them to Demenhoor, whither they had descended from Upper Egypt, was defeated by a small force under El-Elfee.[7] Their ammunition and guns fell into the hands of the Memlooks.

Departure of the British. In March 1803 the British evacuated Alexandria, and Mohammad Bey El-Elfee accompanied them to England to consult respecting the means to be adopted for restoring the former power of the Ghuzz. About six weeks after, the Arnaoot (or Albanian) soldiers in the service of Khusruf tumultuously demanded their pay, and surrounded the house

[1] Napoleon, *Memoires*, t. ii.

[2] Very many of the French had either married Muslim females, or bought concubine slaves of the same faith, whom, on their departure, they left behind them; and these unfortunates were forthwith tied up in sacks and drowned.

[3] Sir R. Wilson's *History of the British Expedition.*

[4] Ibráheem is, however, believed by many, or most, to have been the wife's son by a former husband.

[5] The MS. annals of El-Gabartee have furnished the materials for this narrative of the times of Mohammad 'Alee, until the month of Gumáda-t-Táníyeh, A.H. 1220 (A.D. 1805), when they terminate.

[6] Correctly 'Othmán, but commonly pronounced 'Osmân.

[7] Mengin says that El-Elfee withdrew his force leaving El-Bardeesee with 800 men to meet the enemy.

Egypt.

of the Defterdâr, who in vain appealed to the Páshá to satisfy their claims. The latter opened fire from the artillery of his palace on the insurgent soldiery in the house of the Defterdâr, across the Ezbekeeyeh. The citizens of Cairo, accustomed to such occurrences, immediately closed their shops, and the doors of the several quarters, and every man who possessed any weapon armed himself. The tumult continued all the day, and the next morning a body of troops sent out by the Páshá failed to quell it. Táhir, the commander of the Albanians, then repaired to the citadel, gained admittance through an embrasure, and having obtained possession of it, began to cannonade the Páshá over the roofs of the intervening houses, and then descended with guns to the Ezbekeeyeh, and laid close siege to the palace. On the following day, Mohammad Khusruf made good his escape with his women and servants and his regular troops, and fled to Damietta by the river. This revolt marks the commencement of the rise of Mohammad 'Alee to power in Egypt, and of the breach between the Arnaoots and Turks which ultimately led to the expulsion of the latter.

Táhir Páshá.

Táhir Páshá assumed the government, but in twenty-three days he met with his death from exactly the same cause as that of the overthrow of his predecessor. He refused the pay of certain of the Turkish troops, and was immediately assassinated. A desperate conflict ensued between the Albanians and Turks; and the palace was set on fire and plundered. The masters of Egypt were now split into these two factions, animated with the fiercest animosity against each other. Mohammad 'Alee became the head of the former, but his party was the weaker, and he therefore entered into an alliance with Ibráheem Bey, and 'Osmán Bey El-Bardeesee. A certain Ahmad Páshá, who was about to proceed to a province in Arabia, of which he had been appointed governor, was raised to the important post of Páshá of Egypt, through the influence of the Turks, and the favour of the Sheykhs; but Mohammad 'Alee, who with his Albanians held the citadel, refused to assent to their choice; the Memlooks moved over from El-Geezeh, and Ahmad Páshá betook himself to the mosque of Ez-Záhir,[1] which the French had converted into a fortress. He was compelled to surrender by the Albanians; the two chiefs of the Turks who killed Táhir Páshá were taken with him and put to death, and he himself was detained a prisoner. In consequence of the alliance between Mohammad 'Alee and El-Bardeesee, the Albanians gave the citadel over to the Memlooks; and soon after, these allies marched against Khusruf Páshá, who having been joined by a considerable body of Turks, and being in possession of Damietta, was enabled to offer an obstinate resistance. After much loss on both sides, he was taken prisoner and brought to Cairo; but he was treated with much respect. The victorious soldiery sacked the town of Damietta, and were guilty of the barbarities usual with them on such occasions.

'Alee Páshá.

A few days later, 'Alee Páshá El-Tarábulusee[2] landed at Alexandria with an imperial firmán constituting him Páshá of Egypt, and threatened the Beys, who now were virtual masters of Upper Egypt, as well as of the capital and nearly the whole of Lower Egypt. Mohammad 'Alee and El-Bardeesee therefore descended to Rosetta, which had fallen into the hands of a brother of 'Alee Páshá, and having recovered the town and captured its commander, El-Bardeesee purposed to proceed against Alexandria; but the troops required arrears of pay which it was not in his power to give, and the Páshá had cut the dyke between the Lakes of Aboo-Keer and Mareotis, thus rendering the approach to Alexandria more difficult. El-Bardeesee and Mohammad 'Alee therefore returned to Cairo. The troubles of Egypt were now increased by an insufficient inundation, and great scarcity prevailed, aggravated by the exorbitant taxation to which the Beys were compelled to resort in order to raise money to pay the troops; while murder and rapine prevailed to a frightful extent in the capital, the riotous soldiery being under little or no control. In the meantime, 'Alee Páshá, who had been behaving in an outrageous manner towards the Franks in Alexandria, received a khatt-i-shereef from the Sultán, which he sent by his secretary to Cairo. It announced that the Beys should live peaceably in Egypt, with an annual pension, each, of fifteen purses[3] and other privileges, but that the government should be in the hands of the Páshá. To this the Beys assented, but with considerable misgivings; for they had intercepted letters from 'Alee to the Albanians, endeavouring to alienate them from their side to his own; to these, deceptive answers were returned, and he was induced by them to advance towards Cairo, at the head of 2500 men. The forces of the Beys, with the Albanians, encamped near him at Shalakán, and he fell back on a place called Zufeyteh. They next seized his boats conveying soldiers, servants, and his ammunition and baggage; and, following him, they demanded wherefore he brought with him so numerous a body of men, in opposition to usage and to their previous warning. Finding they would not allow his troops to advance, forbidden himself to retreat with them to Alexandria, and being surrounded by the enemy, he would have hazarded a battle, but his men refused to fight. He therefore repaired to the camp of the Beys, and his army was compelled to retire to Syria. In the hands of the Beys, 'Alee Páshá again attempted treachery. A horseman was seen to leave his tent one night at full gallop; he was the bearer of a letter to 'Osmán Bey Hasan, the governor of Kinè. This offered a fair pretext to the Memlooks to rid themselves of a man whose antecedents, and his present conduct, proved him to be a perfidious tyrant. He was sent under a guard of forty-five men towards the Syrian frontier; and about a week after, news was received that in a skirmish with some of his own soldiers he had fallen mortally wounded.

The death of 'Alee Páshá produced only temporary tranquillity; in a few days the return of Mohammad Bey El-Elfee (called the Great or Elder), from England, was the signal for fresh disturbances, which, by splitting the Ghuzz into two parties, accelerated their final overthrow. The jealousy which existed between El-Elfee and the other most powerful Bey, El-Bardeesee, has been before mentioned. The latter was now supreme among the Ghuzz, and this fact considerably heightened their old enmity. While the guns of the citadel, those at Masr El-'Ateekah, and even those of the palace of El-Bardeesee, were thrice fired in honour of El-Elfee, preparations were immediately commenced to oppose him. His partisans were collected opposite Cairo, and El-Elfee the Younger held El-Geezeh; but treachery was among them; Hoseyn Bey El-Elfee was assassinated by emissaries of El-Bardeesee, and Mohammad 'Alee, with his Albanians, gained possession of El-Geezeh, which was, as usual, given over to the troops to pillage. In the meanwhile El-Elfee the Great embarked at Rosetta; and not apprehending opposition, was on his way to Cairo, when a little south of the town of Manoof he encountered a party of Albanians, and with difficulty made his escape. He gained the eastern branch of the Nile, but the river had become dangerous, and he fled to the desert. There he had several hair-breadth escapes, and at last secreted himself among a tribe of Arabs at Rás-el-Wádee. A change in the fortune of El-Bardeesee, however, favoured his plans for the future. That chief, in order to satisfy the demands of the Albanians for their pay, gave orders to levy heavy contributions from the citizens of Cairo; and this new oppres-

[1] The mosque of Edh-Dháhir Beybars, thus commonly called by the people of Cairo.

[2] Called by Mengin Gezaïrly.

[3] The purse was then worth L.15, 12s. 6d.

Egypt.

sion roused them to rebellion. The Albanians, alarmed for their safety, assured the populace that they would not allow the order to be executed; and Mohammad 'Alee himself caused a proclamation to be made to that effect. Thus the Albanians became the favourites of the people, and took advantage of their opportunity. Three days later they beset the house of the aged Ibráheem Bey, and that of El-Bardeesee, both of whom effected their escape with considerable difficulty. The Memlooks in the citadel directed a fire of shot and shell on the houses of the Albanians which were situated in the Ezbekeeyeh; but on hearing of the flight of their chiefs, they evacuated the place; and Mohammad 'Alee, on gaining possession of it, once more proclaimed Mohammad Khusruf Páshá of Egypt. For one day and a half he enjoyed the title; the friends of the late Táhir Páshá then accomplished his second degradation,[1] and Cairo was again the scene of terrible enormities, the Albanians revelling in the houses of the Memlook chiefs, whose hareems met with no mercy at their hands. These events were the signal for the reappearance of El-Elfee.

Khursheed Páshá.

The Albanians now invited Ahmad Páshá Khursheed to assume the reins of government, and he without delay proceeded from Alexandria to Cairo. The forces of the partisans of El-Bardeesee were ravaging the country a few miles south of the capital, and intercepting the supplies of corn by the river: a little later they passed to the north of Cairo, and successively took Bilbeys and Kalyoob, plundering the villages, destroying the crops, and slaughtering the herds of the inhabitants. Cairo was itself in a state of tumult, suffering severely from a scarcity of grain, and the heavy exactions of the Páshá to meet the demands of his turbulent troops, at that time augmented by a Turkish detachment. The shops were closed, and the unfortunate people assembled in great crowds, crying Yá Lateef! Yá Lateef! "O gracious [God]!" El-Elfee and 'Osmán Bey Hasan had professed allegiance to the Páshá; but they soon after declared against him, and they were now approaching from the south; and having repulsed Mohammad 'Alee, they took the two fortresses of Turà. These Mohammad 'Alee speedily retook by night with 4000 infantry and cavalry; but the enterprise was only partially successful. On the following day the other Memlooks north of the metropolis actually penetrated into the suburbs; but a few days later were defeated in a battle fought at Shubrà, with heavy loss on both sides. This reverse in a measure united the two great Memlook parties, though their chiefs remained at enmity. El-Bardeesee passed to the south of Cairo, and the Ghuzz gradually retreated towards Upper Egypt. Thither the Páshá despatched three successive expeditions (one of which was commanded by Mohammad 'Alee), and many battles were fought, but without decisive result.

Misery of the people of Cairo.

At this period another calamity befel Egypt; about 3000 Delees arrived in Cairo from Syria. These troops had been sent for by Khursheed in order to strengthen himself against the Albanians; and the events of this portion of the history afford sad proof of their ferocity and brutal enormities, in which they far exceeded the ordinary Turkish soldiers and even the Albanians. Their arrival immediately recalled Mohammad 'Alee and his party from the war, and instead of aiding Khursheed, was the proximate cause of his overthrow.

Cairo was ripe for revolt; the Páshá was hated for his tyranny and extortion, and execrated for the deeds of his troops, especially those of the Delees: the Sheykhs enjoined the people to close their shops, and the soldiers clamoured for pay. At this juncture a firmán arrived from Constantinople conferring on Mohammad 'Alee the pashalic of Jiddeh; but the occurrences of a few days raised him to that of Egypt.

On the 12th of Safar A.H. 1220 (May 1805) the Sheykhs, with an immense concourse of the inhabitants, assembled in the house of the Kádee; and the 'Ulamà, amid the prayers and cries of the people, wrote a full statement of the heavy wrongs which they had endured under the administration of the Páshá. The 'Ulamà, in answer, were desired to go to the citadel; but they were apprised of treachery; and on the following day, having held another council at the house of the Kádee, they proceeded to Mohammad 'Alee, and informed him that the people would no longer submit to Khursheed. "Then whom will ye have?" said he. "We will have *thee*," they replied, "to govern us according to the laws; for we see in thy countenance that thou art possessed of justice and goodness." Mohammad 'Alee seemed to hesitate, and then complied, and was at once invested. On this, a bloody struggle commenced between the two Páshás: Cairo had before experienced such conflicts in the streets and over the house-tops, but none so severe as this. Khursheed, being informed by a messenger of the insurrection, immediately laid in stores of provisions and ammunition, and prepared to stand a siege in the citadel. Two chiefs of the Albanians joined his party, but many of his soldiers deserted. Mohammad 'Alee's great strength lay in the devotion of the citizens of Cairo, who looked on him as their future deliverer from their afflictions; and great numbers armed themselves, advising constantly with Mohammad 'Alee, having the seyyid 'Omar and the Sheykhs at their head, and guarding the town at night. On the 19th of the same month, Mohammad 'Alee besieged Khursheed. Retrenchments were raised, and the lofty minaret of the mosque of the Sultán Hasan was used as a battery from whence to fire on the citadel; while guns were also posted on the mountain in its rear. After the siege had continued many days, Khursheed gave orders to cannonade and bombard the town; and for six days his commands were executed with little interruption, the citadel itself also lying between two fires. Mohammad 'Alee's position at this time was very critical: his troops became mutinous for their pay; the Siláhdár, who had commanded one of the expeditions against the Ghuzz, advanced to the relief of Khursheed; and the latter ordered the Delees to march to his assistance. The firing ceased on the Friday, but recommenced on the eve of Saturday, and lasted until the next Friday. On the day following, news came of the arrival at Alexandria of a messenger from Constantinople. The ensuing night in Cairo presented a curious spectacle: many of the inhabitants gave way to rejoicing, in the hope that this envoy would put an end to their miseries, and fired off their weapons as they paraded the streets with bands of music. The Siláhdár, imagining the noise to be a fray, marched in haste towards the citadel; while its garrison sallied forth, and commenced throwing up retrenchments in the quarter of 'Arab-el-Yesár, but were repulsed by the armed inhabitants and the soldiers stationed there; and during all this time, the cannonade and bombardment from the citadel, and on it from the batteries on the mountain, continued unabated.

Khursheed besieged in the citadel. He cannonades and bombards Cairo.

The envoy brought a firmán confirming Mohammad 'Alee, and ordering Khursheed to repair to Alexandria, there to await further orders; but this he refused to do, on the ground that he had been appointed by a khatt-i-shereef. The firing ceased on the following day, but the troubles of the people were rather increased than assuaged; murders and robberies were daily committed by the soldiery, the shops were all shut, and some of the streets barricaded.

Mohammad 'Alee confirmed by the Porte.

[1] Khusruf Páshá has since filled with credit several of the highest offices at Constantinople. He died on the 1st of February in this year, 1855. He was a bigot of the old school, strongly opposed to the influences of western civilization, and consequently to the assistance of France and England in the present war.

Egypt.

While these scenes were being enacted, El-Elfee was besieging Demenhoor, and the other Beys were returning towards Cairo, Khursheed having called them to his assistance.

Soon after this, a squadron under the command of the Turkish High Admiral arrived in Aboo-Keer Bay, with despatches confirmatory of the firmân brought by the former envoy, and authorizing Mohammad 'Alee to continue to discharge the functions of governor for the present. Khursheed at first refused to yield; but at length, on condition that his troops should be paid, he evacuated the citadel, and embarked for Rosetta.

Mohammad 'Alee now possessed the title of Governor of Egypt, but beyond the walls of Cairo his authority was everywhere disputed by the Beys, who were joined by the army of the Silâhdâr of Khursheed; and many Albanians deserted from his ranks. To replenish his empty coffers he was also compelled to levy exactions, principally from the Copts. An attempt was made to ensnare certain of the Beys, who were encamped north of the metropolis. On the 17th of August 1805, the dam of the canal of Cairo was to be cut, and some chiefs of Mohammad 'Alee's party wrote, informing them that he would go forth early on that morning with most of his troops to witness the ceremony, inviting them to enter and seize the city; and, to deceive them, stipulating for a certain sum of money as their reward. The dam, however, was cut early in the preceding night, without any ceremony. On the following morning, these Beys, with their Memlooks, a very numerous body, broke open the gate of the suburb El-Hoseyneeyeh, and gained admittance into the city from the north, through the gate called Bâb-el-Futooh. They marched along the principal street for some distance, with kettle-drums behind each company, and were received with apparent joy by the citizens. At the mosque called the Ashrafeeyeh they separated, one party proceeding to the Azhar and the houses of certain Sheykhs, and the other continuing along the main street, and through the gate called Bâb-Zuweyleh, where they turned up towards the citadel. Here they were fired on by some soldiers from the houses; and with this signal a terrible massacre commenced. Falling back towards their companions, they found the bye-streets closed; and in that part of the main thoroughfare called Beyn-el-Kasreyn, they were suddenly placed between two fires. Thus shut up in a narrow street, some sought refuge in the collegiate mosque El-Barkookeeyeh, while the remainder fought their way through their enemies, and escaped over the city wall with the loss of their horses. Two Memlooks had, in the mean time, succeeded, by great exertions, in giving the alarm to their comrades in the quarter of the Azhar, who escaped by the eastern gate called Bâb-el-Ghureiyib. A horrible fate awaited those who had shut themselves up in the Barkookeeyeh: they begged for quarter and surrendered, were immediately stripped nearly naked, and about fifty were slaughtered on the spot; and about the same number were dragged away, with every brutal aggravation of their pitiful condition, to Mohammad 'Alee. Among them were four Beys, one of whom, driven to madness by Mohammad 'Alee's mockery, asked for a drink of water; his hands were untied, that he might take the bottle, but he snatched a dagger from one of the soldiers, and rushed at the Pâshâ, and fell, covered with wounds. The wretched captives were then chained, and left in the court of the Pâshâ's house; and on the following morning the heads of their comrades who had perished the day before were skinned, and stuffed with straw, before their eyes. One Bey and two others paid their ransom, and were released; the rest, without exception, were tortured and put to death in the course of the ensuing night. Eighty-three heads (many of them those of Frenchmen and Albanians) were stuffed, and sent to Constantinople, with a boast that the Memlook chiefs were utterly destroyed. Thus ended Mohammad 'Alee's first massacre of his too confiding enemies.

Egypt.

The Beys, after this, appear to have despaired of regaining their ascendancy; most of them retreated to Upper Egypt, and an attempt at compromise failed. El-Elfee offered his submission, on the condition of the cession of the Feiyoom and other provinces; but this was refused, and that chief gained two successive victories over the Pâshâ's troops, many of whom deserted to him.

At length, in consequence of the remonstrances of the English, and a promise made by El-Elfee of 1500 purses, the Porte consented to reinstate the twenty-four Beys, and to place El-Elfee at their head; but this measure met with the opposition of Mohammad 'Alee, and the determined resistance of the majority of the Memlooks, who, rather than have El-Elfee at their head, preferred their present condition; for the enmity of El-Bardeesee had not subsided, and he commanded the voice of most of the other Beys. In pursuance of the above plan, a squadron under Sâlih Pâshâ, shortly before appointed High Admiral, arrived at Alexandria on the 1st of July 1806, with 3000 regular troops, and a successor to Mohammad 'Alee, who was to receive the pashalic of Salonica. This wily chief professed his willingness to obey the commands of the Porte; but stated that his troops, to whom he owed a vast sum of money, opposed his departure. He induced the 'Ulamà to sign a letter, praying the Sultân to revoke the command for reinstating the Beys; persuaded the chiefs of the Albanian troops to swear allegiance to him, and sent 2000 purses contributed by them to Constantinople. El-Elfee was at that time besieging Demenhoor, and he gained a signal victory over the Pâshâ's troops; but the dissensions of the Beys destroyed their last chance of a return to power. El-Elfee and his partisans were unable to pay the sum promised to the Porte; Sâlih Pâshâ received plenipotentiary powers from Constantinople, in consequence of the letter from the 'Ulamà; and, on the condition of Mohammad 'Alee's paying 4000 purses to the Porte, it was decided that he should continue in his post, and the reinstatement of the Beys was abandoned. Fortune continued to favour the Pâshâ. In the following month, El-Bardeesee died, aged forty-eight years; and, soon after, a scarcity of provisions excited the troops of El-Elfee to revolt. That Bey very reluctantly raised the siege of Demenhoor, being in daily expectation of the arrival of an English army; and at the village of Shubra-ment he was attacked by a sudden illness, and died on the 30th of January 1807, aged 55 years. Thus was the Pâshâ relieved of his two most formidable enemies; and, shortly after, he defeated Shâheen Bey, with the loss, to the latter, of his artillery and baggage, and 300 men killed or taken prisoners.

The British expedition of 1807.

On the 17th of March 1807, a British fleet appeared off Alexandria, having on board nearly 5000 troops, under the command of General Fraser; and the place, being disaffected towards Mohammad 'Alee, opened its gates to them. Here they first heard of the death of El-Elfee, upon whose cooperation they had founded their chief hopes of success; and they immediately despatched messengers to his successor, and to the other Beys, inviting them to Alexandria. The British resident, Major Misset, having represented the importance of taking Rosetta and Er-Rahmâneeyeh, to secure supplies for Alexandria, General Fraser, with the concurrence of the Admiral, Sir John Duckworth, detached the 31st regiment and the Chasseurs Britanniques, under Major-General Wauchope and Brigadier-General Meade, on this service; and these troops entered Rosetta without encountering any opposition; but as soon as they had dispersed among the narrow streets, the garrison opened a deadly fire on them from the latticed windows and the roofs of the houses. They effected a retreat on Aboo-Keer and Alexandria, after a very heavy loss of 185 killed and 262 wounded; General Wauchope and three officers being among the

former, and General Meade and seventeen officers among the latter. The heads of the slain were fixed on stakes, on each side of the road crossing the Ezbekeeyeh in Cairo.

Mohammad 'Alee, meanwhile, was conducting an expedition against the Beys in Upper Egypt, and he had defeated them near Asyoot, when he heard of the arrival of the British. In great alarm lest the Beys should join them, especially as they were far north of his position, he immediately sent messengers to his rivals, promising to comply with all their demands, if they should join in expelling the invaders; and this proposal being agreed to, both armies marched towards Cairo on opposite sides of the river.

To return to the unfortunate British expedition. The possession of Rosetta being deemed indispensable, Brigadier-General Stewart and Colonel Oswald were despatched thither, with 2500 men. For 13 days a cannonade of that town was continued without effect; and on the 20th of April, news having come in from the advanced guard at El-Hamâd of large reinforcements to the besieged, General Stewart was compelled to retreat; and a dragoon was despatched to Major Macleod, commanding at El-Hamâd, with orders to fall back. The messenger, however, was unable to penetrate to the spot; and the advanced guard—consisting of a detachment of the 71st, two companies of the 78th, one of the 35th, and De Rolles' regiment, with a picquet of dragoons, the whole mustering 733 men—was surrounded, and after a gallant resistance, the survivors, who had expended all their ammunition, became prisoners of war. General Stewart regained Alexandria with the remainder of his force, having lost, in killed, wounded, and missing, nearly 900 men. Some hundreds of British heads were now exposed on stakes in Cairo, and the prisoners were marched between these mutilated remains of their countrymen.

The Beys became divided in their wishes; one party being desirous of co-operating with the British, the other, with the Pâshâ. These delays proved ruinous to their cause; and General Fraser, despairing of their assistance, evacuated Alexandria on the 14th of September.[1] From that date to the spring of 1811, the Beys from time to time relinquished certain of their demands; the Pâshâ on his part granted them what before had been withheld; the province of the Feiyoom, and part of those of El-Geezeh and Benee-Suweyf, were ceded to Shâheen; and a great portion of the Sa'eed, on the condition of paying the land-tax, to the others. Many of them took up their abode in Cairo, but tranquillity was not secured; several times they met the Pâshâ's forces in battle, and once gained a signal victory. Early in the year 1811, the preparations for an expedition against the Wahhâbees in Arabia being complete, all the Memlook Beys then in Cairo were invited to the ceremony of investing Mohammad 'Alee's favourite son, Toosoon, with a pelisse, and the command of the army. As on the former occasion, the unfortunate Memlooks fell into the snare. On the 1st of March, Shâheen Bey, and the other chiefs (one only excepted), repaired with their retinues to the citadel, and were courteously received by the Pâshâ. Having partaken of coffee, they formed in procession, and, preceded and followed by the Pâshâ's troops, slowly descended the steep and narrow road leading to the great gate of the citadel; but as soon as the Memlooks arrived at this gate, it was suddenly closed before them. The last of those who made their exit before the gate was shut were Sâlih Koosh and his Albanians. To these troops their chief now made known the Pâshâ's orders to massacre all the Memlooks within the citadel; therefore, having returned by another way, they gained the summits of the walls and houses that hem in the road in which the Memlooks were incarcerated, and some stationed themselves upon the eminences of the rock through which that road is partly cut. Thus securely placed, they commenced a heavy fire on their defenceless victims; and immediately the troops who closed the procession, and who had the advantage of higher ground, followed their example. Of the betrayed chiefs, many were laid low in a few moments; some, dismounting, and throwing off their outer robes, vainly sought, sword in hand, to return, and escape by some other gate. The few who regained the summit of the citadel experienced the same cruel fate as the rest (for those whom the Albanian soldiers made prisoners met with no mercy from their chiefs or from Mohammad 'Alee), but it soon became impossible for any to retrace their steps even so far; the road was obstructed by the bleeding bodies of the slain Memlooks, and their richly caparisoned horses, and their grooms. Four hundred and seventy Memlooks entered the citadel; and of these, very few, if any, escaped. One of these is said to have been a Bey. According to some, he leaped his horse from the ramparts, and alighted uninjured, though the horse was killed by the fall; others say that he was prevented from joining his comrades, and discovered the treachery while waiting without the gate. He fled, and made his way to Syria. This massacre was the signal for an indiscriminate slaughter of the Memlooks throughout Egypt, orders to this effect being transmitted to every governor; and in Cairo itself, the houses of the Beys were given over to the soldiery, who slaughtered all their adherents, treated their women in the most shameless manner, and sacked their dwellings. During the two following days, the Pâshâ and his son Toosoon rode about the streets, and endeavoured to stop these atrocious proceedings; but order was not restored until 500 houses had been completely pillaged. In extenuation of this dark blot on Mohammad 'Alee's character, it has been urged that he had received the order for the destruction of the Memlooks from Constantinople, whither the heads of the Beys were sent. It may be answered to this plea, that on other occasions he scrupled not to defy the Porte.

The massacre of the Memlooks.

A remnant of the Memlooks fled to Nubia, and a tranquillity was restored to Egypt to which it had long been unaccustomed, and which has rarely been interrupted since. In the year following the massacre the unfortunate exiles were attacked by Ibrâheem Pâshâ, the eldest son of Mohammad 'Alee, in the fortified town of Ibreem, in Nubia. Here the want of provisions forced them to evacuate the place; a few who surrendered were beheaded, and the rest went further south and built the town of New Dongola,[2] where the venerable Ibrâheem Bey died in 1816, at the age of 80. As their numbers thinned, they endeavoured to maintain their little power by training some hundreds of blacks; but again, on the approach of Ismâ'eel, another son of the Pâshâ of Egypt, sent with an army to subdue Nubia and Sennâr, some returned to Egypt and settled in Cairo, while the rest, amounting to about 100 persons, fled in dispersed parties to the countries adjacent to Sennâr.

War with the Wahhâbees.

Mohammad 'Alee being undisputed master of Egypt, at the reiterated commands of the Porte, despatched, in 1811, an army of 8000 men, including 2000 horse, under the command of Toosoon Pâshâ, against the Wahhâbees. After a successful advance, this force met with a serious repulse at the pass of Safrâ and Judeiyideh, and retreated to Yembo'. In the following year Toosoon, having received reinforcements, again assumed the offensive, and captured El-Medeeneh, after a prolonged siege. He next took Jiddeh and Mekkeh, defeating the Wahhâbees beyond the latter place, and capturing their general. But some mishaps followed, and Mohammad 'Alee, who had determined to conduct the war in person, left Egypt for that purpose in the summer of 1813. In Arabia he encountered serious obstacles from the nature of the country and the harassing mode of warfare adopted by his adversaries. His arms

[1] The account of this expedition is taken from published official papers, Mengin, &c.

[2] Correctly Dunkulah, but pronounced by the natives Dungulah.

met with various fortune; but on the whole his forces proved superior to those of the enemy. He led a successful expedition in the Hijáz, and on the conclusion of a treaty with the Wahhábee chief, 'Abd-Allah, in 1815, he returned to Egypt on hearing of the escape of Napoleon from Elba.

He now confiscated the lands belonging to private individuals, merely allowing them a pension for life, and attempted to introduce the European system of military tactics. A formidable mutiny, however, broke out in the metropolis, the Páshá's life was endangered, and he sought refuge by night in the citadel, while the soldiery committed many acts of plunder. The revolt was reduced by presents to the chiefs of the insurgents, and Mohammad 'Alee very honourably ordered that the sufferers by the late disturbances should receive compensation from the treasury. The project of the "Nizám Gedeed," as the European system is called in Egypt, was, in consequence of this commotion, abandoned for a time.

Soon after Toosoon returned to Egypt, but Mohammad 'Alee, dissatisfied with the treaty which had been concluded with the Wahhábees, and with the non-fulfilment of certain of its clauses, determined to send another army to Arabia, and to include in it the soldiers who had recently proved unruly. This expedition, under Ibráheem Páshá, left in the autumn of 1816. After several unimportant advantages, Ibráheem sat down before the town of Er-Rass; but three months' exertions proving unavailing, he raised the siege, with the loss of nearly half his army. Notwithstanding, he advanced on the capital, Ed-Dir'eeyeh, by slow but sure steps. The last place before reaching that city offered a brave resistance, and Ibráheem, in revenge, caused all its inhabitants to be put to the sword, excepting a number of women and children, the former of whom were spared not from motives of pity. Ed-Dir'eeyeh fell after a five months' siege, in the course of which an explosion destroyed the whole of the besiegers' powder; and had the Wahhábees been aware of the extent of the disaster, few, we may believe, would have escaped to tell the tale. 'Abd-Allah, their chief, was taken, and with his treasurer and secretary was sent to Constantinople, where, in spite of Ibráheem's promise of safety, and of Mohammad 'Alee's intercession in their favour, they were paraded and put to death. At the close of the year 1819, Ibráheem returned to Cairo, having conquered all present opposition in Arabia, but without having broken the spirit of the Wahhábees.

The Páshá, since his return from Arabia, had turned his attention to the improvement of the manufactures of Egypt, and engaged very largely in commerce. The results of these attempts are stated in other places, but the important work of digging the new canal of Alexandria, called the Mahmoodeeyeh, must here be again mentioned. The old canal had long fallen into decay, and the necessity of a safe channel between Alexandria and the Nile was much felt. Such was the object of the canal then excavated, and it has on the whole well answered its purpose; but the sacrifice of life was enormous, and the labour of the unhappy Felláhs was forced. Towards the accomplishment of a favourite project, the formation of the Nizám Gedeed, a force was ordered to the southern frontier of Egypt, and the conquest of Sennâr was contemplated in order to get rid of the disaffected troops and to obtain a sufficient number of captives to form the nucleus of the new army. The forces destined for this service were led by Ismá'eel, then the youngest son of Mohammad 'Alee; they consisted of between four and five thousand men, Turks and Arabs, and were despatched in the summer of 1820. Nubia at once submitted, the Shágeeyeh Arabs immediately beyond the province of Dongola were worsted, and Sennâr was reduced without a battle. Mohammad Bey, the Defterdâr, with another force of about the same strength, was then sent by Mohammad 'Alee against Kurdufân with a like result, but not without a hard-fought engagement. In 1822, Ismá'eel was, with his retinue, put to death by an Arab chieftain by name Nimr; and the Defterdâr, a man infamous for his cruelty, assumed the command in those provinces, and exacted terrible retribution from the innocent inhabitants.

The Greek war. In the years 1821 and 1822 Mohammad 'Alee despatched both ships and men (the latter about 7000 or 8000 Albanians and Turks) to the Morea, Cyprus, and Candia, to aid the Porte in reducing the Greek insurrection; and he continued to take part in that struggle, his fleet being engaged at Navarino, until the English insisted on the evacuation of the Morea, in 1828, by Ibráheem Páshá. In the latter of the two years before mentioned (1822), an army of disciplined troops was at length organized: 8000 men (chiefly slaves, from Sennâr and Kurdufân) were trained by French officers at Aswân. Of the vast numbers seized in the countries above named, many died on the way: those who were not eligible were, with the women, sold in Cairo, and in the remainder were incorporated many Felláhs. Colonel Sève (now Suleymán Páshá), a Frenchman who afterwards became a Muslim, superintended their organization; great numbers of the Blacks died of hypochondria, but the Egyptians proved very good troops. Many thousands were pressed in consequence, and they now constitute the bulk of the army. In 1823 the new conscripts amounted to 24,000 men, composing six regiments of infantry, each regiment consisting of five battalions of 800 men, and the battalions of eight companies of 100 men. The organization, pay, &c., of the Egyptian army will be found under section iv.

In 1824, a native rebellion of a religious character broke out in Upper Egypt, headed by one Ahmad, an inhabitant of Es-Sálimeeyeh, a village situate a few miles above Thebes. He proclaimed himself a prophet, and was soon followed by between 20,000 and 30,000 insurgents, mostly peasants, but some deserters from the Nizám, for that force was yet in a half organized state, and in part declared for the impostor. The insurrection was crushed by Mohammad 'Alee, and about one-fourth of Ahmad's followers perished, but he himself escaped and was never after heard of. Few of these unfortunates possessed any other weapon than the long staff (Nebboot) of the Egyptian peasant; still they offered an obstinate resistance, and the combat resembled a massacre. In the same year war was once more made on the Wahhábees, who had collected in considerable numbers. The 2d regiment was sent on this service, and it behaved in a very creditable manner.

The war with the Porte. But the events of the war with the Porte are perhaps the most important of the life of Mohammad 'Alee. The campaign of 1831 had ostensibly for its object the castigation of 'Abd-Allah, Páshá of Acre: the invading force consisted of six regiments of infantry, four of cavalry, four field-pieces, and a greater number of siege-guns, the whole under the command of Ibráheem Páshá, while the fleet, conveying provisions, ammunition, &c., was to accompany the army by sea. The terrible cholera of 1831, however, stayed the expedition when it was on the eve of departing; 5000 of its number died, and it was not until early in October of the same year that it started. Little opposition was encountered on the way to Acre, whither Ibráheem had gone by sea, and that place was invested on the 29th of November. The artillery of the besieged was well served; an assault in the following February was repulsed, and the cold and rain of a Syrian winter severely tried the Egyptian troops. A second assault in like manner failed, and Ibráheem was called away to repel 'Osmán Páshá, governor of Aleppo. The latter, however, hastily decamped without giving him battle, and Ibráheem, deeming this advantage sufficient, retraced his steps towards Acre. He then pushed the siege with fresh vigour, and stormed the city on the 27th of May:

Egypt.

1400 men fell in the breach, and the garrison was found to be reduced to about 400 men. The fall of Acre was followed by negotiation. Mohammad 'Alee evinced a disposition for peace, but demanded the government of Syria, and the Porte, in consequence, denounced him as a traitor. On his part, Ibrâheem pushed his successes: Damascus was evacuated at his approach, and the battle of Hims, fought on the 8th of July 1832, decided the superiority of the Egyptian army, and the advantage of disciplined troops over an irregular force, although very disproportionate in numbers. The enemy composed the advanced guard of the Turkish army, 30,000 strong, and the Egyptians numbered only 16,000 men.

After this victory, Ibrâheem marched to Hamâh, and thence to Aleppo (which had just before closed its gates against the Turkish general-in-chief, Hoseyn Páshá, whose troops became rapidly disorganized), forced the defiles of Beylân, and pursued the fugitive Turks to Adaneh. About the same time an Egyptian squadron had chased the Sultán's fleet into Constantinople. Diplomacy was, at this point, again resorted to, but without any result; the Sultán depended on his fleet to protect the capital, and determined to risk another engagement with the victorious enemy. The charge of this venture was intrusted to Resheed Páshá, the Grand Vezeer. In the mean time, Ibrâheem Páshá had gained the pass of Taurus, and having beaten the Turks at Oulou-Kislák, he hesitated not to give battle to Resheed Páshá at the head of about 60,000 men, his own army being less than half that strength; the battle of Kónyeh, on the plains of Anatolia, proved utterly disastrous to the Porte: in the confusion of the fight, and the darkness of a thick day, the Grand Vezeer was made prisoner, his army routed, and Constantinople was within six marches of the victor, without an army to oppose his passage. The capital of the Ottoman Empire, in imminent danger by sea and land, was then intrusted to the keeping of its hereditary enemy, as the last resource of the Sultán Mahmood, and a Russian fleet and army were sent thither. Negotiations were, in consequence, opened, and on the 14th of May 1833, a treaty was concluded between Mohammad 'Alee and the Porte, by which the whole of Syria and the district of Adaneh were ceded to the former, on condition of his paying tribute. With this terminated the war, but not the animosity of the Sultán. Ibrâheem, by excessive firmness and rigour, speedily restored security and tranquillity to the greater part of Syria; but some years later, the attempt of Mahmood to get the better of his vassal, and the consequent disaster experienced by his arms at Nezeeb, entailed fresh complications, and the interference of Great Britain ended in the restoration of Syria to the Porte in 1841. The political motives which actuated the Great Powers at this time and in 1831 need not be here discussed; and the operations on the coast of Syria, the bombardment of Acre, and the blockade of Alexandria, are familiar to most newspaper readers. It is undoubtedly true that Mohammad 'Alee placed all his reliance on the co-operation of France, and to its desertion of his cause, and his confidence in its assistance, either morally or physically, must be ascribed the unfortunate issue of the war. That the Syrians, in general, preferred the rule of Mohammad 'Alee to the tyranny of Páshás appointed from Constantinople may be safely averred; but we cannot close this account of his possession of that province without animadverting on the horrible cruelties perpetrated by Ibrâheem Páshá, or warning our readers not to give credence to the unmeasured praise bestowed by many on the Egyptian troops there engaged. Conceding that they were superior soldiers to the Turks, it must be borne in mind that they were veterans, disciplined and led by French officers and an able general: their opponents were destitute of any European discipline, badly officered, and discouraged by the disasters in Greece. It has, moreover, been stated on good authority, that Ibrâheem owed much of his success to the placing of artillery in the rear of his troops, with orders to fire on them should they show symptoms of wavering.

Treaty of 1833.

After the peace of 1841, Mohammad 'Alee gave up all grand political projects, and solely occupied himself in improvements, real or imaginary, in Egypt. He continued to prosecute his commercial speculations and manufacturing, educational, and other schemes. The barrage of the Nile, still uncompleted, was commenced by his direction, and in 1847, he visited Constantinople, where he received the rank of Vezeer. In the year 1848, however, symptoms of imbecility appeared, and after a short space Ibrâheem was declared his successor. But his rule was very short. In about two months he died; and, according to the terms of the treaty, Abbâs, a son of Toosoon, and the eldest representative of the family, succeeded to the pashalic. This miserable voluptuary, and withal bigoted, though ignorant, Muslim, utterly neglected the affairs of government, and solely consulted his own gratification. He died suddenly, and, as some assert, mysteriously, in July of last year (1854); and the present Viceroy, Sa'eed Páshá, the fourth son of Mohammad 'Alee, by his energy of character and superior intelligence, gives us some hope that Egypt may improve under his rule. He has, it is said, abolished certain government monopolies, is busily occupied in carrying out the works of the barrage, and takes great pains with the disciplining of his army. He is, besides, known to be favourable to the English. But he is new to his office, and it would be idle to speculate on the future career of an Egyptian Turk.

Ibrâheem Páshá.

Abbâs Páshá.

Sa'eed Páshá.

Mohammad 'Alee survived Ibrâheem, and died on the 3d of August 1849. Many and conflicting have been the opinions entertained of this remarkable man; for such at least all acknowledge him to have been. His massacre of the Memlooks has been the great point of attack by his enemies; but that, as well as many other of his acts, must be ascribed to his boundless ambition, not to innate cruelty; for he has proved himself to be averse to unnecessary bloodshed. That he really esteemed European civilization may be doubted; but his intelligent mind could not fail to perceive that therein lay his great strength, and of this he availed himself with consummate ability. To his firm government Egypt is indebted for the profound tranquillity which it has long been its good fortune to enjoy: a traveller of any nation or faith may traverse it in its length and breadth with greater safety than almost any other country out of Western Europe; and the display of fanaticism has been rigorously punished. This has undoubtedly increased the hatred of the Muslims for the professors of other religions; but we may hope that it will eventually produce a better state of feeling. While, however, Egypt has benefited by the establishment of order, the people have suffered most severe exactions. The confiscation of private lands has been before mentioned: to that arbitrary act must be added the seizure of the lands of the mosques, the imposition of heavy taxation, and a system of merciless impressment. In fact, the condition of the Egyptian Fellâh has rarely been as wretched as it is at the present day. He also misunderstood the real resources of Egypt, which are certainly agricultural; by the much-lauded introduction of cotton, he dealt a severe blow to native produce; and he did more to injure the country by endeavouring to encourage manufacturing industry, and by establishing enormous government monopolies, a measure which crushed the spirit of the agriculturists. His military and governing abilities were assuredly very great, and his career is almost unequalled in Turkish history. Had it not been for the intervention of Great Britain, his Syrian successes over the Porte would probably have led to very beneficial results, by rescuing Egypt from the wretched condition of a Turkish province.

Egypt.

But the firmân of 1841 entailed the loss of all his military power, the army was reduced to 18,000 men, and the navy condemned to rot in the harbour of Alexandria, while Mohammad 'Alee, failing to gain the great object of his ambition, the establishment of an independent dynasty, and being compelled to look on his then living family as his only heirs, thenceforth confined himself to measures of lesser importance, and did not prosecute even these with his former energy.

The entire constitution of the government of Egypt is the work of Mohammad 'Alee. With few exceptions he destroyed all former usages, and introduced a system partly derived from European models. The army and navy are of his creation, so are the taxation, the regulation of import and export duties, &c., quarantine laws, the manufactories, colleges, and the ministry. Some of these institutions are useful; others, both vexatious and ill calculated for the country. The colleges of languages and medicine, and the printing-press at Boolâk, are among the former, and are exceedingly praiseworthy efforts in a right direction; and in the same category must be placed many minor improvements, in which Mohammad 'Alee showed himself to be far in advance of his countrymen; while, weighing his chequered life, and numerous disadvantages of position and nation, his moral character, enlightened mind, and distinguished ability, must place him high among the great men of modern times.

SECTION III.

TOPOGRAPHY AND MONUMENTS.[1]

Lower Egypt. General aspect.

The northern coast of Egypt is low and barren, presenting no features of interest, and affording no indication of the character of the country which it bounds. It is a barrier, generally of sand-hills, but sometimes of rock, for the most part altogether destitute of vegetation, except where grow a few wild and stunted date-palms. Immediately behind are desolate marshy tracts or extensive salts lakes, and then the fertile country. The last is a wide plain, intersected by the two branches of the Nile, and by many canals, whereof some were anciently branches of the river, and having a soil of great richness, though in this particular it is excelled by the valley above. The only inequalities of the surface are the mounds of ancient towns, and those, often if not always ancient, on which stand the modern towns and villages. The palm-trees are less numerous, and not so beautiful as in the more southern part of the country, though other trees are more common. The houses and huts of the towns and villages are of burnt brick near the Mediterranean; but as the climate becomes drier, and the occurrence of rain far less frequent, the use of crude brick obtains, until near the point of the Delta it is very general. The mosques even of the towns are rarely remarkable for architectural beauty in the tract to the north of Cairo. The palaces or villas of the Turkish grandees, which are not uncommon, have, however, a light and picturesque appearance, though their style is not good. The deserts which inclose the plain on either side are rocky tracts of very slight elevation, having their surface overspread with sand, pebbles, and débris.

Alexandria.

Of the towns on the northern coast, the most western, Alexandria, called by the natives El-Iskendereeyeh, is the largest and the most important. It was founded in the year B.C. 332 by Alexander the Great, who gave it the form of a Macedonian mantle (chlamys). The ancient city occupied the space between the sea and the lake Mareotis, being about four miles in its greatest length, and a little less than a mile in its greatest breadth.[2] The island of Pharos was likewise inhabited, and was joined to the continent by the mole called the Heptastadium, a work of Ptolemy Philadelphus, or of his father the first Ptolemy, or of Alexander himself. The Heptastadium and the island divided the bay into two harbours. These were spacious, and although the western, anciently called Eunostus Portus, but now the Old Port, is difficult to enter, and the eastern, Magnus Portus, or the New Port, is not so deep and is less secure, they are by far the best anchorages on the coast of Egypt, and there is nothing else deserving the name of a harbour, nor does there ever seem to have been. Alexandria, which partly occupied the site of the ancient Rhacôtis, a place of little importance, speedily increased in consequence, and became the emporium of the trade between Europe, Arabia, and India, owing this prosperity to its harbours. After the death of Alexander the city became the capital of Ptolemy, the son of Lagus, the founder of a dynasty which generally held more extensive dominions than the kingdom of Egypt, and at one time ruled an empire not inferior to that of the most successful of the Pharaohs. By the Ptolemies, Alexandria was adorned with palaces and temples of great magnificence, for which they did not scruple to despoil more ancient edifices of some of their chiefest ornaments. While its commercial importance increased, it became a celebrated seat of learning, through the wise interest with which the Greek kings regarded science and letters, and Ptolemy Soter commenced the famous Library. Under the Ptolemies, however, the inhabitants, who were chiefly Greeks, became very troublesome to their rulers, like most commercial populations, and their turbulence was ill restrained by the weakness of the later sovereigns of that line. From the time of the Roman Conquest, B.C. 30, until it was taken by the Arabs, A.D. 640, Alexandria sensibly declined, partly in consequence of its being a provincial capital, instead of a royal residence, but chiefly because of the unruly disposition of its inhabitants, and their violent religious and political disputes, which at last resulted in the seat of government being transferred to the fortress of Egyptian Babylon, near the modern Cairo, which became in some sort the capital. During this time it was distinguished for the learning of its ecclesiastics, and the strong part which they took in the theological differences of the early Church. Under the Muslims, Alexandria never regained the position of metropolis of Egypt, and its importance, with some fluctuations, waned until the discovery and consequent adoption of the route to India by the Cape of Good Hope almost withdrew the main cause of its prosperity. Recently, however, the resumption of the overland route has greatly benefited this city, and although it was not made the capital, it became the favourite residence of Mohammad 'Alee, which in like manner contributed to its welfare.

The older part of the town of Alexandria stands upon the Heptastadium, which is much wider than of old, but the recent part, where are the houses of the European merchants, occupies the site of a portion of the ancient city which was nearest to the mole. The most striking edifice is the castle on the island of Pharos, containing a lighthouse, which has succeeded to the more famous Pharos of antiquity. Here also is the Páshâ's palace, as well as a lesser Pharos. The houses of the town are built of stone, or have their lowest story cased with that material, and the portion above of brick plastered and whitewashed. The residences of the European merchants and consuls are spacious and well-built, somewhat in the modern Italian style, but have no claims to architectural beauty. The mosques are not

[1] The following account of the topography and monuments of Egypt is the result of personal observations made during a long residence in that country. It is not therefore deemed necessary to append references, except in cases of particular importance, or where information has been derived from published works.

[2] Comp. Strabo, xvii. 1; and Diod. xvii. 52.

Egypt.

remarkable, but the English church will, if ever completed, be a great ornament to the town. The population is estimated at about 80,000 (including the garrison and sailors of the fleet), by Sir Gardner Wilkinson (1843).[1] One of the favourite projects of Mohammad 'Alee was the fortification of Alexandria, which has been thus rendered so strong that if well garrisoned it could not be invested by a force of less than about 40,000 men.

The remains of ancient buildings are very scanty and of little interest, compared to those which are seen on the sites of other Egyptian towns. Two objects are conspicuous, one of the obelisks commonly but inaccurately called "Cleopatra's Needles," and the great column which is as incorrectly named "Pompey's Pillar." The former is a fine obelisk of red granite nearly seventy feet in height, bearing hieroglyphic inscriptions with the names of Thothmes III., Rameses II., and a later king. Beside it is a fallen obelisk of the same dimensions, its fellow. They were brought here from some ancient temple during the Greek or Roman rule. "Pompey's Pillar" is in like manner of red granite, and its shaft is about seventy feet high, the whole column being nearly a hundred in height. An inscription in Greek upon its pedestal states that it was dedicated to the Emperor Diocletian, but it is not certain that it was set up to him, nor that it did not form one of a series of such columns, which, however, is unlikely, from its great size.[2] The other remains are not worthy a special description in this article, as space would be thus occupied that must be devoted to more remarkable monuments.

Rosetta.

Proceeding to the east of Alexandria, the first place of importance is Er-Rasheed, called by the Europeans Rosetta, a considerable town on the west bank of the branch of the Nile, named the Rosetta Branch, and anciently the Bolbitine. Before the cutting of the Mahmoodeeyeh Canal by Mohammad 'Alee, to connect Alexandria with this branch of the river, Rosetta was a place of greater importance than now, as the overland trade from India chiefly passed through it, in consequence of the decay of the old canal of Alexandria. It is a well-built town, having some gardens, like most of those of Egypt rather picturesque than beautiful, and it is in many respects more agreeable than Alexandria. Its population is stated by Clot-Bey to be scarcely 15,000.[3] A little to the north of the town is the boghâz, a bar of sand stretching across the mouth of the river, and rendering it often impassable; and between it and Rosetta is an old fort called Fort St Julien by the French who repaired it during their occupation of Egypt, when one of their officers discovered the trilingual tablet thence called the Rosetta Stone, which afforded the clue by which the Egyptian hieroglyphics were interpreted.

Saïs.

In ascending the Rosetta Branch, the first place of interest is the site of Saïs, on the eastern bank, marked by lofty mounds, and the remains of massive walls of crude brick, but nothing of greater interest. Perhaps, however, some ruins of the great temple may be buried here. Its position is marked by the walls of crude brick above mentioned, which were those of a great enclosure in which it and doubtless other sacred edifices stood. Saïs was one of the most ancient cities of Egypt, and from it Cecrops is said to have led a colony to Athens. The goddess Neit or Neith was the divinity of the place, and a festival of great solemnity was annually held here in her honour, to which pilgrims resorted from other parts of Egypt. Saïs was remarkable for the learning of its priests, and for a time held a high political position when Egypt was ruled by the kings of the powerful Twenty-sixth Dynasty, whose native place it was, though it does not seem to have been capital of the country. A modern village here is called "Sá-el-Hagar," or "Saïs of the Stone," a name which probably alludes to the famous monolith described by Herodotus.[4]

Towns in the Delta.

In the interior of the modern Delta no remains of importance have been discovered, though there are many ancient sites marked by mounds. The chief towns are El-Mahalleh el-Kebeereh, not far from the Damietta Branch, about forty miles from the sea; Tantà, nearly in the middle of the Delta; and Manoof, farther south. Of these Tantà is best known as the birth-place of the Muslim saint called the seyyid Ahmad El-Bedawee, in whose honour three festivals are annually kept, the greatest of which attracts more pilgrims than any other in Egypt, and is second alone to the pilgrimage to Mekkeh in this particular. Like many celebrations of the kind, the festivals of Tantà are rather distinguished by riot than piety, and recall the revelries of Bubastis and Canopus.

Damietta.

Several sites of interest are found on the course of the Damietta Branch, the old Phatnitic or Phatmetic. First of these is the town whence it takes its name, Dimyât, called by the Europeans Damietta, which stands not far from the mouth of this branch, and on its eastern side. In the time of the Crusades it was a strong place, and regarded as the key of Egypt. It was taken and retaken by the contending forces, and formed the basis of the operations of St Louis in the unfortunate Eighth Crusade. Shortly afterwards the Memlook Sultân Edh-Dhâhir Beybars, in A.D. 1251, razed it and rebuilt it on the present site somewhat further from the sea. It is a flourishing town, and has a population of about 28,000 inhabitants, according to Sir Gardner Wilkinson.[5] The next place of importance is the town of El-Mansoorah, founded by El-Melik El-Kâmil, the nephew of Salâh-ed-Deen, during the Sixth Crusade, to commemorate, as its name imports, his success over the invading army of Jean de Brienne.

El-Mansoorah.

A little to the south of El-Mansoorah, on the opposite bank, at a short distance from the river, are the remains of a very remarkable temple of the goddess Isis, and the mounds of the town of Iseum.

Iseum.

Although the temple is entirely thrown down, as though by a natural convulsion, but no doubt by human violence, its plan may be partly traced and its date ascertained, since the materials have not been removed. It was, unlike most Egyptian temples, built altogether of granite,[6] and about 600 feet in length and 200 in breadth. The materials must have been transported from Syene, a distance by the river, on which they were doubtless floated, of more than 600 miles. Bearing in mind this circumstance, and the difficulty of both working and sculpturing so hard a material, this temple must be considered to be one of the most costly in the country. The earliest name which has been found here is that usually assigned to Amyrtæus of the Twenty-eighth Dynasty, but the most common one is that of Ptolemy Philadelphus. It was in this part of Egypt that Amyrtæus found a refuge during his long contest with the Persians, and it seems not improbable that when he had at last mounted the throne, and made Egypt once more an independent kingdom, he testified his pious gratitude by commencing this magnificent edifice.

Semennood (Sebennytus).

A little to the south of this site is the small town of Semennood, anciently Sebennytus, the city of Hercules, in like manner on the western bank of the river; and a short distance farther, on the same side, is the village of Aboo-Seer, the ancient Busiris, named after Osiris, who, with Isis, was here worshipped.

Aboo-Seer (Busiris).

Herodotus mentions, among the great festivals, that of Isis held at the latter place, but this was more probably kept at Iseum, which was near by.

Tel-Atreeb (Athribis).

For a considerable distance there is nothing of interest until we reach Tel-Atreeb, where the

[1] *Modern Egypt and Thebes*, vol. i., p. 160.
[2] *Englishwoman in Egypt*, vol. i., p. 38, *et seqq.*
[3] *Aperçu Général*, tom. i., p. 196.
[4] *Englishwoman in Egypt*, vol. i., p. 54.
[5] *Modern Egypt and Thebes*, vol. i., pp. 452, 453.
[6] The temple of Bubastis at the city of the same name was likewise entirely of red granite. *Mod. Egypt and Thebes*, vol. i., p. 428.

Egypt.

site of the town of Athribis is marked by high mounds, with remains of ancient houses and some blocks of stone.

Pelusium. To the eastward of the Damietta Branch, in the broad cultivated tract or the desert beyond, are some places worthy of note. The most eastern of these is the site of Pelusium, which was, in the times of the Pharaohs of the Twenty-sixth Dynasty, and probably earlier, the key of Egypt towards Palestine.[1] No important remains have been discovered here. Between this site and the Damietta Branch

Tanis. are the mounds of Tanis, or Zoan, where are considerable remains of the great temple, the most remarkable of which are several fallen obelisks, some of which are broken. From their inscriptions, and those of other blocks, it has been ascertained that the temple was as ancient as the time of the Twelfth Dynasty, and was much beautified by Rameses II. and other kings of that time and the subsequent period. Tanis was on the eastern bank of the Tanitic branch of the Nile, now called the canal of the El-Mo'izz. On the same side of the same branch, but considerably to the south, was

Bubastis. the city of Bubastis, the site of which is indicated by very lofty mounds, in which may be traced the remains of its great temple. Here was held the festival of the goddess Bubastis, which attracted great crowds of pilgrims, and is ranked by Herodotus first of the festivals of Egypt.

Bilbeys. Not far south, and on the borders of the desert, is Bilbeys, which was a place of some importance as a frontier-town in the time of the Eiyoobee princes. Still farther south are

Onion. the mounds of Onion, the Jewish city founded by the high priest Onias, where was a temple closed by Vespasian not long after the overthrow of Jerusalem. The site is called Tell-el-Yahoodeeyeh, or "The Mound of the Jewess."

The Barrage. At the point of the Delta is the unfinished Barrage, which was intended, by crossing both branches of the river, to regulate the inundation above and below this place. The river here becomes broader, as it is generally for a great distance higher, than in its divided state. A little south of the point of the Delta, on the eastern bank of the river, near the village of El-Matareeyeh, is the site of

Heliopolis. the ancient Heliopolis, the City of the Sun, marked by a solitary obelisk, and crude brick ridges formed by the ruins of a massive wall. The obelisk bears the name of Sesertesen I., the head of the Twelfth Dynasty, in the simple inscription, which runs down each of its sides. It is of red granite, and nearly 70 feet in height. The city was famous rather for the learning of its college than for its size, and the temple of Ra was held in high veneration. Many famous Greek philosophers studied here, and much that has been supposed to have been discovered by them was probably derived from their Egyptian instructors. At a short distance south of Heliopolis is the modern metropolis of Egypt, Cairo, not far inland.

Boolák. Boolák, the port of Cairo, is a considerable and flourishing town, having two remarkable mosques, and a very large palace, built by Isma'eel Páshá, a son of Mohammad 'Alee, who fell a victim to a conspiracy caused by his own tyranny, while commanding an expedition in Upper Nubia. It was founded A.H. 713, in the reign of the Sultán Mohammad Ibn Kalá-oon. Two principal roads lead hence to the metropolis, distant about a mile.

Cairo. Cairo is the fourth Muslim capital of Egypt: the site of one of those that have preceded it is, for the most part, included within its walls, while the other two were a little to the south. 'Amr, the Muslim conqueror of the country, founded El-Fustát, the oldest of these, close to the fortress of Egyptian Babylon, the seat of government at that time. Its name signifies "The Tent," as it was built where 'Amr had pitched his tent. The new town speedily became a place of importance, and was the residence of the Náïbs, or lieutenants, appointed by the orthodox and Umawee Khaleefehs. It received the name of Masr, properly Misr, which was applied by the Arabs to every important capital of the country, Thebes and Alexandria excepted. It declined after the foundation of El-Káhireh, but never became altogether deserted, for a small town, called Masr El-'Ateekah, or "Old Masr," occupies, in the present day, part of what was its area in its time of prosperity. Shortly after the overthrow of the Umawee Dynasty, and the establishment of the Abbásee, the city of El-'Askar was founded (A.H. 133) by Suleymán, the general who subjugated the country, and became the capital and residence of the successive lieutenants of the Abbásee Khaleefehs. El-'Askar was a small town adjacent to El-Fustát, of which it was a kind of suburb. Its site is now entirely desolate. The third capital, El-Katáë', or El-Katáyë', was founded about A.H. 260, by Ahmad Ibn-Tooloon, a lieutenant who rendered himself independent of the Abbásee Khaleefeh, and made this his capital. It continued the royal residence of his successors; but not long after the fall of the Dynasty, and a subsequent one, the seat of government was transferred by the Fátimees to a new city, El-Káhireh. El-Katáë', which had been sacked on the overthrow of the Tooloonees, rapidly decayed. A part of the present Cairo occupies its site, and contains its great mosque, that of Ahmad Ibn-Tooloon.

Góhar el-Káïd, the general who subjugated Egypt to the power of his master, the Fátimee Khaleefeh El-Mo'izz, founded a new capital A.H. 358, which was named El-Káhireh, that is, "the Victorious," which has been corrupted into Cairo. This town occupied about a fourth part of the present metropolis, being the north-eastern portion. By degrees it became greater than El-Fustát, and took from it the name of Misr or Masr, which is applied to it by the modern Egyptians. It continually increased, so as to include the site of El-Katáë' to the south, and of the old town of El-Maks to the west. The famous Saláh-ed-Deen, or Saladin, built a citadel on the lowest point of the mountain to the east, which immediately overlooked El-Katáë', and he partly walled round the towns and large gardens within the space now called Cairo. Under the prosperous rule of the Memlook Sultáns this great tract was filled with habitations; a large suburb to the north, the Hoseyneeyeh, was added; and the town of Boolák founded. Since the Turkish conquest (A.D. 1517) the metropolis has constantly decayed, but its limits are the same.

Cairo is of an irregular oblong form. Its greatest length is about three miles, and its average breadth about a mile and a half, and its dimensions do not fall very much short of these in any part.[2] This surface is not, however, entirely occupied by houses, for it contains the citadel, various extensive gardens and open spaces, as well as lakes. The streets are extremely narrow, and the markets generally crowded, so that the stranger usually acquires a delusive idea of the density of the population. Mr Lane states the population to have been 240,000 before the great plague of 1835, and adds that the deficiency, equal to not less than one-third of the inhabitants, caused by that terrible visitation, would be speedily supplied from the villages.[3] Sir Gardner Wilkinson, in his *Modern Egypt and Thebes*,[4] published in 1843, gives the population at about 200,000; and Mrs Poole, writing in 1842, estimates it at about 240,000;[5] but Clot-Bey,[6] whose work appeared in 1840, states the much higher amount of about 300,000 souls. The census of 1847–8, already noticed,[7] states the more moderate sum of 253,541 inhabitants, and in this instance it is not likely to have been far wrong. We may fairly suppose that during the time of

[1] See above, section ii.

[2] M. Jacotin, in the *Description de l'Egypte*, t. xviii. 2, p. 111, estimates the superficies of Cairo at 793 hectares, or about 3 square miles.

[3] *Modern Egyptians*, Introduction.

[4] *Modern Egypt and Thebes*, vol. i., p. 256.

[5] *Englishwoman in Egypt*, vol. i., p. 136.

[6] *Aperçu Général*, tom. i., p. 204.

[7] *Supra*, section i.

Egypt.

comparative prosperity that followed the great plague of 1835 the population gradually increased to about 250,000, and that the cholera in 1848 and the recent conscriptions occasioned by the war between Turkey and Russia have somewhat diminished its amount, which may at the present time be stated at above 200,000, and probably little below 250,000. Of the population of 240,000 in 1834, according to Mr Lane, about 190,000 were Muslim Egyptians; about 10,000 Copts; 3000 or 4000 Jews; and the rest, strangers from various countries. The adult male population was about one-third of the whole, or 80,000 persons, of whom 30,000 were merchants, petty shopkeepers, and artisans; 20,000 domestic servants; 15,000 common labourers, porters, &c.; the remainder chiefly consisting of military and civil servants of the government.[1]

Cairo is still undoubtedly the most remarkable and characteristic of Arab cities. The beauty of its religious and domestic architecture, before the recent Turkish innovations, is unexcelled elsewhere. The edifices raised by the Moorish kings of Spain, and the Muslim rulers of India, may have been more splendid in their materials, and more elaborate in their details; the houses of the great men of Damascus may be more costly than were those of the Memlook Beys; but for purity of taste and elegance of design they are far excelled by many of the mosques and houses of Cairo. These mosques have suffered much in the beauty of their appearance from the effects of time and neglect; but their colour has been often thus softened, and their outlines rendered the more picturesque. What is most to be admired in their style of architecture is its extraordinary freedom from restraint, evidenced in the wonderful variety of its forms, and their being frequently irregular with respect to one another without offending the eye, as well as the skill in design which has made the most intricate details to harmonize with grand outlines. Its beauty seems to resemble that of nature, ever changing, yet ever harmonious, irregular without disproportion, because it appeals to a higher feeling than that which judges by the cold rules of geometry. Yet it never attains to sublimity, unlike the older architecture of the country; for the religion which originated it[2] endeavoured by it to shadow forth the joys of a future paradise in which the senses were to be gratified rather than the soul. The ancient Egyptian raised his pyramid on a rock in the trackless waste, or excavated his sepulchre in one of its most secluded valleys; his time-defying temples stood in the desert, or raised their stern masses above the fields; the Muslim placed his mosque in cities, amidst the homes of men, and where its elegant minaret should be half hidden by the palms, and throw its shadow of red and white across a tranquil lake. Both have now passed away, the ancient art and the modern, and nothing has taken their place that can lessen regret or awaken hope. See the article Cairo.

Environs of Cairo.

To the east of Cairo is a bold spur of the mountains known as El-Gebel El-Mukattam. Beneath it, and to the north of the citadel, is the cemetery of Kāït Bey, remarkable for the splendid tombs of the Memlook Sultāns. The most beautiful of these is that of Kāït Bey from which it takes its name, but those of the Sultān Barkook and of El-Ghooree must not be passed by unmentioned. At a little distance to the north-east is the Gebel el-Ahmar or "the Red Mountain," and southward of this on the rocky tract is petrified wood in large quantities strewn on the surface. The space between Cairo and the Nile, varying from a mile to a mile and a half in breadth, is occupied by plantations which were made by Ibrāheem Páshá during his father's rule. Formerly this side of the city was, as the other three are still to a great extent, bounded by lofty mounds of rubbish; these he caused to be removed, and by doing so conferred a great benefit upon the inhabitants, as well as by planting with trees the intervening space. By irrigating this tract very freely by a steam-engine he considerably lessened the good he had effected, rendering the western part of the city somewhat damp. To the south of Cairo are a great cemetery containing the tomb of the Imâm Esh-Shâfe'ee, and an aqueduct, built by the Sultān El-Ghooree, which conducts water from the Nile to the Citadel; and further, the Roman fortress of Egyptian Babylon, now called Kasr-esh-Shema, and chiefly occupied by a Coptic convent, as well as the small town of Masr El-'Ateekah, which is all that remains of the famous metropolis El-Fustāt. It contains no remarkable edifices; in its immediate neighbourhood however is the oldest mosque in Egypt, that of 'Amr, the Muslim conqueror of the country, but it has been so frequently repaired and almost rebuilt, that it is impossible to form any idea of its original appearance. Opposite to Masr El-'Ateekah, from which it is separated by a very narrow branch of the Nile, is the island of Er-Rόdah, containing the famous Mikyâs or Nilometer, and Ibrâheem Páshá's garden, which was beautifully laid out after the European manner by the late Mr Traill, a Scottish horticulturist.[3]

El-Geezeh.

The chief place on the western bank of the river near Cairo is the small town of El-Geezeh, opposite Masr El-'Ateekah. El-Geezeh is best known as having given its name to the three most famous pyramids of Egypt, which are, with the small ones in their neighbourhood, called by both natives and the Franks the Pyramids of El-Geezeh. These marvellous structures stand on the slightly elevated border of the low Libyan range, not more than a quarter of a mile beyond the limit of the cultivated land. Before describing them it is necessary to form some idea of the great necropolis to which they belong.

Necropolis of Memphis.

The city of Memphis stood on the western bank of the Nile about ten miles above Cairo. The kings and people who dwelt there chose the nearest part of the desert as their burial-place, and built tombs on its rocky edge, or excavated them in its sides. The kings raised pyramids around which their subjects were buried in smaller sepulchres. The pyramids were grouped together, and often there is a considerable distance from one group to another. It must be borne in mind, however, that many pyramids have been nearly or wholly destroyed; yet as the largest undoubtedly remain, the general features of the necropolis cannot be much changed. From the citadel of Cairo we obtain a good view of the several groups. First, opposite to us, but a little to the south, are the three great pyramids of El-Geezeh, two of which exceed all the others in magnitude; at some distance farther south we see those of Aboo-Seer, likewise three in number, of much smaller dimensions; and not so far beyond them the great pyramid of Sakkārah, called from its form that of Steps, with smaller pyramids in its neighbourhood. Farthest of all, after a wider interval, are the two large pyramids of Dahshoor, which approach in size the great structures of El-Geezeh. There are more to

---

[1] *Modern Egyptians, loc. cit.*

[2] Arab or Moorish architecture must be held to have originated with Muslim nations. Many things it certainly owed to Byzantine; but as we have no example which does not present the most remarkable essential differences, we cannot say it was the offspring of that style any more than we can assert that Greek architecture was derived from Egyptian.

[3] This gentleman, during the many years for which he was occupied in forming the garden of Er-Rόdah, introduced various foreign trees and plants, and gained much information respecting the botany of the country. By his premature death a true friend of science has been carried away, and one who possessed beyond any of his contemporaries the combined knowledge and abilities needed by a describer of the Egyptian Flora, who should supply the deficiencies of Forskäl and Delile. That task he did not live to execute, to the lasting detriment of science and the regret of his many friends.

the south as far as the Feiyoom, the last being that of El-Lâhoon, but none to the south of the pyramids of Dahshoor can be included within the Memphite necropolis. That great tract, which was also the burial-place of Heliopolis, extended, if we measure from the ruined pyramid of Aboo-Ruweysh, somewhat to the north of those of El-Geezeh, to the southernmost pyramid of Dahshoor, throughout a space of nearly twenty miles, in almost every part of which some sepulchres have been discovered, while it cannot be doubted that many more await a fortunate explorer.

Pyramids of El-Geezeh.

The road to the pyramids of El-Geezeh from the town whence they derive their modern appellation, is through cultivated fields diversified by villages in palm-groves. As we approach them, these structures do not give us that idea of size that we had expected from our first distant view; and until we stand at their feet we do not appreciate their vastness. But as we endeavour to scan the height of the Great Pyramid, when about to commence its ascent, we fully realize a result that human labour has not achieved elsewhere. The very dimensions—a height of half a thousand feet, four sides each measuring the seventh of a mile—are in themselves gigantic; but when we know that this huge space is almost wholly solid, containing a few chambers so small as not to be worthy of consideration in calculating its contents, we discover that no monuments of man's raising elsewhere afford any scale by which to estimate its greatness.

Great Pyramid.

The present perpendicular height of the Great Pyramid is, according to the late General Vyse's excellent work, 450 ft. 9 in.; and its present base 746 ft. 0 in. It is about 30 feet lower than it was originally, in consequence of much of the outer masonry having been torn off, as well as the casing-stones; and its base is likewise smaller. Gen. Vyse gives the former height at 480 ft. 9 in., and the former base at 764 ft. 0 in. Like all the other pyramids, it faces the cardinal points. At the completion of the pyramid the faces were smooth and polished, but now they present a series of great steps formed by the courses of stone, and are in some places (particularly in the middle of each face, and at the angles, and about the entrance) much broken. The ascent is easy though fatiguing, and the traveller is amply rewarded by the view which he obtains from the platform, about 32 feet square, at the summit. The prospect of the fertile plain and valley on the one side, and of the undulating barren surface of the Great Desert on the other, as well as of the pyramids and tombs beneath, is alike remarkable from its character and the associations which it calls up. The examination of the interior is no less interesting. All other tombs but the Memphite pyramids and those which were simply pits were not closed, the upper chambers being intended for the performance of funeral rites when the family of the deceased visited his sepulchre. These pyramids, however, were most carefully closed. The chambers, which contained the bodies of the king, and of those (doubtless of his family) who were sometimes buried in the same structure, were without sculptures, and scarcely ornamented in any way, being sometimes wholly plain. The passages leading to them were only large enough to admit a sarcophagus, and after the king's burial were closed by the lowering of heavy stone portcullises, and the blocking up of the entrance. The desired object was security, and we must not, therefore, expect beauty or grandeur in chambers constructed for this purpose, although we cannot fail to admire their massive and gloomy aspect.

The entrance to the Great Pyramid is not far from the middle of the northern face, 49 ft. 0 in. in perpendicular height from the base. The fallen stones and rubbish have, however, raised a mound which reaches nearly to the entrance, the masonry about which having been torn down, we gain some idea of the construction of the pyramid. In this manner the passage has lost somewhat of its length. The passage itself is 3 ft. 11 in. high, and 3 ft. 5½ in. wide, and is lined with fine limestone. It descends at an angle of 26° 41′.[1] At a distance of 63 ft. 2 in. from the beginning of the roof of the present entrance, a second passage commences from this, taking an ascending direction. The entrance of this new passage is obstructed by great blocks of granite which entirely fill it, and have been passed by means of an excavation around them. We thus enter the ascending passage, which is of the same breadth and height as the former, and inclines at an angle of 26° 18′. The stones which line its roof and sides are very rough, and it has evidently been left unfinished. After ascending this passage for a distance of 109 ft. 7 in., we reach the Grand Passage, which, from its greater dimensions, presents a comparatively imposing appearance. It ascends at the same angle as the last, while a horizontal passage runs beneath it to a chamber to be subsequently mentioned. Just within the Grand Passage is the mouth of the Well, an irregular pit, partly excavated in the rock, leading to the lower portion of the first passage. Its object was probably to afford an exit to the workmen who had been engaged in closing the ascending passage. The Grand Passage is 7 ft. 2 in. in width at its base, 28 ft. high, and 156 ft. long. The blocks which compose its sides gradually approach, every course above the second projecting a little, and on each side is a stone bench. At the end of this passage a horizontal one commences, of much smaller but unequal dimensions, and 22 ft. 1 in. in length, leading to the Grand Chamber, commonly called the King's Chamber, which it enters at the eastern end of its north side. This, which is the principal sepulchral chamber (unless, indeed, there be an undiscovered one of greater importance), is lined with red granite, and measures in length 34 ft. 3 in., in width 17 ft. 1 in., and in height 19 ft. 1 in. It is altogether plain, and contains only a sarcophagus of red granite, which is equally unadorned. Above this chamber are five small ones, which may be called entresols, evidently designed to lighten the pressure of the superincumbent masonry, particularly as the uppermost of them has a pointed roof. Four of these were discovered by the late Gen. Howard Vyse, who found in them quarry-marks, bearing the names of Shufu and Num-shufu, the former of whom had been previously identified with the builder of this pyramid mentioned by Herodotus, Diodorus, and Manetho. These chambers are reached with difficulty, and chiefly by forced passages. The horizontal passage beneath the Grand Passage must now be described. This is but 3 ft. 10 in. high, and 3 ft. 5½ in. wide for the first 92 feet of its length, and then we descend a step and find the passage to be 5 ft. 8 in. high for 17 ft. 11 in. farther, until it enters the "Queen's Chamber," as it is usually called, at the eastern corner of its north side. This chamber is 18 ft. 9 in. long, and 17 ft. broad, and its extreme height is 20 ft. 3 in. It has a pointed roof, of great blocks of stone, inclined upwards and meeting in the middle. Within it is the entrance of a forced passage. The remainder of the first passage, beyond where the first ascending passage leads to the most interesting parts of the structure, remains to be noticed. It continues below the forced entrance to the ascending passage for a distance of 239 ft. 10 in., being cut through the rock on which the pyramid is built. For this space its inclination and proportions do not change, but it then becomes horizontal for 27 ft., termi-

[1] See Sir John Herschel's "Observations on the Entrance Passages in the Pyramids of Gizeh," in Vyse's *Pyramids of Gizeh*, vol. ii., pp. 107–109. The different angles of the entrance passages of other pyramids, and the circumstance that they were always closed at the completion of the buildings, show that the fact of this one's having pointed, at the period of its erection, to α Draconis, which was then the pole-star, is not to be regarded as more than accidental. Nevertheless, as above mentioned, the pyramids face the cardinal points.

Egypt.

nating at the entrance of an excavated chamber 46 ft. in length, and 27 ft. 1 in. in breadth, but of irregular and inconsiderable height. There is no doubt that this chamber was left unfinished at the closing of the pyramid. Beyond it the passage continues, opposite to where it entered the chamber, and extends horizontally 52 ft. 9 in. into the rock in the same direction.

Manetho calls the founder of the Great Pyramid Sûphis I., but Herodotus names him Cheops, and Diodorus Siculus Chembês, or Chemmis. His hieroglyphic name Shufu, or Khufu, according to the pronunciation of different dialects, was found, as before mentioned, by General Vyse, in the quarry-marks of one of the chambers above the King's, and occurs in the inscriptions of the neighbouring tombs of private individuals. The name of Num-shufu, Manetho's Sûphis II., occurs with that of Shufu, both in the quarry-marks and in the tombs: he appears to have ruled jointly with Shufu, and it is not improbable that he was also buried in this pyramid.

Second Pyramid.

The Second Pyramid stands at a short distance to the S.W. of the Great Pyramid, which does not very much exceed it in magnitude, though far superior in its construction. It has a base of 690 feet 9 inches square, and is 447 feet 6 inches in height, being more steep than its larger neighbour. It is chiefly remarkable on account of a great part of its casing having been preserved, extending about a fourth of the distance from the summit. The ascent is thus rendered very difficult, especially as when one has climbed on to the cased portion, he can see nothing of the lower part of the building, and thus feeling as if upon a pyramid in the air, is very liable to become dizzy. There are two entrances, both at the north side, from which, and other peculiarities, it appears probable that it was originally much smaller than now, and that, after its first completion, it was enlarged, and a new entrance and sepulchral chamber added. Herodotus and Diodorus Siculus ascribe its erection to a king whom the former calls Chephrên and the latter Kephrên, the brother and successor of the builder of the Great Pyramid. Diodorus says, that according to some he was named Chabryïs, and was the son of the latter sovereign. These are all variations of the name Shafra or Khafra, of an Elephantinite, Manetho's Sephrês, the second king of the Fifth Dynasty, who was about contemporary with Shufu.

Third Pyramid.

The Third Pyramid is almost in a line with the other two, but of much smaller dimensions, being only 203 feet in height, and 354 feet 6 inches square at the base. It is constructed beautifully, and in a costly manner, and in these respects is unexcelled, if equalled, by any other pyramid. The exterior was anciently cased altogether, or in part, with granite, but this has been generally torn off. General Vyse opened it, and found that it had been previously ransacked. In it he discovered a very beautiful sarcophagus (which was unfortunately lost at sea on its way to England), as well as part of a mummy-case, bearing the name of King Menkaura, and the body of a workman,[1] both of which are now in the British Museum. Herodotus and Diodorus ascribe the building of this Pyramid to Mykerinos, whom some, according to the latter, called Mecherinos; but Manetho makes it the work of Queen Nitôkris. The former sovereign is Manetho's Mencherês, the fourth ruler of his Fourth Dynasty, and the latter ends his Sixth Dynasty. This apparent inconsistency is explained, as the Chevalier Bunsen first remarked,[2] by the construction of the pyramid, which has two principal chambers, and was evidently enlarged after its first completion, so that we may fairly suppose that it is the sepulchre of both Mencherês and Queen Nitôkris.

Smaller Pyramids.

Near the three large pyramids are six smaller ones; three of these are near the east side of the Great Pyramid, and three on the south side of the Third Pyramid. They were probably the tombs of near relations of the kings who founded the great pyramids. The space around the pyramids is occupied by almost countless tombs, some built of stone, others excavated in the sides of the rock on which the pyramids stand, while others are simply pits with sepulchral chambers leading from them. The most interesting of these occupy a square bounded on the east by the Great Pyramid, and on the south by the Second, and are the sepulchres of the subjects of Cheops and other kings for the most part of the same period. These tombs, which are of inconsiderable dimensions in comparison to many at Thebes and elsewhere, are all built of stone, and have inclined walls, so as to resemble truncated pyramids. They usually contain several small chambers, the walls of which are decorated with most remarkable painted sculptures, pourtraying the every-day life of the Egyptians at that remote age, with short inscriptions of an explanatory character. The absence of representations of the gods and of the other subjects connected with religion, would lead one to suppose that at this time their belief was purer than at later periods, did not the inscriptions show this to be a false conclusion. Other similar tombs stand to the east and south of the Great Pyramid; and in the former direction are the principal sepulchral grottoes hewn in the side of the elevated rocky tract on which the pyramids stand. Some of these excavations bear similar representations to those of the tombs already mentioned. To the east of the Second Pyramid is the Great Sphinx, one of the most characteristic monuments of this wonderful necropolis. It is a recumbent andro-sphinx, or man-headed lion, 188 ft. 9½ in. in length,[3] hewn out of a natural eminence in the solid rock, some defects of which are supplied by a partial stone-casing, and the legs are likewise added. Steps lead to its front where are a sanctuary and tablets, but these are covered by the sand, which, after the hollow has been cleared, speedily fills it up again. Not far to the westward of the Sphinx is the remarkable excavation known as Campbell's tomb, chiefly consisting of a large pit surrounded by a trench. It was discovered by General Vyse, whose name is honourably connected with the most important discoveries in the necropolis of Memphis. The causeways leading to the Great Pyramid and to the Third, the former of which so greatly excited the admiration of Herodotus, are well worthy of a careful examination. The only pyramid which stands to the north of this group is that of Aboo-Ruweysh, which is in so ruined a condition as scarcely to deserve a visit. It lies about five miles to the north of the Great Pyramid.

Egypt.

Tombs.

Great Sphinx.

Pyramid of Aboo-Ruweysh.

Pyramids of Aboo-Seer.

Southward of the Pyramids of El-Geezeh, the first objects of interest are those forming the similar group of Aboo-Seer, of much smaller dimensions, the largest being about the size of the Third Pyramid. They are on the elevated edge of the Libyan chain, about seven miles from the Third Pyramid, and are four in number, three being large, and the fourth very small. The Northern Pyramid of Aboo-Seer appears to have been the tomb of Shura or Sôris, the first king of the Fourth Dynasty.

Pyramids of Sakkârah.

Pyramid of Steps.

About two miles further in the same direction, are the Pyramids of Sakkârah, the greatest and most remarkable of which is called the Pyramid of Steps. The tract around them appears to have been the principal burial-place of Memphis, from its nearness to the site of that city, and the number of the sepulchres. The Pyramid of Steps has a height of 196 feet 6 inches, and its base formerly measured at the north and south sides 351 feet 2 inches, and at the east and west, 393 feet 11 inches. Beneath it are numerous passages and a gallery, which must, for the most part, have been made subsequently to the completion of the structure.

[1] This body has been erroneously supposed to be that of king Mykerinos.

[2] *Egypt's Place*, vol. ii., p. 165, *et seqq.*, and 210, *et seqq.*

[3] Brugsch, *Reiseberichte aus Aegypten*, p. 336.

Egypt.

In the centre is a very lofty and narrow chamber, and near it a small one, which was lined with blue tiles. In the latter was an inscription containing the name and titles of a very early king, the former reading Ra-nub-rokhee, or Nub-rokhee-ra, which may correspond to Manetho's Necherôchis or Necherôphês, the name of the head of the Third Dynasty. In the tract between the Pyramids of Sakkârah and Aboo-Seer are the remains of the Serapeum, and the burial place of the Bulls Apis, both discovered by M. Mariette. They are inclosed by a great wall, having been connected, for the Serapeum was the temple of Apis. The tomb is a great subterranean gallery, whence smaller passages branch off, and contains many sarcophagi, in which the bulls were entombed. Not the least important result of this discovery is the certainty that Serapis was a form of Osiris, and that his name was Osir-hapi or Osiris-Apis,[1] as Sir Gardner Wilkinson had long previously suggested.[2] The other pyramids are of comparatively little interest. There are also some curious private tombs, among which may be particularized a large grotto excavated in the face of the rock overlooking the valley, which is remarkable for being vaulted on the principle of the true arch, but without a key-stone. It is of the time of Psammitichus II. of the Twenty-sixth Dynasty, being, as Sir Gardner Wilkinson remarks, one of the two earliest known examples of the arch in stone, though, as he adds, there are brick arches at Thebes of the time of Amenoph I. of the Eighteenth Dynasty.[3]

Site of Memphis.

The site of Memphis is marked by mounds in the cultivated tract to the east of the Pyramids of Sakkârah, and near the village of Meet-Raheeneh. Of the great temple of Ptah, or Hephæstus, its tutelary divinity, there are no remains above ground, except a few blocks of stone and some broken statues, one of which is a fine colossus of Rameses II., which stood most probably in ancient times before one of the principal entrances of the temple. It is of white chert and beautifully executed, representing the king in a standing posture. It has fallen to the ground, and part of its legs has been broken off; nevertheless it has suffered inconsiderable damage elsewhere, so as to be still one of the finest specimens of Egyptian art. The original height was more than 40 feet.[4] The site of Memphis being in the cultivated tract, and near the modern capitals of Egypt, its monuments have alike suffered from the destructive power of nature, and from the barbarism of those who have used them as quarries or defaced them from motives of fanaticism. The Pyramids have not escaped man's violence, but their vastness has generally defied his attacks.

Pyramids of Dahshoor.

At a distance of about five miles to the south of the Pyramid of Steps is the northernmost of the Pyramids of Dahshoor, an interesting group, of the history of which nothing certain is known. Two of these are of stone, and three of crude brick. The former exceed in size all the other Pyramids except the First and Second of El-Geezeh, and have remarkable chambers within them. The Northern Stone Pyramid has a base of 700 feet, and a height of 326 feet 6 inches, and has lost somewhat of its size, having originally measured 719 feet 5 inches, and 342 feet 7 inches. Some of the casing remains. It has an entrance in the northern face, leading to three chambers of similar construction to the Grand Passage in the Great Pyramid. The Southern Stone Pyramid is distinguished by the peculiarity of its form and by having two entrances, one in the eastern face and the other in the northern. The lower portion has an angle of 54° 14′ 46″, but the inclination then changes to 42° 59′ 26″. It has been supposed that it was suddenly completed, and had been originally intended to be much loftier, but the method in which the pyramids were built renders this unlikely; and it seems rather to have been given this form to gratify a whim of the founder, especially as the entrances in different faces afford a similar peculiarity. Its base is 616 feet 8 inches, and its height 319 feet 6 inches. At its southern side is a small brick Pyramid. The Northern and Southern Brick Pyramids of Dahshoor are to the east of those already described. They are in a very ruined state, being merely low mounds, and one cannot decide which of them is that of Asychis mentioned by Herodotus, for it can scarcely be doubted to be one of these.

It would be ungrateful to conclude this necessarily brief notice without mentioning to whom we are indebted for the most important discoveries made in the necropolis of Memphis. Among the earlier explorers were Belzoni, by whom the Second Pyramid was opened, Salt, and Caviglia, who made interesting excavations in the Great Pyramid and in its neighbourhood. But the late General Howard Vyse undertook a complete examination of the series of Pyramids, and having secured the valuable assistance of Mr Perring and an able staff, carried out this project with well-merited success. His most valuable discoveries have been noticed above, and it should be remembered that by the outlay of his private fortune he accomplished results that have been unexcelled by any expedition supported by the funds and the influence of a government. Dr Lepsius, the head of the Prussian Expedition, opened many tombs near the Pyramids of El-Geezeh and Sakkârah, and has published in his magnificent work (*Denkmäler aus Aegypten und Aethiopien*) the most interesting sculptures which they contain. M. Mariette, aided by the French government, recently discovered the Serapeum, and the tomb of the Bulls Apis. Many others have explored this great necropolis with various success.[5]

Ascent of the Nile.

The voyage up the Nile from Cairo may now be described. The traveller usually embarks at Boolâk or Masr El-'Ateekah. The objects of interest which he first sees have therefore been mentioned in speaking of those towns and of the environs of Cairo. Not far south of Masr El-'Ateekah the mountain and desert approach very near the river on that side, and soon after the wide opening of a valley is seen. Beyond it is a bold promontory of the eastern range which gradually recedes and then becomes parallel with the river for some distance, leaving but a narrow strip of cultivated land. Behind the village of Turâ, the ancient Troja, are the quarries named after it, and a little further to the south are those of El-Maasarah. These are great excavated chambers and passages, which are entered by large square apertures in the steep face of the mountain. Hence were taken the finer blocks of limestone, employed in the construction of the Pyramids of El-Geezeh. Tablets in both quarries record the quarrying executed under different sovereigns.[6] South of the quarries the character of the eastern bank continues unchanged, and presents no remarkable object until we reach the promontory of the sheykh Aboo-Noor, which will be subsequently mentioned. The western bank, on the contrary, is broad and fertile, abounding in villages, and above its palm groves rise in the dis-

Quarries of Turâ and El-Maasarah.

---

[1] Brugsch, *Reiseberichte aus Aegypten*, p. 27, *et seqq.*

[2] *Materia Hieroglyphica*, p. 21, and Vocab. MS. addition.

[3] *Modern Egypt and Thebes*, vol. i., pp. 368–9.

[4] This colossus is the property of the British Museum, but no steps have been taken to remove it to this country. As Sir Gardner Wilkinson remarks, "when the Turks have burnt it for lime, it will be regretted." (*Modern Egypt and Thebes*, vol. i., p. 373.)

[5] For an account of the Pyramids, or copies of the bas-reliefs in the tombs around them, see General Vyse's *Pyramids of Gizeh*, and the folio plates published under the same title; Sir Gardner Wilkinson's *Modern Egypt and Thebes*; Mrs Poole's *Englishwoman in Egypt*; Lepsius's *Denkmäler* and *Briefe aus Aegypten und Aethiopien*; Brugsch's *Reiseberichte aus Aegypten*, &c.

[6] Vyse's *Pyramids of Gizeh*, vol. iii., p. 93, *et seqq.*

tance the picturesque and massive forms of the long series of pyramids. Considerably beyond those of Dahshoor, which may be considered as the most southern of those in the Memphite necropolis, are the two Pyramids of El-Metâneeyeh, which are too small to be seen from the river, and yet farther the solitary Pyramid of Meydoom, commonly called the False Pyramid. This is a structure of considerable size, having a base of about 400 feet, and a height of about 310 feet. In consequence of blocks having been pulled off its sides for building purposes, it has the appearance of being built in two degrees, the lower of which is much greater than the upper, while the fallen stones around its base make it seem as if raised upon an eminence to increase its apparent size, and hence its name. The entrance has not been discovered, and as it is so far from Memphis it may have escaped the spoliation which the other pyramids suffered in ancient times.[1] Its position, rising alone above the rich valley and desert beyond, without any object by which to measure its size, render this pyramid, especially when seen from some distance across a broad part of the river to the north, a very striking and picturesque object. There is nothing else worthy of a visit on the western bank until we reach the town of Benee-Suweyf, about seventy miles by the course of the river from Cairo.

Pyramid of Meydoom.

Benee-Suweyf.

Benee-Suweyf is a busy town, being the port of the Feiyoom. A road leads hence to that province, in a north-westerly direction. After crossing the Bahr-Yoosuf, a branch of which waters the Feiyoom, we pass through the opening in the Libyan range, which leads to that province, leaving on our right the ruined brick Pyramid of El-Lâhoon, so called from an adjacent village.

Feiyoom.

The Feiyoom, including its lake, is a pear-shaped tract, its narrowest part being to the west, extending into the desert, and measuring in its greatest length about thirty miles, and in its greatest breadth about twenty. The part now cultivated is more than two-thirds of this extent from the east. At the north-western extremity is the great lake of El-Karn, which is long and narrow, and fills the northern portion of the valley. A branch of the Bahr-Yoosuf, as already mentioned, flows through the opening leading to the Feiyoom. This canal soon spreads into many streams, two of which, after joining into a single course, carry off the superabundant waters of the inundation into the lake of El-Karn, while they contribute with the others to irrigate the cultivable tracts.

Labyrinth.

The site of the famous Labyrinth first claims our notice after entering the Feiyoom. Its position may be known by a ruined crude brick pyramid, that of Hawârah, which is spoken of by both Herodotus and Strabo, and may be called the Pyramid of the Labyrinth. The remains of the Labyrinth itself, which had been previously known, were first carefully examined by the Prussian Expedition, headed by Dr Lepsius, in 1843, and much information was gained respecting it. The structure was so ruined, however, that the results were not as decisive as might have been hoped. Yet the plan was to some extent made out, and the building shown to have contained a great number of very small chambers, as ancient writers had said; and the discovery of royal names of the Twelfth Dynasty, particularly of Amenemha III. to whom Manetho ascribes the founding of the Labyrinth, leaves little doubt that this king was the Mœris who built the Labyrinth according to the classic writers. Notwithstanding, the name Mœris seems to have been applied to more than one sovereign, although there is little doubt that of these the most important was Amenemha III. His prenomen Ma-en-ra, probably corrupted into Ma-ra, appears to have originated Mœris, and is certainly sufficiently similar to afford some argument for the identity of Amenemha III. with Mœris of the Labyrinth. The use of this building has not been distinctly ascertained. Manetho indeed makes it to have been the founder's tomb, but it is most probable that he was buried in the pyramid, which, however, the Egyptian historian may have regarded as part of the Labyrinth, since it is evidently connected with that structure. It seems not improbable that the Labyrinth itself was a kind of council-house where the representatives, at first of the different kingdoms, and afterwards of the various nomes, met to transact the general business of the country, and where the records of these assemblies were preserved. Such an explanation seems best to suit the accounts of ancient writers and the character of the building, but it cannot be regarded as more than hypothetical.

Not far beyond the site of the Labyrinth is the capital of the province, usually called "El-Medeeneh" or "the City," and "Medeenet-El-Feiyoom," "the City" or "Capital of the Feiyoom," close to the mounds of the ancient Arsinoë, or Crocodilopolis. It is a small but flourishing town. The only monuments of antiquity in its neighbourhood are the remains at Beyâhmoo somewhat to the north, and the great broken tablet at Begeeg, at a smaller distance to the south. The former are two structures supposed by some to be pyramids, and the latter is a record of the time of Sesertesen I., which, since it bears the figures of several divinities, throws some light upon the religion of ancient Egypt at the remote period of his reign, which we may date as having commenced early in the twenty-first century before the Christian era. This is usually called an obelisk, but it must rather be regarded as a very tall and narrow stela or tablet, upwards of forty feet in height.

Lake Mœris.

In this part of the Feiyoom, to the north of El-Medeeneh, may be traced the remains of that remarkable hydraulic work the Lake Mœris, or, more properly, the Lake of Mœris, since Mœris is doubtless the name of the king by whose orders it was dug. A French engineer, of whom mention has been made already in this article, M. Linant, was the first to determine the position and character of this famous work of antiquity; and the results of his investigations are in accordance with the opinions of some who had previously noticed the subject in published works. To M. Linant certainly is due the merit of having settled a controversy of no little importance, and the Egyptian Society of Cairo deserves our thanks for the publication of his most interesting memoir.[2] The Mœris who gave his name to the lake was probably Amenemha III., the king who can scarcely be doubted to have been the founder of the Labyrinth. The object of the Lake Mœris was to regulate the irrigation of the Feiyoom, very anciently the Crocodilopolite Nome, and afterwards the Arsinoïte; and it was valuable on account of its fisheries. It seems rather to have deserved the name of a very large reservoir or broad canal than that of a lake. Notwithstanding the drying up of the Lake Mœris, the Feiyoom is still an important and fertile province. It produces very large quantities of grapes; and the fields of roses, cultivated for the sake of rose-water, present a remarkable appearance.

Lake of El-Karn.

The great Lake of El-Karn is perhaps the most interesting object in this part of Egypt. Its name, Birket-el-Karn, signifies "The Lake of the Horn," or "Projection," by

[1] Mr Harris of Alexandria remarked to the writer that the statement of Herodotus that Cambyses opened ancient sepulchres at Memphis (iii. 37) probably indicates the period at which most of the pyramids were rifled, since those opened in modern times have generally been found to have been carefully closed subsequently to their having been plundered.

[2] More than ten years ago the Egyptian Society was formed at Cairo, and afterwards the Egyptian Association. The former has published the *Mémoire sur le Lac Mœris*, noticed in the text, and reports of proceedings, and the latter, a useful volume of miscellanea. It is to be feared that both these societies have fallen into decay chiefly through the neglect of travellers, who would do well to encourage such useful institutions.

Egypt.

which an island is intended, and not its general form, as has been supposed. It is, as already stated, according to Sir Gardner Wilkinson, about 35 miles long, 7 broad at its widest part, and is not deep, as far as has been ascertained. The water is brackish and unwholesome, although derived from the Nile, which has at all seasons a much higher level. It is bounded on the south by tracts in a state of cultivation, or deserted for want of labourers though anciently cultivated, and on the north by the Libyan desert, above which rises a bold range of mountains; and it has a strange and picturesque wildness. Its northern shore was anciently cultivated, at least in part, but is now entirely waste. Near the lake are several sites of ancient towns, and the temple called Kasr-Kâroon distinguishes the most important of these. That temple, however, being devoid of sculpture, and doubtless of the Roman period, could not attract attention except in a region so barren of monuments. Not far from it are other remains of still less interest. After this cursory view of the Feiyoom we may return to the Nile and continue our southward course.

Not far south of Benee-Suweyf the eastern chain is washed by the river at the picturesque promontory of the sheykh Aboo-Noor, whose tomb stands on its summit. From this point as far as the town of Menfaloot the mountains on the east are close to the Nile, leaving a narrow space of cultivable land, or none at all, while on the contrary the western bank is far broader than before. For forty miles nothing remarkable attracts the eye except the lofty mounds of ancient towns, until one sees the well-proportioned minaret of a mosque in the large village of Semeloot, said to have been erected by the architect of the mosque of the Sultân Hasan at Cairo. Not far beyond, the river washes the picturesque cliffs of Gebel-et-Teyr, or the Mountain of Birds, part of the eastern range. Upon its summit stands a Coptic convent, called the Convent of the Virgin, Deyr-el-'Adra. One of the monks of this convent usually climbs down the steep face of the mountain by a dizzy path, and swims to the traveller's boat to solicit an alms as a fellow Christian; an appeal not to be slighted, however low one's opinion of the Coptic Church may be. In this part of Egypt we first begin to notice the entrances of grottoes in the face of the eastern mountains, but none of these for some distance are known to be of any interest. Not far beyond Gebel-et-Teyr is the town of El-Minyeh, on the western bank, a place wearing a cheerful aspect. Opposite El-Minyeh are quarries and sepulchral grottoes, the most remarkable of the latter being at a site called El-Kóm el-Ahmar, or "the Red Mound." These are of the time of the Fourth and Sixth Dynasties; but they have recently sustained so much damage that they do not repay a visit, except from one who is a student of hieroglyphics. The governor of El-Minyeh, an ignorant Turk, used these ancient tombs as quarries; and had it not been for the interference of Mr Harris of Alexandria, the more important grottoes of Benee-Hasan would have shared the same fate at his hands.

Gebel-et Teyr.

Grottoes of Benee-Hasan.

The first remarkable objects above El-Minyeh are the sepulchral grottoes of Benee-Hasan, just mentioned, which are inferior to none in Egypt for beauty and interest. They are excavated in the face of the eastern mountains, which are here very low and sloping, and separated from the river alone by a small extent of débris and desert, and a very narrow strip of cultivable land. There is a large island beneath, and the channel that runs between it and the eastern mountains is dry for a great part of the year. The grottoes are almost in a line near the summit of the mountain, and at no great height above the river. The two northernmost are remarkable for having porticoes, each supported by two polygonal columns of an order which is believed to be the prototype of the Doric. Most of the grottoes are adorned with sculptures and paintings which pourtray with eminent truthfulness and character the manners of the Egyptians of the remote period at which they were executed, for they are monuments of the Twelfth Dynasty, dating about B.C. 2000. The persons who were entombed here were governors of what must have been an extensive district, the chief town of which was doubtless not far distant. The tombs generally consist of a chamber of large dimensions, having sometimes a portico before it, and a niche with seated figures of the chief persons buried in it at the extremity, and pits leading to sepulchral chambers. The principal apartment is sometimes supported by pillars cut out of the rock, and vaulted. Its walls bear representations of the diversions of the occupant during his life-time, and of his varied occupations, in scenes depicting hunting, fishing, games, feasts, the processes of agriculture, and the like. The figures of beasts and birds, more especially the latter, are characterized by a remarkable fidelity and beauty, and there can be no doubt that Egyptian art had attained a greater excellence at this time than it possessed under the Fourth Dynasty, although it was not until the rule of the Eighteenth Dynasty that it rose to its highest perfection. A little to the south of these grottoes, in a ravine, is the Speos Artemidos, a small rock temple of Pasht, the Egyptian Diana, and some sepulchres of little interest.

A few miles to the south of the Speos Artemidos are two sites, one on either side of the river, which were marked, within the memory of persons now living, by most important monuments which have since been destroyed by the barbarism of the Turks. That on the right bank, near the large village of El-Ashmooneyn, the ancient Hermopolis Magna, was part of a magnificent portico, bearing the names of Philip Aridæus, Alexander Ægus, and Ptolemy Lagus, all that stood of the temple of Thoth; while on the opposite side of the river were considerable remains of the edifices of the town of Antinoë, founded by Hadrian. But while we regret the destruction of such interesting records, we must not charge either the Turks or the native Egyptians with all the mischief of this kind which is perpetrated, though our sorrow is increased by the reflection that to European travellers, not excluding the heads of more than one scientific expedition, must be charged no small share in the destruction or mutilation of the monuments. The apathy of the Turks, who cannot comprehend the value of the records of any but their own nation (and happy would they be could they blot out much of those annals); the vulgar desire of every traveller, especially of our own country and of America, to leave his name cut in every monument as a witness of his Vandalism, and to aid in its destruction by carrying off a fragment; the cupidity of the natives excited by this Frank custom of cutting pieces out of sculptures so as to produce the most deplorable results; and worst of all, the selfishness which has induced savans to take away part of a valuable monument to the ruin of the rest, in order to embellish a museum and gratify a patron,—all these causes have done more than time, or fanaticism, or the rage of an enemy, would have effected in a similar period.

A short distance south of Antinoë is the town of Mellawee on the western bank, and a little farther, but on the other side of the river, the promontory called the Gebel-esh-sheykh Sa'eed, which is honeycombed with grottoes, some of which are shown by their sculptures to be very ancient, but are so ill preserved as to require but a short examination. A little beyond, however, in the district of Tell-El-'Amârineh, or the Mound of El-'Amârineh, a small fertile tract where the eastern mountains recede, noted, like Benee-Hasan, for the turbulent and thievish propensities of its inhabitants, are very curious remains of a town. This place has been identified with Alabastron, or with the Psinaula of the Itinerary of Antoninus, but it is not improbable that it was deserted long before the Greek and Ro-

Tell-El-'Amârineh.

man rule in Egypt. It was the principal seat, or the capital of a foreign race of sun-worshippers who gained the chief power in Egypt towards the close of the Eighteenth Dynasty, and it was most likely destroyed when they were overthrown, and not subsequently rebuilt. In the mountain behind it are very curious sculptured grottoes, in which were buried the subjects of these foreigners, and from them we obtain much information respecting the people and their religion, a very pure form of sun-worship. The representations are chiefly of the king, his queen, and their children, distributing presents to the soldiers and others, of acts of worship to the sun, and of temples, as well as gardens and villas. Dr Lepsius has published a valuable series of these records in his great work.[1]

Deroot-esh-Shereef.

On the western bank of the Nile, a little to the south of Tell-El-'Amârineh is the small town of Deroot-esh-Shereef, supposed to be on the site of the Thebaïca Phylace, which was a strong place, guarding, as its name imports, the northern boundary of the Thebaïs. About 20 miles to the south is the town of Menfaloot on the same side of the river, which has a decayed appearance from the manner in which the stream has encroached upon, and washed away, part of it. Opposite to Menfaloot in the eastern range are extensive crocodile-mummy catacombs. There is nothing of note during the next 25 miles of the river's course, which is very winding, and therefore difficult to navigate, until we reach

Asyoot (Lycopolis).

the village of El-Hamra, the port of Asyoot. This town, the capital of Upper Egypt, or the Sa'eed, that is of the whole country above Cairo, and the residence of its governor, lies inland, about two miles from El-Hamra, in a richly cultivated plain. The town with its beautiful mosques, two of which, one of the Memlook style, and the other of the Turkish, are not unworthy of comparison with those of the metropolis, and its Constantinopolitan palace, surrounded on three sides by verdant fields, and having behind it a fine rounded spur of the western chain, which here, for the first time, is near the river, presents a picturesque appearance to one who approaches it. On entering Asyoot he is not disappointed, for the excellence of the goods and provisions sold in the well-built chief market, and the solid look of the houses, indicate activity and prosperity. And it is not a little remarkable that this was an important town at least 3500 years ago, and has thus outlived Thebes and Memphis, Tanis and Pelusium. The ancient Egyptian name was Ssut, or probably Ssiut, but the Greeks called it Lycopolis, on account of the worship of the dog-headed or wolf-headed divinity of the place. This was Hepuher, who seems to have differed from Anubis in his name alone. In the mountain behind Asyoot are some ancient grottoes, one of which is of great size, but their sculptures have unfortunately suffered much, and there is little to see in them after ascending the hill. The view of the valley and the town beneath is however an ample reward for the trouble. Thirty miles further by the course of the river, and on the eastern bank, is the village of

Kaw el-Kebeereh (Antæopolis).

Kâw el-Kebeereh where was anciently Antæopolis; the interesting remains of the temple of Antæus, which stood here early in the present century, have entirely disappeared through the encroachment of the river, and also, it is believed, from having been used as a quarry by the Turks. A few miles beyond this, the lofty part of the eastern range called the Gebel-esh-sheykh El-Hareedee, a famous Muslim saint, hems in the river on one side for a short distance. It soon however retires again, and the valley on that side becomes broader than usual. Here, a short way from the river, stands the small town of Akhmeem, the ancient Chemmis, or Panopolis. No remains of importance mark this site. About 22 miles farther by the course of the river, on the western bank, is the important

Girga.

town of Girga, which was, until a comparatively recent period, the capital of the Sa'eed. The rise of Asyoot, however, and the agency of the river which is gradually washing it away, have contributed to its decline, and it wears a dilapidated aspect. Near it must have been situated the very ancient city of This, whence the First and Second Dynasties took their name. Probably This stood not far from the sacred city of Abydos, the site of which is a few

Abydos.

miles from Girga, in a south-westerly direction, on the border of the Libyan desert, which is separated from the Nile by a broad tract of cultivated country. Two interesting edifices render Abydos worthy of a visit. The southernmost of these is a temple of Osiris, in which we find the names of Rameses II. and his father Sethee I., by whose orders it seems to have been constructed. It is so choked with sand and rubbish that little can be seen of its sculptures, and its plan can scarcely be ascertained; it is very desirable that it should be cleared. The other structure is believed by Sir Gardner Wilkinson[2] to be the famous temple of Osiris, the chief divinity of Abydos. It is smaller, and in a worse state of preservation than the other temple, and among its sculptures are the same names, those of Sethee I. and Rameses II. Hence was taken the famous list of Pharaohs, known as the Tablet of Abydos, which is now one of the most valuable objects in the British Museum.[3] In the desert near by are many sepulchres, which are chiefly remarkable on account of the interesting antiquities which have been discovered by clearing them out. The sanctity of Abydos as a reputed burial-place of Osiris, rendered this a favourite necropolis of the ancient Egyptians from very early times, and the extent of that of Memphis seems to have been partly owing to the same superstition.

Dendera (Tentyra).

At a distance of more than 40 miles from Abydos, but in nearly the same latitude, is the village of Dendera on the western, or rather southern, bank of the Nile. Before reaching it we pass the small town of Farshoot at the mouth of the great canal, called the Bahr-Yoosuf, and the large village of Hoo, marking the site of Diospolis Parva. Opposite the latter place are some sepulchral grottoes in the eastern chain, called those of Kasr-es-Seiyâd which is believed to occupy the position of Chenoboscion. They contain names of kings of the Sixth Dynasty, and that of the head of the Fifteenth, but the representations which occupy their walls are not of an unusual interest. Dendera, however, is remarkable as giving its name to the first well-preserved and unencumbered temple that is seen in a voyage up the Nile. This is the famous temple of Athor the Egyptian Venus, who presided over the town of Tentyra or Tentyris, the capital of the Tentyrite Nome. It stands on the mounds of the town about a mile and a half from the Nile. As this temple gives a good idea of Egyptian architecture as applied to such buildings, it must be described with some care, although but briefly.

The temple is surrounded by a great wall of crude brick, a stone portal in which faces its front. The portal is adorned with sculptures representing the Emperors Domitian and Trajan engaged in acts of worship before several divinities, whose names occur, as well as those of the sovereigns, in the accompanying inscriptions. A wall of brick has been recently built from each end of this portal to the front of the temple, thus forming a narrow passage terminating at the entrance of the portico. The portico is about 135 feet in width, and is one of the richest and most beautiful structures of the kind. It is supported by four and twenty columns, four deep, nearly fifty feet in height, and having a diameter of somewhat more than seven feet at the

---

[1] *Denkmäler*, abth. iii., bl. 91 *et seqq.* Compare *Modern Egypt and Thebes*, vol. ii., p. 71; *Transactions of the Royal Society of Literature*, second series, vol. i.

[2] *Modern Egypt and Thebes*, vol. ii., p. 112.

[3] Wilkinson's *Materia Hieroglyphica*, part ii., pl. ix.; *Horæ Æg.*, p. 100–103.

thickest part. The capitals have a full face of Athor sculptured on each of their four sides, and above these a kind of shrine, or small temple. The portico is not seen to advantage in front, as it is buried to a considerable height in heaped-up rubbish, which partly conceals the intercolumniation that connects the three columns on each side of the entrance. But on descending into the interior, we are struck with the grandeur and justness of its proportions, and the richness of the sculptures which adorn its walls. It is, however, like the rest of the temple, of higher merit as regards its architecture than its sculpture, for the latter art had declined under the Greek and Roman rule to a much greater degree than the former. The sculptures are of the same kind as on the portal, representing offerings made by some of the earlier Cæsars; and on the ceiling are various mystical subjects, probably of an astronomical import, and the famous Zodiac from which an extravagant idea of the antiquity of the temple was deduced before hieroglyphics were interpreted. The greater part of the back-wall of the portico was the front of the temple before this portion was added. This inner part consists of three considerable chambers, an isolated sanctuary, and numerous small apartments. The first of these is a hall, supported by a double row of columns, three on each side, of a rather heavy form, for they have, beneath the capital formed of the block with the faces of Athor, and the shrine, another capital of a cup-shape. This hall is entered by a doorway in the middle of the back-wall of the portico, and passing through it we reach a second and third chamber of the same breadth but shorter, and then the sanctuary. The entrance of this chamber is in the same line with the others, but it is much narrower and isolated by a passage running round it. On each side of the chambers and passage are many small apartments, two passages to the exterior, and a staircase; and there are singular inclined passages in the walls, two of which are entered from the sides of the portico. All these chambers and passages, excepting the two last mentioned, are profusely covered with sculptures and inscriptions of a religious character, and chiefly depicting and narrating the piety of the sovereigns by whom the temple was erected. The royal names have not always been filled in, the rings remaining vacant; but when they have been sculptured, they are generally those of the last Cleopatra, and Cæsarion, her son by Julius Cæsar. The staircase already mentioned is on the left-hand side of the second chamber behind the portico, and conducts us to the roof of the temple. Here are a sort of chapel and some small chambers, one of which is very interesting, because its sculptures relate to the story of Osiris. The exterior of the temple is as completely covered with sculptures as the interior. Among the figures represented here are those of Cleopatra and Cæsarion; but they cannot be supposed to convey any resemblance, since they belong not alone to a conventional art, but almost to its lowest period. There are two smaller temples near the great temple of Athor, one of Isis, and the other of the kind called a Typhonium. Both are of the Roman time.

Kinè.

On the opposite side of the Nile, a little above Dendera, is the town of Kinè, between which and Arabia some traffic is carried on by the route through the desert to El-Kuseyr on the Red Sea. The best of the porous water bottles which are used throughout Egypt are manufactured here, as are the great water jars, called "bellâsee," which the women carry, at the large village of Bellâs, a few miles higher on the western bank. Opposite to Bellâs are the villages called Kuft or Kift, marking the site of the important town of Coptos, which was the emporium on the Nile of the Arabian and Indian trade under the Ptolemies; and somewhat to the south, the inconsiderable town of Koos, the ancient Apollinopolis Parva, which succeeded to the trade of Coptos, under the Muslims, until Kinè supplanted it. On the other, that is, the western bank, a little higher, is the small town of Nakâdeh, which the people call Nagâdeh, where are Roman Catholic and Coptic convents. A short distance beyond Nakâdeh are the northernmost of the remains of Thebes.

Thebes.

The monuments of Thebes do not present from afar the imposing appearance of the Pyramids of Memphis. Placed for the most part at a distance from the Nile, as well as from one another, and having on the western side the picturesque form of a much higher mountain than any near Memphis, rising behind them, they do not strike those who see them from the river or its banks. Most of them are not indeed visible from the Nile excepting when it is at its height. The stately colonnade of the temple of El-Uksur, on the very bank, is, however, not unworthy the magnificence of Thebes, and when one approaches the other monuments his utmost expectations are exceeded by the grandeur of El-Karnak, the beauty of the palace-temple of Rameses II, and the mysteriousness of the tombs of the kings. Nowhere else is the mythology, the history, the very life and manners of the Egyptians of old times so vividly brought before his eyes as in the sculptured and inscribed monuments of the capital of the greatest Pharaohs.

It will be necessary to say a few words as to the position of the principal monuments, and respecting the city which they adorned, before entering into a more detailed description. Thebes, or Diospolis Magna, is called in the hieroglyphic inscriptions Ap-t, or with the article prefixed, T-ap, and Amen-ei, or the abode of Amen. The Copts write the former name ταπε, which, according to the Memphite dialect, is pronounced Thaba,[1] and this explains the origin of the Greek Θῆβαι. In the Bible it is mentioned as נא אמון No-Amon, a name of difficult etymology. The date of its foundation is unknown, but remains of the time of the close of the Eleventh Dynasty have been found (*cir.* B.C. 2100), and it is reasonable to suppose it to have been at least as ancient as the commencement of that line, the first of Diospolite kings. Under the sovereigns of the Twelfth Dynasty it must have become a place of importance, but it probably declined during the troubles of the Shepherd period. With the Eighteenth Dynasty it attained its highest prosperity, and maintained it during the Nineteenth and Twentieth. To this period its greatest monuments belong. Then its decline evidently commenced; but from the manner in which Homer mentions it,[2] Thebes must have been still a great city in his days or not long before, for we can scarcely suppose that he did not speak of its condition in his own time, being doubtless unacquainted with the state of Egypt at the period of the Trojan war. After this it suffered severely from the barbarian violence of the Persians, and then of Ptolemy Lathyrus;[3] so that in Strabo's time the Thebans inhabited villages as now, and there was no longer a city.[4]

Monuments.

The monuments of Thebes, exclusive of its sepulchral grottoes, occupy a space on both sides of the river, of which the extreme length from north to south is about two miles, and the extreme breadth from east to west about four. The city was on the eastern bank, where is the great temple, or rather collection of temples, called after El-Karnak, a modern village near by. The temple of El-Karnak is about half a mile from the river in a cultivable tract. More than a mile to the south-west is the temple of El-Uksur, on the bank of the Nile. On the western bank was the suburb bearing the name Memnonia. The desert near the northernmost of the temples on this side almost reaches the river, but

---

[1] *Modern Egypt and Thebes*, vol. ii., pp. 136–7.
[2] *Iliad*, ix. 381–384.
[3] *Modern Egypt and Thebes*, vol. ii., pp. 253–4.
[4] Strabo, *Geogr.* xvii., i.

Egypt.

soon recedes, leaving a fertile plain generally more than a mile in breadth. Along the edge of the desert, besides the small temple just mentioned as the northernmost, are the Rameseum of El-Kurneh, and that of Medeenet-Haboo less than a mile farther to the south-west, and between them, but within the cultivated land, the remains of the Amenophium, with its two gigantic seated colossi. Behind these edifices rises the mountain, which here attains a height of about 1200 feet. It gradually recedes in a south-westerly direction, and is separated from the cultivated tract by a strip of desert in which are numerous tombs, partly excavated in two isolated hills, and two small temples. A tortuous valley, which commences not far from the northernmost of the temples on this bank, leads to those valleys in which are excavated the wonderful tombs of the kings, near the highest part of the mountain which towers above them in bold and picturesque forms.

Temple of El-Uksur.

The temple of El-Uksur must be first described, as it is nearest of the edifices to the river, and but an appendage to the great group of El-Karnak. It takes its name from the small town of El-Uksur, or Abu-l-Haggâg, incorrectly called Luxor, which is built in and around part of it, thus injuring its effect, and rendering examination difficult. It differs from most Egyptian temples in not facing the river, but this is accounted for by its connection with the temple of El-Karnak, from the southern approaches to which a long avenue of sphinxes (now wholly ruined) leads to it, terminating at its entrance. This is a massive portal with wings, 200 feet in width, before which is a very fine obelisk of red granite. Its fellow, which stood on the western side, was removed by the French to Paris in 1831, and now adorns the Place de la Concorde. Both have beautifully cut hieroglyphic inscriptions. The height of that which remains is about 80 feet. It is adorned with three vertical lines of hieroglyphics on each side, in which are celebrated the praises of Rameses II. The other obelisk differs alone from this in being slightly shorter.[1] Close to the winged portal are three seated statues of red granite representing Rameses II.; a fourth has been destroyed. The wings of the portal are covered with sculptures of remarkable interest, representing occurrences in the war of Rameses II. with the Kheta or Hittites, in the early part of his reign.[2] On the left wing is depicted the defeat by the Egyptians, led by their king, of the confederate peoples under the walls of the stronghold called Ketesh,[3] which corresponds to Ashteroth-Karnaim mentioned in the Bible. The king, Rameses II., is represented, according to the Egyptian custom, of a gigantic size, standing in his chariot, which he has urged into the midst of the hostile force, whose warriors fall by his well-directed arrows. The Egyptians, on the other hand, sustain no loss, as in all such representations, which are therefore of a very partial character. It is difficult to understand how a warlike and civilized people could have thought the glory of a victory heightened by the imputation of cowardice to their adversaries, and that they should in such instances, to which the battle-scenes do not afford a single exception, have sacrificed truth to vanity. On the right wing is represented the camp of the Egyptian army during the same war. This has been sculptured over another scene, of which, owing to the falling out of the plaster with which it had been filled, part may be now seen. All these representations are in sunk relief, and beautifully executed.

The entrance to the temple is contracted by the construction of a modern wall, through the small door of which we enter a great court choked by the huts of the town, among which stands a mosque. It is surrounded by a double row of columns, the capitals of which have the form of the bud of the papyrus. A ruined portal with wings forms the end of this court, and with it commences the older part of the edifice, which has a more southerly direction; and its southernmost part in like manner turns a little more in that direction, that is, from the river, though not so remarkably. Some deviation was probably rendered necessary by the course of the Nile. The second court is much obstructed by rubbish, but free from huts; nothing is seen of it but a magnificent avenue of fourteen columns, having capitals of the bell-shaped flower of the papyrus, which led from its portal to that of the next court. The columns are about 60 feet in height, of fine form, and elegantly sculptured. They were raised by Amenoph III., whose name is the oldest which occurs on them and in the rest of the temple. Behind this is another court, which has a double row of columns on each side, and at its end a portico supported by columns four deep. This court is much ruined. Beyond it are several chambers of the time of Amenoph III., and in the midst of them an isolated sanctuary, the sculptures of which bear the name of Alexander Ægus, in whose reign it was built, in the place, no doubt, of one destroyed by the Persians under Cambyses or Ochus, as Sir Gardner Wilkinson remarks.[4] Most of these apartments are in a dilapidated state.

Temple of El-Karnak.

Although there is an approach to the temple of El-Karnak from that of El-Uksur, the grand entrance was towards the river, and from that entrance must commence a regular examination. This extraordinary assemblage of buildings consists of a great temple and several smaller structures, surrounded by a massive crude brick wall of enclosure. There are other remains similarly inclosed, which were connected with the great temple.

The grand entrance is through a propylon or portal with wings, more than 360 feet wide, for this is its measure above the rubbish which is piled up around it. It was never sculptured, nor was its surface smoothed. It presents, therefore, a rude appearance, and is much ruined, a great part of the left or northern wing having been demolished. The court, of which the propylon forms the front, measures 329 feet in width, and 275 in length, having on each side a gallery with a single row of columns, and a double colonnade, of which one column alone stands, formed an avenue from its entrance to that of the hypostyle hall beyond. On the right side a temple of older date interrupts the side gallery, extending 50 feet into the court. Its front is formed by a propylon, about 90 feet wide, on each wing of which Rameses III. is pourtrayed in the act of slaying prisoners before Amen-ra. The interior of this temple consists of a court which has on each side a row of Osiridean pillars, and at the end another row of such pillars with columns behind them. A hall or portico supported by eight columns is next to the court, and beyond it are other apartments. Nearly all the sculptures are of the reign of Rameses III., but the names of later sovereigns occur. On the other side of the great court is a small structure which may be called a chapel, or three chapels. The most interesting sculptures in this part of the group of temples are outside the eastern portion of the south wall of the great court, for here is the famous list of countries and towns subdued by, or tributary to, Sheshonk I., or Shishak, the head of the Twenty-second Dynasty. Among the names in the list is that of the kingdom of Judah, and those of several places in the dominions of Rehoboam and Jeroboam I.[5] At the end of the

[1] The inscriptions are given by Rosellini, *Monumenti Storici*, No. cxvii.

[2] See Rosellini, *Monumenti Storici*, Nos. civ.–cvii.; and above, section ii.

[3] Lepsius reads the first character of this name "k," from its being thus rendered by Hephæstion, in the name of one of the decans. *Chronologie der Aegypter*, i., p. 69.

[4] *Modern Egypt and Thebes*, vol. ii., p. 245.

[5] Champollion, *Lettres*, p. 99; Rosellini, *Monumenti Storici*, No. cxlviii.

court is a fine portal, the wings of which are much ruined. This is the entrance to the great hypostyle hall, the most magnificent work of its class in Egypt. Its length is 170 feet, and its width 329; it is supported by 134 columns, the loftiest of which are nearly 70 feet in height, and about 12 in diameter, and the rest more than 40 feet in height, and about 9 in diameter. The great columns, 12 in number, form an avenue through the midst of the court from the entrance, and the others are arranged in rows very near together on each side. There is a transverse avenue made by two rows of the smaller columns being placed farther apart than the rest. This great hall is therefore crowded with columns, and the effect is surprisingly grand. The spectator, being generally unable to see beyond those which are immediately around him, perceives the vast dimensions which, if viewed from a distance, might lose their effect. The forest of columns seems interminable in whatever direction he looks, producing a result unsurpassed in any other Egyptian temple. The partial ruin of its stone roof, and of some of the columns, render the hall the more picturesque, and make us wonder at the force which must have been expended in attempting to demolish it. This grand hall was built by Sethee I., the head of the Nineteenth Dynasty (*cir.* B.C. 1340), and sculptured partly in his reign and partly in that of his son and successor Rameses II., who has sometimes effaced his father's name to substitute his own. Thus it commemorates, not in its grandeur alone, but by its sculptures, the magnificence and power of these two great Pharaohs. The sculptures of the interior of the walls represent these kings making offerings to the gods, and the like subjects occupy the great columns. Far more interesting are those which adorn the exterior of the walls, and record the achievements of the same kings, those of Sethee I. being on the north wall, and those of Rameses II. on the south. The former are of much greater interest than the latter, as far as we can judge, and in this respect inferior to none in Egypt. The scenes on the north wall are arranged in three compartments, of which the upper one has been nearly destroyed. In them the king is represented of a gigantic size charging in his chariot, and putting to the rout his enemies, capturing their strongholds, and returning home in triumph. The chief nations are the *Kheta* or Hittites, the *Ruten* (*Luten*) or Lydians, who were apparently in those days not seated in Lydia but near to Mesopotamia, the *Shasu*, the people of the land of *Shari*, of *Remenen* (*Lemenen*) Hermon or Armenia, and of *Kanana* (*Kanaan*) or Canaan. Among the captured places is *Ketesh* or Ashteroth-Karnaim, which was in those days the most important stronghold between Egypt and Mesopotamia. There is also a long list of countries, cities, and tribes conquered or ruled by the king, among which we find *Nahareena*, that is Aram-naharaim, or Mesopotamia, *Kesh*, Kush, or Ethiopia, &c. The battle-scenes of Rameses II. on the south wall do not, as far as they are seen, equal these in interest. Here also is a list of the king's conquests and possessions, and on the west side of a wall which joins this one at right angles, forming the side of a court of the southern approach to the temple, is a representation of the capture of Askalena or Askalon, and an inscription recording a treaty between Rameses II. and the Kheta, concluded in the twenty-first year of the king's reign. The back of the hypostyle hall is formed by a ruined propylon bearing the name of Amenoph III., and then at a distance of about 50 feet is another propylon, entirely ruined. In the space between these propyla, which was a court, stands a beautiful obelisk of red granite, upwards of 70 feet high, raised by Thothmes I. The fragments of its fellow, which was more to the north, strew the ground. Behind the second of these propyla is another granite obelisk 92 feet high, and inferior in size to no other known Egyptian obelisk excepting that of San Giovanni Laterano at Rome. This great obelisk of El-Karnak is a monument of Queen Amen-numt who came to the throne in the year B.C. 1458 or 1457, and an inscription on its pedestal records the period which elapsed (nineteen months) from the time that it was begun to be cut in the quarry until its completion in Mesori (the twelfth month) of the queen's sixteenth year (B.C. 1442). The fellow of the great obelisk, which stood to the south of it, has been broken, and its fragments occupy its place. Beyond the great obelisk is the chief sanctuary, a structure almost entirely of granite, divided into two apartments, which was built under Philip Arrhidæus, in the place, no doubt, of one destroyed by Cambyses or Ochus. The space between the hypostyle hall and this sanctuary is extremely ruined, the huge stones being piled up in heaps as though an earthquake had overthrown the temple. But this destruction is doubtless to be ascribed to human violence, having probably been effected by the Persians, or Ptolemy Lathyrus, or both. Behind the sanctuary are fragments of a very ancient part of the temple bearing the name of Sesertesen I., the first king ot the Twelfth Dynasty, who came to the throne *cir.* B.C. 2080. Considerably farther is a large oblate building of the time of Thothmes III., which affords a remarkable example of architectural caprice, its columns having inverted shafts and capitals, and its cornices being likewise inverted. Behind this and a stone wall of enclosure are ruined chambers, and far beyond, directly behind the centre of the great temple, in the crude brick wall of enclosure is a handsome portal, never finished, bearing the name of Nectanebes I.

The southern approach to the temple of El-Karnak from that of El-Uksur is, as before mentioned, by a ruined avenue of sphinxes, which, when near the great structure, terminates, and two other avenues commence. The westernmost of these, which is of colossal rams, conducts to a temple situated not far to the south-west of the first court of the great temple, which we approach through a stately portal bearing in its inscriptions the name of Ptolemy Euergetes I. The front of the temple, before which was another avenue of rams, is a propylon, which is almost uninjured. Behind it is a court having a double row of columns on each side and at the end, and again behind this is a hall supported by eight columns, and many small chambers. This temple was dedicated to Khuns, the third member of the Theban triad. It was commenced under the Twentieth Dynasty, and continued by the later kings of the Twenty-first. A small edifice having sculptures of the time of the Greek and Roman rule stands on the west of the court of this temple.

The avenue of sphinxes, which branches off at the same place as does that of rams leading to the temple of Khuns, takes an easterly direction and terminates where another begins at right angles to it, which connects the southern courts leading to the great temple with a separate enclosure. The latter contains a lake which has the shape of a horse-shoe, and the remains of sacred structures. At the northern extremity of the avenue, which is of criosphinxes, is a propylon forming the front of a large court which terminates in a second propylon, which, like the other, is much ruined. Beyond this, but not in exactly the same direction, after a vacant space, the approach continues through two smaller propyla, the second of which is nearly destroyed. Each fronts a court, and at the end of the second of these courts was the great side entrance to the temple. The first and second propyla were, like the criosphinxes, monuments of King Har-em-heb, or Oros, of the Eighteenth Dynasty, and were partly built of materials of a temple or palace of the foreign sun-worshippers whom he overthrew. The third propylon is more ancient, since it bears the names of Thothmes III. and Amenoph II., as well as of subsequent kings: the age of the fourth is not certain: the name of Rameses II. occurs here, but it may

have been founded before his time. There is an enclosure in the angle formed by the third and fourth propyla with the great temple, which contains a sacred lake.

Adjoining the great crude brick wall of enclosure at its north-eastern portion is another containing the ruins of an important temple. The chief approach is through a stately portal of the Ptolemaic period, in the crude brick wall. The temple to which it conducted was very beautiful and costly, as we can judge by its remains, which show with how much violence it was destroyed. It seems to have been founded under the Eighteenth Dynasty. There are two small temples or chapels, one of the time of Achoris and the other of that of the supposed Amyrtæus and Nectanebes I. in the same enclosure. Another crude brick enclosure of small dimensions, near the south-east corner of that of the great temple, contains some unimportant remains of a small edifice.—The preceding brief description will convey some idea of the magnitude of the temple of Amen-ra at Thebes, with its appendages, since a mere enumeration of its various parts, with their date and a few of their most important sculptures, has occupied so much space. But no one who has not seen that wonderful assemblage of ruins can picture to himself the massiveness of its castle-like propyla, the grandeur of its hall of columns, the beauty of its great obelisk, and the sublimity of its heaped-up ruins. In that work of two thousand years, amid the records of the might and of the fall of Egypt, the past ushers up a long train of great historic figures, from Sesertesen I. and the Shepherd times to Rameses II. the conqueror, to Shishak, who subdued Judah, to the Persian conquest, and to the final ruin of the "City of Thrones" by Ptolemy Lathyrus, after its last noble struggle. In the great hall, undisturbed by any living thing, we seem to hear the sacred music of the priests and to see the pomp of the returning victor as he passes on to the sanctuary to pay his vows. And when we stand before the lofty obelisk rising above the mass of ruins and pointing heavenwards, like the monument of a devoted city and people, we see the fulfilment of God's decree, "No shall be rent asunder."[1]

In describing the monuments on the western bank at Thebes, it will be best first to notice the remarkable temples and remains of temples, excepting the two small ones among the tombs, and then to give some account of the necropolis. It has been already mentioned that the great suburb which stood here was called the Memnonia.

Setheum.

Beginning our examination from the northward, the first object of interest is the Setheum, a small temple of Sethee I., which the natives call Kasr-Er-Rubeyk, at the ruined village of El-Kurneh. A portico originally supported by ten columns, of which two have fallen, extends along the whole front of the building. Three entrances lead to the interior of the temple: the middle one of these is the door of a hall having twelve columns. From this apartment we pass into several small chambers, which are of no particular interest, like the ruined chambers which we enter from the northern door. The southern door is the entrance of a separate part of the edifice, which contains a small hall supported by two columns, and three chambers behind it, the middle one of which was a sanctuary or chapel, devoted, as its sculptures show, to the worship of Rameses I., the father of Sethee I. The inscriptions of the temple tell us that it was dedicated to Amen-ra by its founder Sethee I., and continued by his son Rameses II., and his grandson Menptah.

Rameseum of El-Kurneh.

The great temple of Rameses II., which may be called the Rameseum of El-Kurneh, but is commonly though incorrectly known as the Memnonium, is situated at a distance of about a mile to the westward of the Setheum, and is like it on the edge of the desert, which here is much farther from the Nile than it is near the other temple. Notwithstanding that its condition is so much more ruined than that of other edifices here, the beautiful architecture of what remains, and the historical interest of its spirited sculptures, render it altogether second alone in its attractions to the great pile of El-Karnak. A propylon, 225 feet in width, of which a great part has been thrown down, forms the front of the edifice. Through its portal we enter a spacious court, 180 feet in width and 142 in length. It had originally a double colonnade on either side, every column of which has been destroyed, while the side walls have been entirely demolished, and the end wall partially. On the back of the propylon are sculptured a battle and other scenes of a campaign in the king's eighth year. In this court is one of the most wonderful objects at Thebes, a colossal statue of Rameses II., broken in pieces, exceeding in its weight and equalling in its dimensions any other known Egyptian statue. It was of a single block of red granite, and must have been transported hither from the quarries of Syene, notwithstanding that its weight was, according to Sir Gardner Wilkinson's computation, about 887 tons, $5\frac{1}{2}$ hundredweight.[2] It was 60 feet in height, representing the king seated on his throne, and was placed on the left side of the entrance to the second court. Of that court, happily, there are more remains than of the first. Its width was about 170 feet and its length about 140, so that it was not much smaller than the other court. It had a double colonnade on each side and at the end, and but a single colonnade at the front. All these were of columns having capitals of the form of the papyrus bud, excepting eight of the ten forming the front row, that is, all of that colonnade but the two extreme columns, and, in like manner, the corresponding ones of the opposite row, which were square Osiridean pillars, or pillars formed of a square block, having in front a figure of Osiris. Many of the columns and pillars have been demolished, nevertheless those which yet stand enable us to judge how magnificent this part of the temple must have been. On what remains of the front wall of the court, that is, on its northern half, are very remarkable sculptures which must not be passed by unnoticed. Here is a great scene representing a battle between the Egyptians, led by Rameses II., and the Kheta or Hittites, near the strong city of Ketesh or Ashteroth-Karnaim. The king of Egypt is pourtrayed routing the chariots of the enemy, who flee in disorder towards Ketesh, across a double moat, beyond which and beneath the city a strong force of regular infantry endeavours to protect their retreat. This was doubtless the decisive action of the campaign against the confederates, which must be regarded as the most important of those which distinguished the reign of Rameses II.[3] Higher up on the same wall is a procession of priests bearing small statues of kings, the first of which is that of Mênês, the earliest sovereign of Egypt, the second of Munt-hotp, a king of the Eleventh Dynasty, and the subsequent ones of the kings of the Eighteenth and Nineteenth Dynasties as far as Rameses II., with whom the series terminates.[4]

Next to the second court is a hypostyle hall, which is the most admirable part of the temple. It measures 100 feet in length and 133 in breadth, and originally contained forty-eight columns in eight longitudinal rows, each consisting of six columns. A central avenue is formed by twelve lofty columns, about 36 feet high, which have capitals of the shape of the papyrus-flower, while the columns on each side, about 24 feet high, have capitals of the shape of the bud of the same flower. The elegance of the form and the justness of the proportions of all these columns is not equalled in any other Egyptian temple, and render this one

[1] Ezek. xxx., 16.

[2] *Modern Egypt and Thebes*, vol. ii., pp. 144–5.

[3] Rosellini, *Monumenti Storici*, Nos. cix., cx.

[4] Lepsius, *Denkmäler*, abth. iii. bl. 163.

Egypt.

of the most beautiful structures of its kind. Happily although much injured, it has suffered less from violence than the first and second courts. On its front wall, to the left as one enters, are curious sculptures, representing the rout of a hostile force and the capture of a town, the walls of which the Egyptians ascend by means of scaling-ladders: Rameses II. and six of his sons lead the army. On the end wall are religious subjects, and a series of the sons and daughters of Rameses II., whose legitimate offspring they seem to have been, twenty-six in number, twenty-three sons and three daughters. At the temple of Wadee-es-Suboo'a in Nubia were represented, according to Lepsius, a much larger number of children of this king.[1]

Beyond the hypostyle hall are two smaller chambers, the first of which is entered by a doorway in the middle of the end wall of the hall. It is supported by eight columns, and has on its walls representations of mythological or religious subjects. It is chiefly remarkable, however, for its astronomical ceiling, one of the most precious records of ancient Egyptian science.[2] Behind this is a ruined chamber, which seems to have been of the same dimensions. The other apartments which must have adjoined these are entirely demolished. The description which Diodorus Siculus gives from Hecatæus of Abdera of the Tomb of Osymandyas agrees best with the Rameseum of El-Kurneh; and his mention of the sacred library is in accordance with the character of the sculptures of the first chamber beyond the hypostyle hall, as well as with the statement in several papyri that they were written by the scribes in this temple, in which, or attached to which, was a kind of college.[3]

Amenophium.

To the south-east of the Rameseum of El-Kurneh, at a distance of less than half a mile, a mound, just within the cultivable plain, marks the site of a magnificent temple of Amenoph III., which may be called the Amenophium, and which, there is reason to believe, was destroyed by Cambyses. Of the obelisks and colossi which stood on either side of the approach to the Amenophium, all are thrown down except the two gigantic statues, one of which is known as the Vocal Memnon. The latter, indeed, was broken, but afterwards restored. These colossi stand about a quarter of a mile to the south-east of the mound where are the scanty remains of the temple. They are of hard gritstone, monolithic, and about 47 feet in height, with pedestals about 12 feet high. They represent a king, Amenoph III. (as their inscriptions attest), seated on his throne. Smaller though colossal standing statues of the king's mother, Queen Mutem-wa, and of his wife, Queen Taya, rest against the space between the sides of the throne and the legs of the great statues, one at either extremity; while there are remains of another statue of Queen Taya, of smaller size, which stand between the feet. The colossi are a little less than 60 feet apart; a distance judiciously chosen, so that they should neither seem smaller than they actually are, by being placed too far from each other, nor should be so near as to appear but a double statue. As they now stand in the midst of the fields, far away from human habitations or ancient temples, bearing in their mutilated forms the marks of successive ages, as well as of barbarian violence, calling up the story of Egyptian greatness so long departed, and the poetic traditions of Greece once believed, reminding us of those who have stood here before the rising of the sun to hear the mysterious sound, and have themselves passed away with their religion and their power, while they have kept their places as watchmen overlooking the change of empires and of faiths, they are not dumb, and their inarticulate voice tells us more than did that of Memnon in old times.

Vocal Memnon.

The Vocal Memnon is the more northern of the two, and is, as before mentioned, imperfect. It was broken in the midst either by the barbarism of Cambyses, or by an earthquake, more probably the former,[4] but long afterwards repaired. It presents in consequence a very shattered appearance, and the other colossus gives us a better idea of what the pair must anciently have been. Many Greek and Latin inscriptions on the Vocal Statue record the visits of those who were with Hadrian, and of others, and relate that they heard the voice of Memnon. There is thus satisfactory evidence to show that some sound was frequently heard here at sunrise; and the only dispute is whether it was produced by a physical cause, or was an imposture of the priests. The former appears to be the more probable view, as such a deception could hardly have been carried on so long without detection; and its being a natural occurrence does not seem impossible from the examples we have of sounds resembling that which is described as having been heard here by the ancients.

Medeenet-Haboo.

Less than half a mile from the mound of the Amenophium, in a south-westerly direction, within the desert, is the group of temples known as those of Medeenet-Haboo. This name is that applied by the Arabs to a town, which appears to be that called Papa in the Roman times. The ruins of its houses obstruct the temples, more especially the larger of the two. The smaller temple may be first described, since it is nearer to the river, to the eastward of the other. We first enter a ruined court which was never completed, and which had a colonnade whereof two columns alone yet stand, at its end, a little before the first propylon of the temple, which bears the name of Ptolemy Lathyrus and that of Auletes among the sculptures of its gateway. Beyond this is a court which had a colonnade on each side, and a propylon, much smaller than the other, at the end. Most of its columns have fallen, and the propylon has also suffered much. On the latter we see the names of Tirhakah the Ethiopian, and later sovereigns. Beyond this is another court, and then the chambers of the temple. The chief of these is an isolated sanctuary, with a gallery around it having square pillars and fluted columns like those of certain of the tombs at Benee-Hasan. The sanctuary is ornamented with sculptures of sovereigns of the Eighteenth Dynasty, including Queen Amen-numt.

Small temple.

Palace.

To the south-west of this temple is a very remarkable structure, which differs in its use and architecture from any other ancient monument in Egypt. It is the only palace that has been preserved, although the temples have been supposed to have been likewise palaces, or palace-temples.[5] After passing between what seem to have been lodges, we arrive at the main part of the palace of Rameses III. This consists of two towers on each side of a court ending in another tower, beneath which is a gateway conducting to the great temple. On the front of each of the two towers first mentioned Rameses III. is represented slaying his enemies before Amen-ra, and below is a series of captured chiefs. The inscriptions that remain tell us that these are the chiefs of the Kheta, or Hittites, the Amari, or Amorites, the Tokkaree, or Carians, the Khairetana (Khairetaan) of the sea, or Cretans (Cherethim), the Tuirkha (Tuirsha) of the sea, and of other peoples whose names are partly or wholly destroyed. On the walls of the chambers are curious sculptures representing the private life of Rameses III. Among

[1] Lepsius, *Denkmäler*, abth. iii., bl. 179.
[2] *Id.*, bls. 170, 171.
[3] *Chronologie der Aegypter*, i., p. 39, 53.
[4] Comp. Paus. *Attic.* i., 42.
[5] The size and character of the only chambers in the temples which could have been used for habitation render it most improbable that any but priests and scribes resided in them, except perhaps on the occasion of some important ceremonies which may have lasted a considerable time; and it is most likely that the royal abodes were usually extensive pavilions constructed of no stronger materials than the houses of the people, and this view the representations of the tombs seem to support. The temples, however, were called palaces.

these the king is pourtrayed playing at a game like that of draughts with one of his daughters, while another stands by him. They are all represented naked.

Great temple.

The great temple of Medeenet-Haboo is directly behind the palace through which was, as already mentioned, the approach to it, and is a monument of the same king Rameses III., a sovereign inferior alone as a conqueror to Rameses II., the greatest ruler of Egypt. Both the magnificence of its architecture, and the high interest of its sculptures, render it one of the most interesting edifices at Thebes. It is much obstructed by the remains of the town that formerly stood in and around it.

The first propylon cannot be less than 200 feet wide. It is partly destroyed, and much of it is hidden by the remains of the town. On its wings the king is represented slaying prisoners before the gods, and acts of worship are also depicted. The court, of which this propylon is the front, is about 110 feet in length and about 135 in breadth, and has a colonnade on either side, forming a gallery. The gallery on the right side consists of seven Osiridean pillars, that on the left, of eight columns having capitals of the form of the papyrus-flower, affording a remarkable example of the irregularity of Egyptian architecture. This court is nearly filled with rubbish. At its end is a second propylon, on the left wing of which Rameses III. is represented bringing captives of the Tokkaree, or Carians, before Amen-ra. Passing through the granite portal of this propylon we enter the second or peristyle court, the finest part of the temple. This court measures about 123 feet in length and about 133 or somewhat more in width, thus exceeding in size the first court, contrary to the usual practice of ancient Egyptian architects. It has a single colonnade at the front and on either side, and a double one at the end. The colonnade at the front and that facing it are each of eight Osiridean pillars, while that behind the latter is of columns with capitals of the papyrus-bud, and the side colonnades consist each of five similar columns, one of which, on the left side, has fallen. Happily this court is less choked than the other, and one can form some idea of its original splendour. The Christian inhabitants of the town, the ruins of whose church are seen in the court, defaced many of the sculptures, and particularly the Osiridean pillars; nevertheless the general effect is not lost, and one is struck by a simple grandeur, which is unsurpassed in any similar Egyptian structure. The sculptures of the walls are of especial interest, and a short description of them must therefore be given. On the back of the left wing of the propylon a series of sculptures relating to the wars of Rameses III. commences and extends along the wall on the left side of the court. The rout of the Rebu or Lebu, perhaps Libyans, is depicted, the triumphant return of the king, the bringing of prisoners before him on the field of battle, and the like; and besides these are subjects pourtraying ceremonies. On the right side-wall is a curious representation of the celebration of the Panegyry of Amen-ra Generator, which, from the detail in which it is given, affords us considerable insight into the manner in which such solemnities were kept.[1] On the end-wall, and on part of each side-wall are depicted the many children of Rameses III. A door in the wall first mentioned conducts to the inner part of the temple, which occupies but little less space than the two courts just described. It is entirely choked with rubbish.

The sculptures of the exterior of this edifice next claim our attention, none of which have been mentioned excepting those which occupy the face of the first propylon. On the north, or rather north-eastern wall, is a remarkably interesting series of sculptures commemorating the events of foreign wars of Rameses III., and equalling in the importance of their subjects and the boldness with which they are executed any other records of the kind in Egypt. In the first representation, which is to the extreme right, we see Rameses III. going to war; in the second is depicted the rout of a people called the Tamhu; and in the third, prisoners of the Tamhu and Mashuash are brought before the king, while scribes count the hands, &c., which have been cut from the slain, showing their number to have been 12,535. Then weapons, probably taken from the enemy, are counted. The next scene is very complicated, and represents a great battle with the Tokkaree or Carians, whose army is defeated by the Egyptians. The Tokkaree fight in chariots of two horses and in waggons drawn by four oxen. Mercenaries or allies who are called Khairetana, (Cherethim or Cretans) fight in the army of Egypt. The scene which follows this is one of the most spirited of Egyptian sculptures, and if compared with the similar Assyrian bas-reliefs in the British Museum, shows the great superiority of the best Egyptian art over that of Assyria. The king, who, is passing through a marshy country in his chariot, encounters three lions, and having smitten two of them with his javelins, turns round to meet the third which is about to spring. The next subject is the most remarkable of the series, since it represents a sea-fight, in which the Egyptian fleet defeats that of the Khairetana (Cretans) and the Tokkaree (Carians), while Rameses and his army aid their countrymen from the shore. Thus, probably, the Cretans, in whose navies the Carians fought of old, according to a tradition which Herodotus relates, lost the empire of the sea. Rameses then receives the praises of his warriors, and the hands of the slain are brought before him and numbered. Next he leads prisoners, who are of the Tokkaree and Rebu, before the gods of Thebes. The other battle-scenes of the series represent the capture of strong places, the carrying away of captives, &c. On the end wall the king is pourtrayed setting forth on an expedition, and on the other side-wall, the south-west, is a long calendar, which appears to occupy the whole wall. Not far from the Rameseum, to the southward, is a small Ptolemiac temple containing three chambers. Farther in the same direction is a great lake, over which in ancient times it is probable that the funeral processions passed. At more than half a mile in a south-westerly direction from the lake is another small temple of Roman times, having an isolated sanctuary and other chambers.

Necropolis.

The private and royal tombs must now be briefly noticed, but from their great number, and the variety of the paintings which occupy their walls, it will not be possible to give as detailed an account of them as has been given of the other monuments. Two temples which are situate in the necropolis likewise require a notice. The tombs, as before mentioned, occupy some of the space at the foot of the mountains, or are excavated in their sides towards the valley, and in two isolated hills, excepting the tombs of the kings, which are cut in the sides of two secluded valleys to the westward.

Beginning from the north, we first see the entrances of grottoes in the low spur of the Libyan chain behind the Setheum. Several of these have a series of square apertures, leaving pillars to support the roof, so as to form a kind of portico, behind which is a chamber or chambers, having pits, from which open other chambers for sepulture. Some grottoes here, and others extending towards the Rameseum, are inhabited by the people of El-Kurneh, whose village is ruined. At the foot of the mountains, as well as on their least steep sides, here and throughout the necropolis, are the entrances of many mummy-pits. On the spur above mentioned are brick pyramids, for the most part nearly destroyed; and in the wide tract beyond, where the mountains recede, are very remarkable sepulchres of the time of the

[1] *Ancient Egyptians*, vol. vi., pl. 76.

Egypt.

Twenty-sixth Dynasty. These are extensive excavations, profusely sculptured almost entirely with hieroglyphics, having before their entrances open courts hewn in the rock, and entered through crude brick propyla, from which walls of enclosure of the same material extend around the courts. The largest of these, and indeed of all those known at Thebes, is the tomb of Pet-amen-apt, a priest whose date is not fixed, but who probably lived towards the close of the Twenty-sixth Dynasty, or the beginning of the Twenty-seventh.[1] Sir Gardner Wilkinson says that "the area of the actual excavation is 22,217 square feet, and with the chambers of the pits 23,809, though, from the nature of its plan, the ground it occupies is nearly one acre and a quarter."[2] Almost all the passages and chambers are covered with hieroglyphic inscriptions on a small scale, and the few sculptures are of a religious character. At the end of the Asaseef is a temple which was approached by a very long avenue of sphinxes now entirely demolished. The temple is at the base of a steep cliff, and is partly excavated in the rock, and partly built of masonry. The latter portion is almost wholly destroyed. A portal of red granite which formed its entrance yet remains, bearing the name of Thothmes III., cut over the erased name of Queen Amen-numt. A second granite portal stands behind this, almost close to the rock. At some distance to the left of this are two small chambers, one of which is remarkable for the form of its roof, which is vaulted by horizontal stones, of which the two uppermost meet in the centre, all being cut internally, so as to form an arch. The excavated part of the temple consists of an oblong chamber of moderate dimensions, another of smaller size with a cell on each side, and at the end a sanctuary. All these, excepting the sanctuary, are of the time of Queen Amen-numt and Thothmes III., and have vaulted roofs. The sanctuary bears the sculptures of Ptolemy Physcon, affording a remarkable contrast to the delicate style of those of the chambers which lead to it, and it is flat-roofed.

The isolated hill of the sheykh 'Abd-El-Kurneh (probably a mistake for 'A'bid-El-Kurneh, meaning "the Devotee of El-Kurneh"), presents a singular appearance from the plain, since on that side it is honeycombed by the entrances of tombs. Several of these, like some of those first mentioned, have porticoes before them hewn in the rock, and many have very interesting paintings, representing scenes of domestic life, funeral ceremonies, arts, trades, &c., in their upper chamber or chambers. These have, unfortunately, suffered greatly from the cupidity of the natives, and the disgraceful Vandalism of European travellers. Farther towards Medeenet-Haboo is a similar isolated hill, called Kurnet-Mara'ee, which contains a few grottoes of the same description, and in the valley between this and the main mass of mountain are many other interesting grottoes. At one extremity of this valley, at some distance behind the Rameseum, is a small edifice with a high enclosure of crude brick walls. It is a temple of Athor, of the Ptolemaic period, and has a small portico and three chambers, in one of which, the side chamber to the left, is a curious sculpture, of which the subject is the judgment of a soul by Osiris. Hence we may infer that this was a temple attached to the necropolis, and the same appears to have been the case with that of the Asaseef, since there deceased royal personages receive divine honours, as though they were buried in the vicinity. Beyond the other extremity of this valley is the secluded valley, called that of the Tombs of the Queens from its containing the sepulchres of queens and princesses of the Eighteenth, Nineteenth, and Twentieth Dynasties. These are similar to the tombs of the kings, which are next to be described, but are not large, nor are the subjects on their walls, which seem generally of little interest, well preserved.

Egypt.

Tombs of the kings.

A long and winding valley, the entrance to which is an opening in the mountains behind the Setheum, leads to two other valleys, that of the Tombs of the Kings, and the Western Valley. Both of these contain royal sepulchres, but those of the former are more important than those of the latter, as far as is known, for this may contain unopened tombs. The sepulchres in the Valley of the Tombs of the Kings are twenty or twenty-one in number. Nineteen are sculptured, and are the mausolea of kings, of a queen with her consort, and of a prince, all of the Eighteenth, Nineteenth, and Twentieth Dynasties, unless we make Rameses I. the earliest of these sovereigns to have been head of the Nineteenth Dynasty, instead of including him among the rulers of the Eighteenth. One tomb is without sculpture, and there is likewise an unsculptured passage running for a considerable distance into the mountain which may perhaps be regarded as the commencement of a tomb never completed, making the twenty-first. Their plan is always the same in its main particulars, but they differ greatly in extent, in consequence of having been commenced at a king's accession, or even before (since one of them is the tomb of an heir-apparent), and continued throughout his reign, like the pyramids of Memphis. Their paintings and painted sculptures likewise do not present remarkable varieties, since they are almost wholly of a religious character, and principally refer to the future state. They are remarkable for the manner in which they illustrate the Egyptian religion, and the beauty of their execution; but their mysterious and intricate nature forbids any detailed description of them in the present article. The plan of one of the most interesting sepulchres may however be described. The tomb of Sethee I., commonly called Belzoni's, since that explorer first opened it since ancient times, is in the freshest state of preservation, except in its outer part, although the miserable barbarism of modern travellers is yearly lessening its beauty. We enter by a staircase, and pass along a steep passage, which terminates in a deep pit, now filled up. Thus far the subjects and inscriptions which occupy the walls, are unfinished, showing that the tomb was not completed. Immediately beyond the pit the part discovered by Belzoni commences with a hall 26 feet by 27, supported by four square pillars, the walls of which are covered with very beautiful painted sculptures, including the celebrated procession of the four races. To the right of this is another chamber, supported by two columns, the sculptures of which were never commenced, having only been drawn in outline. From the left side of the former chamber we descend a flight of steps, which leads to a passage, another flight of steps, and then another passage ending in a chamber 17 feet by 14, from which we pass into a hall 27 feet square, having six square pillars, and on either side a small chamber. This forms the portico of the great sepulchral hall, the most splendid part of the tomb, which is of an oblong form, 19 feet in length and 30 in breadth, with an arched roof. In the midst, in a depression, was a splendid sarcophagus of alabaster, and on its removal blocks of stone were found filling up the entrance of an inclined descent which was cleared for 300 feet by Belzoni, without its termination being discovered. It is not improbable that the king was buried in a chamber at the end of this passage. The great sepulchral hall is covered with beautiful painted sculptures, and on its ceiling are astronomical or astrological representations, resembling the astronomical ceiling of the Rameseum of El-Kurneh. A door in the left side of the sepulchral hall leads to a chamber which has two square pillars, and on the same side is a cell; there is another chamber on the opposite side. A large apartment, which was left unfinished, is behind that in which was the sarcophagus, and is the last of those contained in the tomb, if the inclined

[1] *Horæ Æg.*, pp. 68, 69.

[2] *Modern Egypt and Thebes*, vol. ii., p. 222.

Egypt.

descent does not lead to other unknown ones. From the entrance to the end of this chamber is a distance of about 300 feet.

The tomb of Rameses III. is among the most splendid of the royal sepulchres. Its length a little exceeds 400 feet, but from the nature of the rock its sculptures are less delicately executed than those of the tomb of Sethee I. In cells on either side of its passage, a little within the entrance, are interesting paintings illustrating manners and customs, in one of which is the celebrated representation of the harpers.

The tombs which have been found in the Western Valley are only four in number, and but two of these contain paintings. The latter are of Amenoph III. and of King Skhai or Skhee, a sovereign who appears to have come to the throne in the year B.C. 1475 or 1474, though some suppose him to have been of the sun-worshippers who succeeded Amenoph III. The former is decorated with paintings in a very good style, but unfortunately they have sustained much damage; the latter is historically interesting as a record of an uncertain king, but its paintings are of poor execution. Nowhere perhaps are we so forcibly struck by the feeling of the ancient Egyptians with respect to death and the future state, as in the Valley of the Tombs of the Kings, and in the sepulchres themselves. The desolateness of the spot, apart from all signs and sounds of life, fitted it for the solemn use to which it was assigned, and those long dark passages, and lofty chambers, on whose walls we see the awful punishments of the wicked, and the rewards of the good, show us the most secret mysteries of the Egyptian religion in a manner suited to their greatness. The Pharaohs, whose valour and whose piety we have seen commemorated on the walls of their stately temples, are worthily entombed in these marvellous sepulchres; and here we take our farewell of them and of Thebes, knowing well that the world has since produced no monuments excelling those of "the City of Thrones."

Arment (Hermonthis).

Not far south of Thebes, on the western bank, is the large village of Arment, the old Hermonthis, where stands a picturesque temple built by Cleopatra. It has two courts, having colonnades, and three chambers around which was also a colonnade, of which but one column now stands. It is of small dimensions, having been the Typhonium attached to the great temple of Munt, the divinity of the place, which has been razed. On the other bank of the river, a little higher, at Tód, anciently Tuphium, is a small Ptolemaic temple. Not far beyond, and about 20 miles above Thebes, by the course of the stream, are the "Gebeleyn" or "Two Mountains," on the western side of the river, where the sandstone begins. The town of Isnè, the ancient Sne, called by the Greeks Latopolis, is likewise situate on the western bank, about twelve miles higher, and is remarkable as containing a very fine Egyptian monument, the portico of its great temple of Kneph. This is in the heart of the modern town, and until lately was much choked with rubbish. Mohammad 'Alee having, however, caused it to be cleared, its beautiful proportions can be appreciated. It is supported by twenty-four lofty and massive columns, six in front, and four deep, having capitals of various forms, of which those alone in corresponding positions on opposite sides are of the same description, a deviation from regularity of which we do not see examples previous to the Greek rule. The columns and walls are covered with minute sculptures of the bad style of the period when the portico was erected, that of the Cæsars. It contains the hieroglyphic names of Claudius, Vespasian, Titus, and other emperors as late as Severus. The back is, however, more ancient, since it bears the name of Ptolemy Epiphanes, being the front of the older temple of which nothing more is known for certain to remain. Upon the ceiling is a Zodiac, from which this monument was supposed to have been of very great antiquity before the interpretation of hieroglyphics had been discovered. On the other bank of the Nile, on the site of Contra Latopolis, is a small temple of the Ptolemaic and Roman periods.

Isnè (Latopolis).

Eilethyas.

A few miles above Isnè, where both the Libyan and Arabian chains approach the river, are the curious remains of Eilethyas. There is a small temple of the Ptolemaic time, and two little sacred edifices of the period of the Pharaohs, but the most interesting monuments are the tombs and the fort. The former, which are excavated in a hill, are very remarkable as illustrating history, husbandry, &c.; and in one of them is the very curious inscription of its occupant Aahmes, chief of the mariners, recording his services to early kings of the Eighteenth Dynasty.[1] The fort is a large enclosure of crude brick,[2] which was a place of importance as early as the Shepherd war, for it is mentioned as the "Fort of Seben," that is of Eilethyas, in a part of the inscription above mentioned, which relates to the time of that war. The goddess of the place was Seben, or Lucina (Eilethyia), who was especially regarded as the protector of Upper Egypt.

Adfoo (Apollinopolis Magna).

Having proceeded about twelve miles to the southward we reach the large village of Adfoo, which represents the town called by the Greeks Apollinopolis Magna, the great temple of which yet stands in a comparatively perfect state, and is one of the most stately monuments of ancient Egypt, although of a time at which art had greatly declined. It was dedicated to Har-het, the god of the place, whom the Greeks called Agathodæmon. Unfortunately mounds of rubbish within and around it, as well as the huts of the village, some of which stand, or stood until recently, on its roof, injure the effect, and prevent a complete examination of the temple.

The great propylon which forms the front of the temple measures about 226 feet in width, and is, like the rest of the edifice, in a good state of preservation. The sculptures upon its front represent acts of worship by Ptolemy the Elder, son of Auletes, who is pourtrayed slaying prisoners. The portal between the wings of this propylon is the entrance to the temple, of which the first part is a great court about 161 feet long and 140 broad, with a colonnade along its front and each side, of columns with various capitals fronting covered galleries. At the end is a portico having 18 columns, 6 in front and 3 deep, about 82 feet broad and 46 long measured within, beyond which are a hall and passages and other chambers, the most important of which is an isolated sanctuary. This part of the temple, commencing with the portico, is much choked with rubbish, which often reaches to the roof. The wall of the great court is continued so as to inclose the further portion of the temple, leaving a passage around it. The sculptures show that it was probably commenced by Ptolemy Philopator and completed at the end of the Greek monarchy, though an insignificant additional subject was added by Claudius. Not far from the great temple is a smaller one of the sort called Typhonia, containing two chambers, around which runs a gallery supported by Typhonian columns.

Gebel-es-Silsileh.

About 23 miles above Adfoo the mountains on either side, which had for some distance confined the valley to a narrow space, reach the river and contract its course. They are low but steep and picturesque, and in their western side are seen the entrances of excavations. They receive the appellation of Gebel-es-Silsileh, a name derived from the earlier Silsilis. The most interesting of the excavations is a rock-temple in which is pourtrayed the defeat of a negro nation by King Har-em-heb, or Oros, of the Eighteenth Dynasty: here, also, are subjects depicting acts of worship paid to Nilus and Sebak. To the southward of this, and

[1] De Rougé *Tombeau d'Ahmes*; and Champolion, *Lettres*, pp. 197, 198.

[2] For an account of the Egyptian system of fortification, see Wilkinson in *Trans. Royal Society of Literature*, new series, vol. iv.; and Popular Account of the Ancient Egyptians, vol. i., pp. 407–409.

Egypt.

also facing the river, are the entrances of several excavated tombs, the representations in which are not of a remarkable character. Beyond these are three chapels of the time of the Nineteenth Dynasty. On the opposite side are very important quarries where much of the materials of the great temples was cut, especially under the Eighteenth and subsequent Dynasties.

Beyond Gebel-es-Silsileh, although the mountains recede, the tract of cultivated land is extremely narrow, and sometimes the desert touches the river: this is partly owing to the sinking of the level of the stream, which, as mentioned in an earlier part of this article, was very anciently restrained by some barrier at Silsilis. About eleven miles above that place is the extremely picturesque temple of Ombos, placed on a rocky eminence called "Kóm-Umboo," or "the Hill of Umboo." It stands within a great enclosure of crude brick walls, which we see on every side, except that towards the river. There is a portal in this wall of the time of Queen Amen-numt and Thothmes III. The great temple is double, one-half having been dedicated to the worship of Sebak, and the other to that of Har-oër or Aroëris. It consists of a portico of fifteen columns, whereof two have fallen, the foremost of which were connected by a wall of intercolumniation having two entrances, behind which is a smaller portico and remains of chambers, including the two sanctuaries. The earliest name here is that of Ptolemy Philometor,[1] unless Champollion be right in saying that the name of Epiphanes is also found in the temple,[2] which appears to have been completed by Ptolemy Auletes. There were also remains here of a smaller Ptolemaic temple which have been washed away by the river.

Kóm-Umboo (Ombos).

Nothing remarkable occurs between Ombos and Syene, a distance of about twenty miles. The valley is confined to a very narrow space by the mountains, which take bold forms on both sides near the latter place. Just before we reach it, we see the Island of Elephantine, where is the famous Nilometer of the Roman time. The town of Aswân, which represents the ancient Syene, stands amid palm-trees on the eastern bank opposite to Elephantine. It is a considerable place, of greater political than commercial importance, and has succeeded to an older town of the same name, the ruins of which occupy the river's bank, and a granite hill to the south. Among them may be mentioned a pier, which has a well which is most probably the Nilometer constructed by 'Amr, the Muslim conqueror of Egypt. In the ruined town is also a small temple of Roman date. Farther to the south is its extensive Arab cemetery, which is full of curious tombstones bearing inscriptions in Cufic characters. In the granite hills to the eastward are the quarries whence were taken so many of the obelisks and statues which adorned the Egyptian temples.

Aswân (Syene).

The bed of the river above Aswân is obstructed by numerous rocks and islands of granite, one of the latter of which, that of Saheyl, is interesting on account of the numerous hieroglyphic tablets and inscriptions at its southern part. This island is almost a mile and a half above Aswân, and at the distance of another mile from it begin the rapids called the First Cataract, caused by the granite rocks, which almost entirely choke the river. The Cataract is so inconsiderable, that during the inundation, boats favoured by a strong northerly wind can pass it without aid, though at other times it is necessary to hire natives, who drag them through, but then the principal rapid has a fall of only five or six feet,[3] and that is not perpendicular. Nevertheless the roaring of the troubled stream, and the red granite islands and rocks which stud its surface, through which our boat threads its way, give the approach a wild picturesqueness until we reach the open stream, less than two miles farther, and the beautiful isle of Philæ suddenly rises before the eyes, completely realizing our highest idea of a sacred place of ancient Egypt.

The First Cataract.

Philæ is beyond the proper limits of Egypt, but as it is usual to describe it in noticing Aswân and the rapids, some account of it will here be given, which is the more desirable as it contains very beautiful and interesting monuments, and was held in high reverence by the ancient Egyptians as a burial-place of Osiris. It is very small, being only a quarter of a mile long, and about 500 feet broad. On its granite rock is a little alluvial soil and some vegetation, with a few date-palms, but its verdure has been exaggerated, and its beauties are little owing to it. On the east side is a small but very picturesque temple, now hypæthral, of the Greek and Roman time, and unfinished. It is 48 feet in width and 63 in length, and has 14 columns with capitals of various forms, connected by intercolumnal walls. The great temple of Isis stands to the westward of this. Its front is formed by a propylon, before which is a kind of court, to be afterwards described. The portal bears the name of Nectanebes I., but the wings were added by the Ptolemies, making the entire width about 122 feet. Through the portal we enter a court, on the right side of which is a gallery fronted by columns, behind which are several small chambers, and on the left side is a separate small temple of Athor, the main entrance to which is by a door and passage in the left wing of the great propylon. This small temple commences with a portico having four columns with the faces of Athor sculptured in high relief upon each of its sides above the capital. Beyond this are three chambers behind one another, above the door of the first of which is a Greek dedication by Ptolemy Physcon, or Euergetes II., and the two Cleopatras. The temple was, however, commenced by Epiphanes. The court of the great temple, or that of Isis, is bounded by a second propylon of smaller dimensions than the first, and forming the entrance to the portico, which is a very elegant structure raised on ten columns, eight of which are at the back and one on each side. It is partly hypæthral, an open space being left between the two columns last mentioned. The beautiful forms of the columns, and the bright remains of colour on them and the walls, with the effect of the sunlight through the aperture of the roof, produce a most graceful and pleasing effect. Behind this hall are several small apartments, one of which, reached by a staircase, contains very curious sculptures relating to the story of Osiris. The temple appears to have been commenced by Ptolemy Philadelphus (whose name is the earliest found there), and was continued under the Roman emperors. The court before the temple remains to be noticed. It is bounded by two galleries with columns in front. One of these is about 250 feet long, and is built close to the western side of the isle terminating at a small temple of Athor near its southern end. This edifice, which is much ruined, was supported by columns with the block adorned with faces of Athor above their capitals, of which six stand; it was raised by Nectanebes I. The eastern gallery, which is shorter than the other, is not parallel with it, and thus shows that this court was not part of the great temple, but rather an approach to it. The other remains are of minor importance, and the same may be said of the ruins of a temple on the neighbouring large island of Bigè.

Philæ.

A few words must be said respecting the eastern and western deserts. The latter desert is remarkable for two valleys besides those called the Oases. The first of these valleys is that of the Natron Lakes to the westward of the Delta, containing four Coptic monasteries, the remains of the famous anchorite settlement of Nitria. To the southward of this, and parallel to it, is a sterile valley called the Bahr bela-Ma, or "River without Water." Yet farther to the southward is the Little Oasis (Oasis Parva), about 100

Western desert.

---

[1] *Modern Egypt and Thebes*, vol. ii., p. 282. [2] *Lettres*, p. 173. [3] *Modern Egypt and Thebes*, vol. ii., p. 294.

Egypt.

miles from the Nile in E. Long. 29°., nearly due west of the town of Bahnesè. It contains remains of little interest. Within 200 miles due south of this oasis is another, of which the usual appellation is Wáh ed-Dákhileh, where, near the town of El-Kasr, is an Egyptian temple of the Roman period. This, according to Sir Gardner Wilkinson,[1] is the most flourishing of the oases. About half-way between this oasis and the Nile at Thebes lies the Great Oasis (Oasis Magna). Here, near the town called El-Khárigeh is a considerable temple of the Persian and subsequent times; and in the same oasis are other ruins of the period of the Ptolemies and Cæsars. The Oasis of Jupiter Ammon, that of Seewah, is not far from the coast at a great distance to the westward, and it is not properly included in Egypt. Various Arab tribes occupy this desert besides the settled inhabitants of the oases.

Eastern desert.

In the eastern desert must be mentioned the town of Es-Suweys, or Suez, anciently Arsinoë, a small place at the head of the gulf to which it gives its name. To the southward, a little below lat. 29°, are the secluded Coptic convents of St Antony and St Paul near the sea. Farther south are the porphyry quarries of Gebel-ed-Dukhán, extensively worked under the Romans, and the granite quarries of Gebel-el-Fateereh. Considerably more to the south, at El-Hammámát, on the old way from Coptos to Philoteras Portus are the Breccia Verde quarries, which were much worked from very early times, and have interesting hieroglyphic inscriptions. At Gebel Zabárah are emerald mines now abandoned as unproductive. At the various mines, and on the routes to them and to the Red Sea, are some small temples and stations, ranging from the Pharaonic to the Roman time. Along the shore of the sea are the sites of several ancient ports, the most important of which were Myos Hormos and Berenice, and the modern town of El-Kuseyr. The northern part of this desert is occupied by the Ma'ázee Arabs and smaller tribes as far as the Kuseyr road, beyond which are the 'Abábdeh, an African tribe very different from the Arabs in appearance, and to the south of these, to the east of Lower Nubia, is the Bisháree tribe, a people also of African race.

SECTION IV.

STATISTICS.

Government.

Egypt is governed by a Páshá of the family of the late Mohammad 'Alee, in virtue of the firmán of the 13th of February 1841, by which the government of that province of the Turkish empire was conferred on him, and on his then living family, the members of which were to succeed him by seniority; by that firmán the governor of Egypt was to recognise all laws and treaties enacted and concluded by the Porte; the imposts and revenues of Egypt were to be collected in the name of the Sultán, one-fourth of the revenue was to be transmitted yearly to Constantinople, the army, limited to 18,000 men, the officers above the rank of major to be appointed by the Sultán on the nomination of the Páshá, and ships-of-war to be built only by express permission of the Porte. The non-fulfilment of any of these conditions would cancel the concessions then granted.

Under the Páshá the several departments of the administration are presided over by ministers and councils. These offices were mostly created by Mohammad 'Alee, and are great improvements on the former system of government, although necessarily filled by creatures of the higher power. The principal offices are that of the minister for the internal administration of the affairs of the state, that for foreign affairs, and those for war, marine, finance, and public instruction, a tribunal of commerce, and councils of health in Cairo and Alexandria. The provinces into which Egypt is divided are governed by officers called Mudeers, and the subdivisions of those districts by Mámoors and Názirs. The Mudeers are Turks, but native Egyptians were appointed by Mohammad 'Alee, and since by his successors, to the inferior posts. The government *employés*, as clerks, &c., are chiefly Copt scribes.

Army.

By the firmán of investiture, the army was reduced to 18,000 men, but since the war with Russia it has been very much increased, and, as is well known, the Egyptian contingent not only forms a large portion of 'Omar Páshá's army, but has very honourably distinguished itself. When on the peace-footing it is variously distributed throughout Egypt, but the artillery is confined to Cairo and Alexandria, and a considerable garrison of regular infantry is always maintained in both those cities. Each Mudeer has under his orders a corps of irregulars, and about five regiments of regular cavalry are generally stationed in Upper Egypt. According to reliable information obtained in 1849, the following is the scale of pay per month:—private soldier, 15 piasters; corporal, 20; sergeant, 25; sergeant-major, 30; lieutenant, 300; captain, 500; major, 2000; lieutenant-colonel, 2750; colonel, 4000. The privates receive rations and clothing, and the officers, rations. The commissioned officers of the cavalry and artillery receive rather more, viz. lieutenant, 360 piasters; captain, 600; colonel, 5000. A soldier in the irregular cavalry (who finds his own horse) receives 112½ piasters, and in the irregular infantry 65, in either case everything included. The pay of the Egyptian army is, therefore, good; but the common soldiers generally receive orders on the treasury, in lieu of money, which are not presentable for some months, and are not always honoured when due. The regular troops are recruited by impressment, every village being required to furnish its quota, but the irregulars are volunteers—Turks and Albanians. In the last war the Páshá also maintained a force of Arab horsemen. A regiment of regular infantry is composed of four battalions of 1000 men each, divided into eight companies, of which one is a grenadier and another a light company, and four guns are attached to each regiment. A regiment of regular cavalry consists of six squadrons, each of 192 men, a battery of horse artillery, of six companies, and one of foot artillery, of eighteen companies. The irregulars (horse and foot) are divided into corps of 400 men, each commanded by a "chief of four hundred."[2]

Navy.

Since the conclusion of the Syrian war, until the present struggle, the navy has been totally inactive. At the former period it numbered 11 ships of the line, 6 frigates (one moved by steam-power), 5 corvettes, 9 brigs (3 being steamers), and 2 cutters. Some of these were constructed in the naval yard at Alexandria, but the larger number were contracted for in Europe. Great care was bestowed on the formation of the navy, and the establishments connected with it at Alexandria, but the Egyptians do not seem to be a maritime people, or, at any rate, their men-of-war have none of the tautness and neatness of European ships of the class.

Colleges and schools.

Mohammad 'Alee devoted considerable attention to the establishment of colleges and military schools, besides sending young men to Europe for purposes of scientific study. In Cairo and its environs he founded several elementary schools[3] of a higher order than the native schools of the same class (mentioned in Section I. of this article), a school of languages, now at Boolák, a printing-press at Boolák, which, however, has been principally used for the publica-

[1] This account of the deserts is chiefly taken from Sir Gardner Wilkinson's *Modern Egypt and Thebes*, vol. i., p. 382, *et seqq.*; and ii., p. 353, *et seqq.*

[2] Private information. See Mengin, *Histoire*, vol. iii., p. 135; and for details respecting the Navy, *Ib.*, p. 143.

[3] Government Schools are of three classes or grades, and in all number about fifty in the whole country.

Egypt.

tion of works on military and naval sciences, &c., though some valuable books (among these the *Thousand and One Nights*) have issued from it at the expense of private individuals; and a school of medicine at the Kasr-El-'Eynee, between Cairo and Masr El-'Ateekah. At El-Khankah and in its neighbourhood, he placed a military hospital and a school of medicine, a veterinary college, an infantry school, and a school of music; at El-Geezeh, a cavalry school; and as Turà, one of artillery. A civil hospital likewise exists in Cairo, and another at Alexandria.[1] The dock-yard and arsenal of Alexandria, with the gun-factory at the village of El-Hód el-Marsood, organized by French officers, are very creditably conducted. Indeed all these establishments are remarkably well designed and carried out, when we consider the lamentable deficiency of similar institutions in the East, and the bad organization of the few that exist there.

Manufactories.

Mohammad 'Alee also promoted manufactures, and established large manufactories of cotton, silk, and woollen goods, tarbooshes, &c., and, especially in Upper Egypt, sugar-refineries. Ibráheem Páshá was much opposed to his father's policy, and in pursuance of his own views he laid out extensive plantations of olive and other trees, erected powerful steam-engines for the irrigation of his lands, and on all his estates endeavoured to encourage agriculture. It cannot be doubted that had he lived the correctness of his conviction that Egypt is an agricultural, and not a manufacturing country, would under his rule have been fully verified.

Culture of cotton.

Mohammad 'Alee introduced cotton, and largely cultivated it; the Turkish grandees found that from it they were able to extract more gain than from other field-produce, and large tracts were speedily devoted to its culture. The necessity, however, of excluding the waters of the Nile has caused several destructive inundations, and the cotton, being a monopoly of the Páshá has not tended to enrich the producer.[2]

Agriculture.

It may truly be said that the agriculture of the country is in the hands of the government, unless Sa'eed Páshá have made very extensive alterations in the system carried out by his father. By the seizure of almost all private lands, by enormous government monopolies, and by heavy taxation on all the fruit of their labour, Mohammad 'Alee effectually destroyed every feeling in the Felláh beyond the mere desire for daily bread; and the cruelty and oppression of subordinate officers rendered his condition more wretched than these exactions alone would have done. The agriculturists are compelled to sell their produce to the Páshá at his own price, and he again sells it to the consumers, and for export, at an arbitrary tariff, by which he secures an exorbitant profit. This rule applies *always* to some kinds of produce (as cotton, flax, &c.), and very often to all, although such is not invariably the case.

Taxation, &c.

The principal taxes are direct taxes on land, which, with indirect exactions from the Felláhs, amount to nearly one-half of the entire revenue of Egypt, the poll-tax, a species of income-tax (firdeh) of about one-twelfth of a man's annual income, with a maximum of 500 piasters; the tax on palm-trees, water-wheels, &c. To these sources of revenue must be added the profits obtained by the sale of produce, custom-dues at the sea-ports, and a duty paid by the inhabitants of Cairo and other large towns on all kinds of grain, with other custom-dues, tax on fisheries and freight.

Revenue.

The total revenue may average about 3,000,000 of pounds sterling.[3] The fullest published table of the revenue and expenditure of Egypt is perhaps that given by Mengin for the year 1833; since that time few great alterations have taken place in the country; but it must be received with caution, as we believe it is derived from government statistics, which in eastern countries are generally distorted for state purposes. It will, however, be found useful as giving the relative amount of various sources of income, and heads of expenditure.

REVENUE FOR 1833.[4]

	Purses.
Land-tax	225,000
Capitation, or poll-tax	70,000
Duty on grain	36,000
Profit on other produce	90,000
Do. on linen	12,000
Do. on silks	9,500
Customs and Octroi duties at	
Alexandria	6,000
Damietta and Boolák	7,353
Old Misr	1,601
Suez and El-Kuseyr	6,000
Deráwee	250
Fisheries of El-Menzeleh	2,750
Duty on salt, boats, and fish	3,500
Do. on merchandise entering from Syria by land	200
Profit on lime, plaster, and stone	4,400
Do. on liquids	2,771
Do. on senna	260
Do. on fisheries and Octroi of the Feiyoom	580
Do. on hides, dressed and undressed	7,000
Octroi of Upper and Lower Egypt	3,200
Tax on dancers, &c.	500
Do. on beasts for slaughter	2,000
Do. on jewellery and lace	450
Do. on inheritances	1,200
Do. on Wekálehs and Bazaars in Upper Egypt	400
Tribute paid by the rayahs	640
Profit on the mint	3,000
Do. on mats	800
Do. on natron and sal-ammoniac	1,000
Do. on soda (Alexandria)	300
Tax on palm-trees	4,000
Freightage of government vessels	2,400
Total	505,055

EXPENDITURE FOR 1833.

	Purses.
Army	120,000
Principal officers of government	39,859
Employés	20,000
Pensions	9,500
Caravan of Pilgrims	2,200
Manufactories	21,600
Government works	18,000
Tribute to the Porte	12,000
Navy	60,000
Palaces	10,000
Rations of employés	5,000
Irregular cavalry	6,500
Bedawees	5,000
Machinery, &c.	15,000
Boat-yard (Boolák)	3,300
Military schools	1,500
Printing-press	350
Dock-yard (Alexandria)	15,505
Páshá's kitchen	4,000
Matériel of war	14,000
Forage	2,500
Purchase of clothing and jewels, &c.	14,000
Total	399,814

Field-produce.

The principal field-produce for the same year was as follows:

	Ardebbs.		Hundred-weights.
Wheat	1,450,000	Cotton	114,500
Beans	700,000	Sugar	8,558
Barley	650,000	Henneh (hinnè)	35,000
Maize	160,000	Flax	18,000
Millet	750,000	Nitre	15,784
Lentils	70,000		Okes.
Rice	80,000	Indigo	77,300
Linseed	22,000	Opium	14,500
Sesame Seed	18,000	Silk	6,450

[1] For much information on the hospitals and medical schools, &c., see Clot-Bey, *Aperçu Général*, vol. ii., pp. 394–448.
[2] Personal observation.
[3] *Modern Egyptians*; and Mengin, *Histoire d'Egypt sous Mohammed Ali*, vol. iii., p. 150, *et seqq.*
[4] Mengin, *Ib.*

Imports and exports.

According to the annual report issued by the Custom-house at Alexandria, the total amount of exports in 1853 was L.3,472,000, and of imports from all parts L.2,670,000. Great Britain, Austria, and France, are the countries principally trading with Egypt, and the exports and imports to and from those countries were:

	Great Britain.	Austria.	France.
Exports.........	L.1,787,546	L.389,000	L.491,000
Imports.........	1,153,000	310,000	242,000

The same report gives the following table of exports:

Wheat (quarters)	706,000	To Great Britain	405,000
Beans „	215,000	...	169,000
Barley „	 62,000	...	50,000
Indian Corn „	 47,000	...	46,000
Linseed „	 20,000	...	18,000
Sesame Seed „	 32,000	...	...
Cotton (bales)	181,000	...	100,000
Flax „	 44,000	...	35,000
Wool „	 22,000	...	11,000
Henneh „	 5,300	...	...

The total value of manufactures imported was L.475,000, of which Great Britain contributed L.353,000; and the number of merchant-ships that sailed in 1853 from the port of Alexandria was 1191, of which 944 were with cargoes, and 247 in ballast. The *imports* are principally timber, woollen caps (tarbooshes), cochineal, copper, and copper wire, coal, cloth, drugs, tin-plates, iron wire, fruit (fresh and dry), oil, paper, jewellery, &c., sugar, cotton, woollen and silk stuffs, glass, &c. From Syria, India, and the East are imported shawls, silks, tobacco, spices, coffee, &c., and from the south, elephant-tusks, hides, castor-oil, senna, colocynth, and slaves; of the latter about 5000 are annually brought from the interior, of which some 1500 are sold in Egypt.

The following shows the amount of the principal exports to Europe for the years 1850–54, both inclusive:

	Bales Cotton.	Do. Flax.	Ardebbs Wheat.	Do. Beans.	Do. Barley.
1850	146,387	29,549	961,171	474,420	180,006
1851	121,439	30,715	1,163,949	465,380	178,782
1852	270,168	26,243	783,004	370,920	131,948
1853	148,829	30,799	815,629	320,239	68,771
1854	150,943	15,269	1,011,695	394,167	114,428

Measures.

The Egyptian measures are: The " fitr" or space measured by the extension of the thumb and first finger; the " shibr" or span; the common cubit = 22⅔ inches, the cubit of about 25 inches, used principally for Indian goods, and the cubit of about 26½ inches, used for European cloth. Of the measures of land, the feddán was equal to about 1 English acre and one-tenth; it is now less than an acre. It is divided into " keeráts" or 24ths, and consists of 333⅓ kasabehs or rods. The kasabeh is 22 " kabdahs," and the kabdah, about 6¼ inches, or the measure of a man's fist with the thumb erect. The Egyptian league varies in Upper and Lower Egypt, and is stated to be, in the former, equal to a journey of an hour and a half, and in the latter, to one hour's journey. The " ardebb" is equal to very nearly 5 bushels, and consists of 6 " weybehs," and each weybeh of 4 " rubas."

Weights.

The weights are the "kamhah" (or grain of wheat), the 64th of a " dirhem," and 4th of a " keerát." It is equal to about ¾ of an English grain. The " habbeh" (or grain of barley) is the 48th of a dirhem and 3rd of a keerát, and = $\frac{127}{128}$ English grain. The keerát, or carat, is the 24th of a " mitkál;" and = from $2\frac{125}{128}$ to 3 English grains. The dirhem = 47⅝ to 48 English grains. The mitkál = weight of a deenár = from $71\frac{7}{16}$ to 72 English grains. The " wukeeyeh" or ounce = from 571½ to 576 English grains. The " ratl" or pound = from 1 lb. 2 oz. 5¾ dwt., to about 1 lb. 2 oz. 8 dwt. troy. The " wukkah" or oke = from 3 lb. 3 oz. 13¾ dwt. to 3 lb. 4 oz. troy. The " kantár" or hundred-weight = from 98 lb., less 200 grs., to about 98 lb. avoirdupois.

Money.

European sovereigns and dollars are current in Egypt; the former being now equivalent to about 100 piasters, the latter, if French, to about 20 piasters, and if Spanish (pillar-dollars), to about 22 piasters; but the value of these coins is constantly changing. The Spanish doubloon, and Venetian sequin are also current, and so are Constantinople coins. Of native coin the " faddah" (or para) is equal to $\frac{6}{25}$ of a farthing, and there are pieces of 5, 10, and 20 faddahs. The " kirsh," or Egyptian piaster, contains 40 faddahs, and is equal to 2⅖ pence. These coins are of silver and copper. Of gold coins there are the " kheyreeyeh" of 4 piasters, and the kheyreeyeh of 9 piasters (but the value of these coins has recently depreciated), and pieces of 5, 10, 20, and 100 piasters. The " riyál beledee," or native dollar, is equal to 90 paras, but is only a nominal money, as is the " kees," or purse, which contains 500 piasters, and the " khazneh," or treasury of 1000 purses. For the weights, measures, and money we are indebted to the *Modern Egyptians*. (R. S. P.)

EHRENBREITSTEIN (*i.e. Broad stone of honour*), a town of Rhenish Prussia, government of Coblentz, on the right bank of the Rhine, immediately opposite Coblentz, with which it is connected by a bridge of boats. Pop. (1849) of town 2198; military, 1783. The town stands at the foot of a rocky precipitous height rising 772 feet above the river, and occupied by the celebrated fortress of Ehrenbreitstein, one of the strongest places in Europe. The fortress was originally a Roman castrum: and during the middle ages it was the stronghold of the electors of Treves, who in later times occupied the palace at the foot of the rock, now used as a granary. The French under Marshal Boufflers, aided by the celebrated Vauban, in vain besieged it in 1688. In 1799, however, it fell into their hands, after a siege of fourteen months, in which the garrison was reduced to such a state of famine, that a pound of horse flesh sold for 30 kreutzers, or somewhat more than 1s. The French blew up the defences when they evacuated it on the peace of Luneville. Since 1814, Prussia has expended large sums in the reconstruction of this fortress. It is defended by about 400 pieces of cannon, and on three sides the escarped rocks and steep slopes would bid defiance to almost any attack. Its weak point is on the N.W., where three successive lines of defences have been constructed. The platform on the top of the rock (serving for a parade-ground) covers vast arched cisterns capable of containing a three years' supply of water for the garrison, furnished from springs without the walls. There is also a well sunk 400 feet deep in the rock, and communicating with the Rhine. The castle of Ehrenbreitstein has been celebrated by Lord Byron, in the following magnificent stanza:—

Here Ehrenbreitstein, with her shattered wall
Black with the miner's blast upon her height,
Yet shows of what she was when shell and ball
Rebounding idly on her strength did light:
A tower of victory! from whence the flight
Of baffled foes was watch'd along the plain;
But Peace destroy'd what War could never blight,
And laid those proud roofs bare to Summer's rain,
On which the iron shower for years had pour'd in vain.
Childe Harold.

EIA, or EY, is the pure Icelandic or Scandinavian for island. Hence the termination *ey* in names of places denotes that they are islands; as Ramsey, the isle of rams; Shepey, the isle of sheep, &c. Eia is also sometimes used for water; and hence the names of places near water sometimes terminate in *ey*.

EICETÆ, a sect of Syrian monks of the seventh century, who used to recite their prayers dancing with the nuns or other females who frequented the monasteries. In this they pleaded the example of Miriam the sister of Moses. They were soon suppressed.

EICHHORN, JOHANN GOTTFRIED, celebrated for his works on biblical criticism, was born in 1752, at Dörrenzimmern, in the principality of Hohenlohe-Oehringen. After having been for some time rector at Ohrduff, he was in 1775 appointed professor of oriental languages at Jena, and in 1788 professor of philosophy at Göttingen, where he died in 1827. His principal works are the Introductions to the Old Testament, 3 vols. 1780–83—to the Apocryphal Books, 4 vols. 1795—and to the New Testament, 1 vol. 1804; Universal Repertory of Biblical Literature, 10 vols. 1787–1810; History of the World, 5 vols. 1799–1814; History of the three last centuries, 6 vols. 1803; History of the Nineteenth Century, 1 vol. 1817; History of Literature, 12 vols. 1805–12; and on the Hebrew Prophets.

EICHSTADT, a town of Bavaria, circle of Middle Franconia, on the Altmühl, 54 miles N.N.W. of Munich. It is the capital of a small principality formerly belonging to the prince-bishops successors of St Willibald, but secularized in 1801, and in 1817 given to Prince Eugene Beauharnois, Duke of Leuchtenberg. It is a neat and well-built town; and is the seat of a bishop and of an appeal court for the circle. The castle formerly occupied by the prince-bishops is now the summer residence of the ducal family, and contains the celebrated Brazilian cabinet and other collections. The cathedral, a Gothic edifice founded in 1259, contains many curious monuments of bishops and canons, the shrine and statue of St Willibald to whom the church is dedicated, and some good paintings. The church of St Walpurgis contains the bones of that saint, in a small recess above the altar, inlaid with gold. From these, at certain times in the year, there flows a stream of oil, to which are attributed certain healing qualities. There are a number of other churches, a capuchin monastery, a nunnery, ecclesiastical seminary, Latin school, public library, and several museums; manufactories of earthenware, hardware, and woollen goods, with breweries and stone quarries. About a mile from the town is Willibaldsburg, a castle standing on a height, and the residence of the bishops till 1725. In the vicinity is a handsome monument, erected by the citizens to Prince Eugene Beauharnois. Pop. 7000.

EIDER, or EYDER, a river of Denmark, having its source in a small lake 8 miles S. of Kiel, flowing generally westward, and falling into the German Ocean at Tönningen, after a course of 90 miles, for 70 of which it is navigable. It forms with the Kieler Canal a navigable connection between the North Sea and the Baltic.

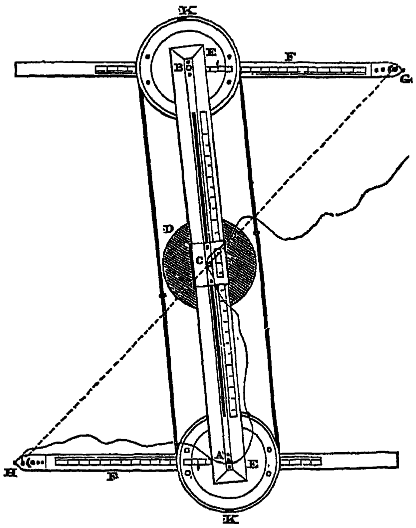
EIDER DUCK. See index to ORNITHOLOGY.

EIDER *Down*, the down of the eider duck. The eider duck plucks off the down from its breast for the purpose of making its nest, which it continues to renew as often as deprived of it, until its breast becomes quite bare.

In commerce this down is sold in balls about the size of a man's fist, and weighing from three to four pounds. It is so remarkably fine and elastic, that if one of these balls be opened and cautiously held near a fire to expand, it will fill a quilt about five feet square. Supplies of it are received chiefly from Norway, Iceland, and the Faroe Islands, where the birds abound. There are two kinds of it, sea-weed down and grass down. The former is the heaviest, but not so easily cleaned as the other.

EIDOGRAPH (εἶδος and γράφω), a very ingenious instrument for copying drawings, either upon a reduced or an enlarged scale, invented in 1821 by Mr Wallace, professor of mathematics in the University of Edinburgh.

The instrument is represented in the annexed figure.



The *beam*, AB, which is made of mahogany, slides backwards and forwards in a *socket*, C; and the socket turns on a vertical axis, supported by the *fulcrum*, D, which stands on a table. There is a slit in the beam, through which the axis of the socket passes, so that, when the beam slides in the socket, a portion of it passes on each side of the axis. There are two equal wheels, E, E, below the beam, which turn on axes that pass through pipes fixed at A, B, near its extremities; and a steel chain passes over the wheels as a band, by which a motion of rotation may be communicated from the one to the other. There

are two *arms*, F, F, which slide in sockets along the lower face of the wheels, just under their centres; at the extremity, G, of one arm, there is a metal *tracer*, with a handle attached to it, by which its point may be carried over the lines in any design; and at H, the extremity of the other arm, there is a black-lead pencil fixed in a metal tube, which is ground to fit exactly into a pipe, so as just to slide up or down. In using the instrument, the pencil, in its tube, is raised by a thread which passes over a pulley, and it descends again by a weight with which it is loaded.

From the perfect equality of the wheels, it is easy to see that, if the arms attached to them be placed parallel in any one position, they will retain their parallelism, although one of the wheels, and consequently both, be turned on their centres. Supposing, now, that BC and AC, the parts into which the axis is divided at the centre, have any proportion whatever to each other, if the distances of the tracing point G, and pencil point H, from the centres of their wheels, have the very same proportion, then it follows, from the elements of geometry, that the tracing point G, the centre C, and the pencil point H, will be in a straight line; and further, that CG and CH, the distance of these points from the centre, will have to each other the constant proportion of CB to CA, or of EG to AH. Such being the geometrical property of the *eidograph*, if the subject to be copied be fixed to the table on which the instrument stands, and the tracing point be carried over every line of the design, the pencil point will trace a copy in all respects similar to the original. To facilitate the adjustment of the instrument, so that the copy may have any given ratio to the original, there are scales of equal parts on the beam and the two arms; by these and verniers, both halves of the beam, and equal lengths on the arms, are each divided into 1000 equal parts, and at certain intervals corresponding numbers are marked on them. By means of the scales, when any ratio is assigned, the adjustment is made without the least difficulty. To avoid any derangement by the chain slipping on the wheels, there are *clamps* at K and K, which hold it fast to the wheels at points where it never quits them. They are slackened when the instrument is adjusted. (See also PANTOGRAPH, and PLATOMETER.)

EIGNE (Norman *aisne*), eldest; an epithet used in law to denote the eldest son.

EILAU-PREUSSISCH, a town of Prussia, province of East Prussia, government of Königsberg, and 22 miles S.S.E. of the town of that name. It is chiefly celebrated for the victory gained there by the French over the united Prussian and Russian armies on 8th February 1807. Pop. (1849) 2778.

EILENBURG, a town in the Prussian province of Saxony, government of Merseburg and circle of Delitzsch, situated on an island in the Mulde, 9 miles N.E. of Leipzig. Pop. (1849) 9754, chiefly engaged in the manufacture of cotton and in calico-printing. It is surrounded by walls, and has an old castle now in ruins. Large quantities of hops are grown in the vicinity.

EIMBECK, or EINBECK, a town of Hanover, capital of the principality of Grubenhagen, in the landrost of Hildesheim on the Ilme, 39 miles S. by E. of Hanover. Pop. about 5700. It is inclosed by old walls and ditches, and is generally ill-built and dirty. Alexander's church contains numerous monuments of the dukes of Grubenhagen. Eimbeck was formerly celebrated for its beer, and it still has some breweries; but the chief manufactures are linen and woollen stuffs, stockings, leather, and chemical products. It has an active trade in flax and agricultural produce.

EINSIEDELN, a market-town of Switzerland, canton of Schwitz, on the Sihl, 9 miles N.N.E. of Schwitz. Pop. about 5000. Above the town, on a naked plain 3000 feet above the level of the sea, stands the famous Benedictine Abbey of Einsiedeln. It was founded in 906, but has been several times rebuilt, the present edifice dating from 1719. The building is in the modern Italian style, but is more remarkable for size than for architectural beauty. It has many spacious apartments, a library of 26,000 volumes, a museum, and a marble chapel with an image of the Virgin. The treasury was plundered by the French in 1798. Numerous pilgrims, not only from Switzerland but also from other countries, annually resort to this abbey, particularly on the 14th September. The annual average is about 150,000; and within a fortnight in 1834 no fewer than 36,000 pilgrims repaired to the shrine. The town contains about 50 or 60 inns, chiefly for the reception of pilgrims. Paracelsus was born here; and Zuinglius was for some time curate of Einsiedeln.

EISENACH, a principality of Germany, forming part of the possessions of the grand duke of Saxe-Weimar-Eisenach. It consists of one principal and several detached portions, the former being bounded on the N. by Prussian Saxony, E. by Saxe-Gotha and Saxe-Meiningen, S. by Bavaria, and W. by Hesse-Cassel. This principality was formerly an independent possession; but on the death of the last duke in 1741, it fell by succession to the dukes of Saxe-Weimar, of whose dominions it now forms a circle. It has an area of 466 square miles, and in 1853 had 82,321 inhabitants. The general character of the soil is mountainous, and the grain produced is not equal to the wants of the inhabitants.

EISENACH, the capital of the above principality, is situated at the confluence of the Hörsel and Nesse, 42 miles W. of Weimar. Pop., including suburbs, about 10,000. The town is surrounded by walls, and is clean and well-built. It has a handsome ducal palace, several churches and hospitals, a town-hall, library, mint, gymnasium, normal school, and school for foresters. The chief manufactures are woollen, linen, and cotton goods, soap, white lead, and leather. About a mile and a half S. of the town is the celebrated castle of Wartburg—once the residence of the landgraves of Thuringia—in which Luther was confined for ten months, after his return from Worms, under the friendly arrest of the Elector of Saxony. The chapel in which he preached, and the cell which he occupied, have been carefully preserved.

EISENBERG, or EISENBURG, a town of Germany, duchy of Saxe-Altenburg, and 20 miles W. of Altenburg. It stands on a height not far from the Saale, is surrounded by walls, and has a castle with an observatory, a town-hall, and hospital. Manufactures—porcelain, ribbons, &c. Pop. 4800.

EISENSTADT, a free royal town of Hungary, county of Oedenburg, on the frontiers of Austria, 26 miles S.E. of Vienna. Pop. 5700. The town consists of three principal streets, and is surrounded by walls with two gates. It contains the splendid palace of the prince of Esterházy, built by Prince Paul Palatine of Hungary, in 1683, but altered and enlarged in 1805. The interior is tastefully fitted up, and the banqueting-hall is capable of accommodating 1000 persons. The park is large, rising in terraces, and ornamented with temples and cascades. It has a large orangery, containing 400 orange trees, and conservatories with about 70,000 species of exotic plants. The Franciscan monastery contains the burial vault of the Esterházy family. On the north of the town are extensive zoological gardens.

EISLEBEN, a town in the Prussian province of Saxony, government of Merseburg, and circle of Mannsfeld, 20 miles W.N.W. of Merseburg. Pop. (1849) 9481. It consists of an old and a new town (the former being surrounded with walls and ditches), besides several suburbs. It has an old castle, and several churches, of which St Andrew's contains the pulpit from which Luther preached; a gymnasium, and two hospitals. In the vicinity are extensive copper and silver mines, which afford employment to a large portion of the inhabitants. Eisleben is celebrated as the birth-place of

Martin Luther. The house in which he was born has been rebuilt, and is now used as a charity school.

EISTEDDFOD (Welsh, from *eistedd*, to *sit*), the name given to the assemblies or sessions of the Welsh bards, at which poets and minstrels contended for prizes after the manner of the ancient Greeks. These meetings were discontinued after the year 1568; but the old custom has been revived of late, and annual meetings for the recitation of prize poems and performances on the harp are now held under this name. (See Pennant's *Tour in Wales*.)

EJECTMENT, in *Law*, a writ or action which lies for the recovery of possession of land from which the owner has been ejected, and for trial of title. Ejectment may also be brought by the lessor against the lessee, for rent in arrears, or for holding over his term; also by the lessee for years who has been ejected before the expiration of his term.

EKATERINEBURG, the chief town of a cognominal circle, in the government of Perm, Asiatic Russia. It is situated on the river Iset, at the foot of the E. declivity of the Ural Mountains. This town was founded by Peter the Great in 1723, and is regularly built and fortified. It is the seat of a mining administration for the district, and has a mint, museum of mineralogy, mining school, extensive foundries and forges, and works for the cutting and polishing of precious stones. Being on the high road from Russia to Siberia, this place enjoys a considerable transit trade. Pop. (1851) 15,852, almost wholly employed in the mines, and in the working of metals.

EKATERINOSLAV, or JEKATERINOSLAV, a government in the south of European Russia, bounded on the N. by the governments of Poltava, Kharkov, and Voronez, E. by the territory of the Don Cossacks, S. by the sea of Azoph and the government of Taurida, and W. by the government of Kherson. The district of Taganrog, and the territory of the Azovian Cossacks belonging to this government, are separated from it by the territory of the Don Cossacks, and extend along the N.E. shores of the sea of Azoph. The area and population are as follows:—

	Area in Sq. Miles.	Pop. in 1846.
Ekaterinoslav	23,734	787,200
Taganrog	1,680	76,900
Azovian Cossacks	116	6,000
	25,530	870,100

The population consists of Russians and Cossacks, with a considerable admixture of German colonists and other races. About two-thirds of the surface consist of an open steppe or plain without trees, and only adapted to pasturage. This is particularly the case with that large portion lying to the E. of the Dnieper; to the W. of that river the soil is much more fertile. The inhabitants are chiefly pastoral, and possess immense numbers of horses, cattle, sheep, hogs, goats, &c. They also devote some attention to bees and silkworms. The grain produced is scarcely sufficient for home consumption. The other productions are hemp, flax, peas, beans, vegetables, and fruits.

EKATERINOSLAV, the capital of the above government, is situated on the right bank of the Dnieper, immediately below the Cataracts, in N. Lat. 48. 27. 20., E. Long. 35. 5. 53. The first stone of the town was laid by the Empress Catherine II. in 1787. It is laid out on a regular plan with broad rectangular streets, but is still far from being completely filled up. Pop. (1851) 12,117. It is the seat of an archbishop, and has an ecclesiastical seminary, gymnasium, and manufactures of woollens and silks.

EKRON, the principal and most northerly of the five Philistine states, was originally assigned to Judah, although afterwards apparently given to Dan. It was the station of the ark when taken by the Philistines. Eusebius and Jerome describe the village as lying between Azotus and Jamnia. It is incidentally noticed in the history of the Crusades under the name Accaron; and has been identified by Robinson with a small Moslem village, five miles south of Ramleh and now called Akri.

ELÆOTHESIUM, the anointing apartment in the ancient gymnasia and baths. See BATHS, and GYMNASIUM.

ELAINE, the name given by Chevreul to the thin oily principle of fats and oils. See CHEMISTRY.

ELAM (ELYMAIS), a country frequently mentioned in Scripture, but not very definitely marked out either by the sacred writers or by the ancient geographers. It was peopled originally by a Semitic tribe descended from Elam, whence its name. In Scripture it is generally connected with Media, and the Elamites are described among the nations of the Persian empire, while Susa is said by Daniel to lie on the river Ulai (Eulæus or Choaspes), in the province of Elam. It thus seems to have formed a part of the ancient Susiana—the modern Khusistan—which was bounded E. by Persia Proper (ancient Persis, modern Fars), W. by Babylonia (the Arabian Irak), N. by Media, and S. by the Persian Gulf. By the classical geographers Elymais is generally distinguished from Susiana. The Elymæi and Kissi formed the ancient population not only of this province, but also of Persia, whence, under Elam, the sacred writers often include the country of the Persians in general. Along with the Uxii, the Kissi, and the Cossæi, who inhabited the neighbouring districts, the Elymæi were renowned for their skill in archery; and from the days of Chedorlaomer, the contemporary of Abraham, they were frequently the terror of the world. The prophecy of Jeremiah (xlix. 30–34), that they would be destroyed by the Chaldæans, received its fulfilment when Nebuchadnezzar subjected Western Asia to his dominions, and his successor Belshazzar established his throne at Susa, the capital of Elam.

ELAPHEBOLIA, in *Grecian Antiquity*, a festival in honour of Diana the huntress. The offering on this occasion was a cake made in the form of a deer (ἔλαφος.) This festival was instituted, it is said, to commemorate a victory obtained by the Phocians over the Thessalians, under the following circumstances: The Phocians, reduced to extremity by the Thessalians, had resolved, rather than to submit to the enemy, to raise a pile of combustibles, and to burn their wives, children, and effects. This resolution was approved of by the women; but when all was prepared, the Phocians once more engaged the enemy, and utterly routed them. (Plutarch, *De Mul. Virt.*; *Paus*. x. 35; *Athen*. xv.)

ELAPHEBOLION, in *Grecian Antiquity*, the ninth month of the Athenian year, corresponding nearly to our March. It consisted of thirty days, and took its name from the festival Elaphebolia, observed in this month in honour of Diana the huntress. See ELAPHEBOLIA.

ELAPS, a genus of poisonous snakes. See SERPENTS.

ELASTICITY, or ELASTIC FORCE, that inherent property in bodies by which they recover their original figure after any force which has disturbed it is withdrawn. Elasticity is generally accounted for by the great law of attraction. Thus, when a hard body is struck or bent, so that the component parts are moved a little from each other, but not so far as to overcome the power of the attractive force by which they cohere, they necessarily, on the cessation of that external force, return to their former state. All hard bodies are elastic, as steel, glass, and ivory, and many soft ones, as caoutchouc, silk thread, &c. The great elasticity of air is a familiar fact. Liquids are also perfectly elastic, but in the smallest degree.

ELATEA, in *Ancient Geography*, an important town and military stronghold of Phocis, situated in the valley of the Cephissus, on the southern slope of Mount Chemis. By the Athenians Elatea was regarded as the key of southern Greece; and it was its seizure by Philip in 338 B.C., that opened the eyes of that people to the real designs of the

Macedonian prince. The town remained faithful to its conquerors, till with the rest of the Greeks they succumbed to the arms of Rome. Considerable Hellenic remains have been discovered at the small village of Lefta, which occupies the site of Elatea.

ELATERIUM (ἐλαύνειν, *to stimulate*), a drastic purgative medicine, prepared from the wild cucumber. It is chiefly used in the treatment of dropsy.

ELATH, a city of Idumæa. See AKABAH.

ELBA, called ILVA by the Romans, and ÆTHALIA by the Greeks, an island in the Mediterranean Sea lying off the promontory of Populonium, at about equal distances from Corsica and the Italian mainland, though somewhat nearer the latter. Its outline is extremely irregular, and its sides are indented by numerous inlets and arms of the sea, reducing its breadth in some places to about 3 miles. The extreme length of the island is about 18 miles; its extreme breadth about 12 miles; and its area about 150 miles. The whole length of the island is occupied by a mountain range, one peak of which (that of Capanna) rises to the height of about 3500 feet above the sea. The mountains of this range, though themselves barren, inclose valleys of considerable fertility. Vines, olives, and mulberries, grow in large quantities in the island, which also produces wheat, Indian corn, and vegetables in abundance. Some of the wine produced in Elba is of excellent quality, and a considerable quantity of it is annually exported. The smaller domestic animals thrive well and are very numerous in the island; but the larger kinds, such as oxen and horses, are somewhat scarce. The fisheries off the coast are important.

The iron mines of Elba in modern as in ancient times are extremely valuable. The great facility with which the metal is worked, and the abundance in which it is found, render these mines among the most valuable of their kind in the world. The ore is dug from a hill, 500 feet high and nearly 2 miles in circumference, which is itself almost entirely one mass of ore. When smelted, it is found to contain on an average about 60 per cent. of pure iron. Fuel on the island is very scarce; and the ore is consequently conveyed on shipboard to the adjoining mainland to be smelted. The total quantity of iron ore annually extracted amounts to nearly 20,000 tons, giving employment to 130 miners. The salt mines of Elba are hardly inferior in celebrity to the iron ones. About 4,000,000 lbs. are annually produced, giving employment to about 100 workmen. Besides Porto Ferrajo, the capital, and the town of Porto Longone, Elba contains no town of any size or importance. Campo, Capo Liveri, Marciana, and Rio are mere villages or fishing stations. In ancient history the name of Elba very rarely occurs; and in modern times it is chiefly memorable as having been the residence of the Emperor Napoleon after his first abdication from May 1814 till February 1815. From that time till the present Elba has been an appanage of the grand duchy of Tuscany. Pop. (1854) 21,559.

ELBE (the *Albis* of the ancients), a large river of Germany, which rises in the *Riesen Gebirge*, or Giant's Mountains, between Silesia and Bohemia, and is known at its source by the Sclavonic name of the *Labbe*. Its principal sources are the White Fountain, at the base of the *Schnee-Kuppe*, and the eleven fountains of the Elbe in the Navarian meadow. To the number of streams which descend into Bohemia from the neighbouring mountains it owes its early increase. After its junction with the river Eger, it becomes navigable; and, entering Saxony, it passes successively Dresden, Meissen, Torgau, and Wittenberg. In its course, which is northerly, it receives as tributaries the Muldau and the Saale; and running through the territory of Magdeburg and the dúchies of Mecklenburg and Launburg, it discharges itself at last into the German Ocean, about 70 miles below Hamburg, after a course of 500 miles. The Elbe has always been an important river in a military point of view. With respect to commerce, it is of inestimable value to the countries of N.W. and central Germany, being the channel by which they export their surplus products and receive their imports from abroad. It gives to Hamburg its command of the navigation far into the interior, although the voyage is difficult on account of the numerous sand-banks with which the estuary and the rivers are encumbered. It communicates with the Havel by the canal of Plauen, in the territory of Magdeburg; and at Hamburg it is connected in like manner with the Trave at Lubeck. It is also joined to the Weser by a canal running between Vegesak and Stade. By the railway from Leitmeritz to Vienna it communicates with the Danube; and the other railways that touch upon other quarters of the river supply channels for distributing merchandise through the various districts which they traverse.

About 40 miles from its source, the elevation of the river above the level of the sea is only 658 feet; at Schandau it is 341 feet; at Dresden, 279 feet; and at Arneburg in Brandenburg only 176 feet.

Formerly 3 entrepots (Pirna, Dresden, and Magdeburg) and 35 tolls, and numerous corporations of privileged watermen, opposed almost insurmountable difficulties to the navigation: the Austrians and the Saxons could alone navigate the Upper Elbe, that is, from Magdeburg to where it ceases to be navigable, and the Prussians and Hamburgers had the sole privilege of navigating the Lower Elbe. But the navigation of the river was definitively regulated by a convention concluded on the 13th June 1821, between all the bordering states, viz., Austria, Saxony, Prussia, Hanover, Denmark (for Holstein and Lauenburg), the grand duchy of Mecklenburg-Schweren, and the three principalities of Anhalt. This convention established the principle of free navigation, allowing every merchant, to whatever bordering state he might belong, with his own vessel and crew to navigate the whole course of the river without interruption; the 35 tolls were reduced to 14; the heavy dues which were levied upon goods of the first necessity were reduced to those which are paid, one for the cargo (*Elbe Toll*), and the other for the ship (*Recognitionsgebühr*); and each state was bound to watch over the portion of river which passed through their territories, and to preserve it from everything injurious to the commerce or navigation. But notwithstanding these regulations, merchants are still exposed to vexatious burdens and interruptions. Wood, stones, fruits, and earthenware, are the principal articles that are brought down the Elbe. Corn, salt, and colonial produce are the principal articles which are carried up, and on these the greater part of the duties are levied.

Numerous steam-boats now traverse the Elbe, and communicate between that river and London, Rotterdam, Havre, &c.

ELBERFELD, a large manufacturing town of Rhenish Prussia, in the government of Düsseldorf, and 19 miles E. of the town of that name. It is situated in a narrow valley on both sides of the Wapper, and on the Düsseldorf and Dortmund railway. The town is long and straggling, with streets irregular and narrow, and altogether it has a very dirty and unprepossessing appearance. The river too being the receptacle of all the sewers, and the refuse of the dye-works and factories, instead of improving the appearance, adds to the unseemliness of the town. Some of the newer parts of the town, however, are to be excepted from this general description. The town-hall and the new Roman Catholic church are the handsomest buildings in the place. It has numerous educational institutions—among which are the gymnasium and the trade school (*Gewerbschule*),—a general infirmary, two orphan asylums, museum, and library. Elberfeld may be said to have taken its rise almost within the present century. In 1817 its population was only 15,681, while in 1851 it amounted to 39,944. It is at present one of

the first manufacturing and commercial towns in Germany. The great articles of manufacture are silks and cottons, but linen and woollen goods are also made. There are also extensive bleachfields and dye-works. For the dyeing of Turkey red Elberfeld stands unrivalled; and large quantities of yarn are annually sent from Glasgow and other places in the United Kingdom to be dyed, and are again imported to be wrought up.

ELBEUF or Elbœuf, a large manufacturing town of France, in the department of Seine-Inferieure, on the left bank of the Seine, 12 miles S.S.W. of Rouen. The town is generally ill-built, although many improvements have recently been made. The only public buildings worthy of notice are the churches of St Etienne and St Jean-Baptiste; in the latter of which is a stained glass window, presented by the cloth manufacturers of the town about the year 1466, and representing various implements of their craft. Elbeuf has been long celebrated for its woollen manufactures, and is at present the chief seat of that branch of industry in France. Pop. 16,010; more than two-thirds of whom, and also about 2000 of the inhabitants of neighbouring communes, are employed in the manufactures.

ELBING, a fortified seaport-town in the Prussian province of Prussia, government of Danzig, and capital of a cognominal circle on the Elbing, 4 miles from where it flows into the Frische Haff, and 36 miles E.S.E. of Danzig. Pop. (1849) 21,637. The town is surrounded by old walls flanked with towers, and by ditches. It is divided into an old and new town, and has seven gates and eleven suburbs. In the old town the streets are narrow and the houses lofty, but the new town is generally well-built. Elbing has a Roman Catholic, a Calvinist, and five Lutheran churches, a synagogue, six hospitals, orphan and other asylums, a gymnasium, and a library. This town is indebted to Richard Cowle, an Englishman who lived there for some time previous to 1820, for several of its charitable institutions, among which is a school of industry for the maintenance of 400 children. Elbing was founded about the year 1237, and formerly was one of the most important members of the Hanseatic League. It was united to the Prussian dominions in 1772. The chief manufactures are sail-cloth, leather, tobacco, soap, oil, vitriol, pearl ash, starch, chicory, refined sugar, and woollen cloth. The trade is very considerable; but only small vessels can come up to the town, larger ones being obliged to discharge their cargoes at Pillau, at the mouth of the Frische Haff.

ELCESAITES, a Jewish-Gnostic sect who branched off from the Essenes about the time of Trajan. They seem to have derived their name from Elcesai their founder. In their creed they confounded Judaism, Paganism, and Christianity. They rejected the Pentateuch and the Pauline Epistles. They believed their founder had the power of forgiving sin, and observed the Old Testament ceremonial. In the second century they were blended with the Ebionites.

ELCHE, the ancient *Ilici*, a town of Spain, province of Alicante, and 13 miles S.W. of the town of that name. Pop. 15,649. The town, which has a very oriental appearance, being built in the Moorish style, is surrounded by walls, and divided by a ravine over which there is a handsome bridge. The principal church is a fine edifice, surmounted by a majestic dome. There is a magnificent old castle belonging to the Duke of Arcos, on whose estate the town is built. Elche has manufactures of coarse linen and cotton goods. The town is surrounded on all sides by extensive plantations of date palms, the fruit of which constitutes its chief article of export, and is shipped from Alicante as Barbary dates. This is the birthplace of Don George Juan, the travelling companion of Ulloa in South America.

ELCHINGEN, a small village of Bavaria, on the N. bank of the Danube, 7 miles N.W. from Ulm. Here the French under Ney (Oct. 14, 1805) succeeded in forcing the Austrian position; for which service Ney was rewarded with the title of Duke of Elchingen.

ELDER, a title of office among the Jews, first applied to the seventy who assisted Moses in the government. In the New Testament it is equivalent to the term presbyter, and is applied to the highest ecclesiastical office-bearers under the apostles. In Presbyterian churches, elders are of two classes, viz., those who only rule in the church, and those who teach as well as rule. In popular phraseology the term elder is applied only to the former class. See Presbyterians.

ELDORADO (Span. *the Golden Region*), the name given by Orellana, the lieutenant of Pizarro, to a region which he pretended to have discovered in South America, and which he thus named on account of the immense treasures of gold and precious stones he asserted that he had seen at Manoa, the capital of the country. From this fiction, the word Eldorado has become a proverbial term for a region of boundless wealth and felicity, like the Elysium of the ancients, or the paradise of Mohammed.

ELEAZAR, the eldest son of Aaron. He succeeded his father in the high-priesthood, and held the pontificate during the military government of Joshua. This was also the name of one of the Maccabæan brothers, who was crushed to death by the fall of an elephant which he had stabbed in the belief that it carried Antiochus Eupator.

ELEATIC Philosophy, among the ancients, a name given to that of the Stoics, because it was taught at Ἐλέα, (in Latin *Velia*), a town of Lucania.

The founder of this philosophy, or of the Eleatic sect, is supposed to have been Xenophanes, who flourished between B.C. 540 and 500. This sect was divided into two parties, which may be denominated *metaphysical* and *physical*, the one rejecting and the other approving the appeal to fact and experiment. Of the former persuasion were Xenophanes, Parmenides, Melissus, and Zeno of Elea. They are supposed to have maintained principles not very unlike those of Spinoza: they held the eternity and immutability of the world; that whatever existed was only one being; that there was neither generation nor corruption; that this one being was immoveable and immutable, and was God; and that whatever changes seemed to happen in the universe were to be looked upon as mere appearances and illusions of sense. However, it is supposed by some that Xenophanes and his followers, speaking metaphysically, understood by the universe, or the one being, not the material world, but the great originating principle of all things, or the true God, whom they expressly affirm to be incorporeal. Thus Simplicius represents them as merely metaphysical writers who distinguished between things natural and supernatural, and who supposed the former to be compounded of different principles. Accordingly, Xenophanes maintained that the earth consisted of air and fire; that all things were produced from the earth; that the sun and stars sprung from clouds; and that there were four elements. Parmenides also distinguished between the doctrine concerning metaphysical objects, called *truth*, and that concerning physical or corporeal things, called *opinion*. With respect to the former, there was one immoveable principle; but in the latter, two that were moveable, namely, fire and earth, or heat and cold: and in these particulars Zeno agreed with him. The other branch of the Eleatic sect, the Atomic philosophers, formed their system from observing the phenomena of nature: of these the most considerable were Leucippus, Democritus, and Protagoras.

ELECAMPANE, (*Inula Helenium*, Lin.) a perennial plant of a bitter aromatic taste; formerly much used as an expectorant.

ELECTION, in British polity. See Parliament.

ELECTIVE Affinity. See Chemistry.

ELECTRICITY.

Introduction.

Electricity, from the Greek word ηλεκτρον,[1] *electron, amber*, is the name given to a modern science which treats of the phenomena and effects produced by the friction of amber, and other bodies which possess analogous properties.

The science of Electricity, in its most general acceptation, may be divided into four different branches, viz.

I. *Ordinary Electricity*, or that which is developed by friction.

II. *Galvanism*, or that which is produced by chemical action.

III. *Magneto-Electricity*, or that which is developed by magnets; and

IV. *Thermo-Electricity*, or that which is developed by heat.

Under these four articles we shall be able, not only to give a perspicuous and condensed view of those splendid discoveries which have illustrated the present age, but to render our account of them much more complete than if we had treated the subject under the titles of *Electro-magnetism* and *Galvanism*, which occur so early in our alphabetical arrangement.

In giving a succinct and popular view of the science of *Electricity* in the ordinary acceptation of the word, the subject naturally divides itself into two parts: 1*st*, On the phenomena and laws of electricity; and, 2*dly*, on the instruments and apparatus used in electrical experiments. Before we proceed, however, to these topics, we shall give a brief history of the origin and progress of the science.

HISTORY OF ELECTRICITY.

Thales, B. C. 600.

The name of the philosopher who first observed that amber when rubbed possesses the property of attracting and repelling light bodies has not been handed down to our times. Thales of Miletus is said to have described this remarkable property, and both Theophrastus (B. C. 321) and Pliny (A. D. 70) mention the power of amber to attract *straws* and *dry leaves*. The same authors speak of the *lapis lyncurius*, which is supposed to be a mineral called *tourmaline*, as possessing the same property.

Animal electricity.

The electricity of the torpedo was also known to the ancients. Pliny informs us, that when touched by a spear it paralyses the muscles and arrests the feet, however swift; and Aristotle adds that it possesses the power of benumbing men, as well as the fishes which serve for its prey. The influence of electricity on the human body, and the electricity of the human body itself, were also known in ancient times. Anthero, a freedman of Tiberius, was cured of the gout by the shocks of the torpedo; and Wolimer, the king of the Goths, was able to emit sparks from his own body.

A. D. 415.

Eustathius, who records this fact, also states that a certain philosopher, while dressing and undressing, emitted occasionally sudden crackling sparks, while at other times flames blazed from him without burning his clothes.

Such are the scanty gleanings of electrical knowledge which we derive from the ancient philosophy; and though several writers of the middle ages have made occasional references to these facts, and even attempted to speculate upon them, yet they added nothing to the science, and left an open field for the researches of modern philosophers.

History.

Gilbert, A. D. 1600.

Our countryman Dr Gilbert of Colchester may therefore be considered as the founder of the science of electricity, as he appears to have been the first philosopher who carefully repeated the observations of the ancients, and applied to them the principles of philosophical investigation. In order to determine if other bodies possessed the same property as amber, he balanced a light metallic needle on a pivot, and observed whether or not it was affected by causing the excited or rubbed body to approach to it. In this way he discovered that the following bodies possess the property of attracting light substances: Amber, gugates or jet, diamond, sapphire, carbuncle, rock crystal, opal, amethyst, vincentina or Bristol stone, beryl, crystal, paste for false gems, glass of antimony, flags, belemnites, sulphur, gum-mastic, sealing-wax of lac, hard resin, arsenic, sal gem, mica, and alum.

These various bodies attracted, with different degrees of force, not only straws and light films, but likewise metals, stones, earths, wood, leaves, thick smoke, and all solid and fluid bodies. Among the substances which are not excited by friction, Gilbert enumerated emerald, agate, carnelian, pearls, jasper, chalcedony, alabaster, porphyry, coral, marble, Lydian stone, flints, hæmatites, mugris (*emery* or *corundum*), bones, ivory, hard woods, such as cedar, ebony, juniper, and cypress, metals and natural magnets.

Having thus determined the bodies which were capable, as well as those which were incapable, of electrical excitation, Dr Gilbert was desirous of ascertaining the circumstances which were most favourable to the production of electricity. When the wind blew from the north and east, and when the air was dry, the body was excited in about ten minutes after the friction commenced; but when the wind was in the south, and the air moist, the attractive power of the body was greatly diminished, and in some cases it could not be excited at all.

Boyle, A. D. 1675.

The celebrated Mr Boyle added many new facts to the science of electricity, and he has given a full account of them in his *Experiments on the Origin of Electricity*. By means of a suspended needle, he discovered that amber retained its attractive virtue after the friction which excited it had ceased; and though smoothness of surface had been regarded as advantageous for excitation, yet he found a diamond which in its rough state exceeded all the polished ones and all the electrics which he had tried, having been able to move a needle three minutes after he had ceased to rub it. He found also that heat and *tersion* (or the cleaning or wiping of any body) increased its susceptibility of excitation; and that if the attracted body were fixed, and the attracting body moveable, their mutual approach would still take place. To Dr Gilbert's list of electrics Mr Boyle added the resinous cake which remained after evaporating one fourth part of good oil of turpentine; the dry mass which remains after distilling a mixture of petroleum and strong spirit of nitre, glass of antimony, glass of lead, caput mortuum of amber, white sapphire, white amethyst, diaphanous ore of lead, carnelian, and a green stone supposed to be a sapphire.

Otto Guericke, born 1602, died 1686.

To these discoveries of Mr Boyle, his illustrious contemporary Otto Guericke added the highly important one of *electric light*. Having cast a globe of sulphur in a glass sphere, the glass was broken, and the sulphur ball mounted upon a revolving axis, and excited by the friction of

[1] According to Salmasius, the word *karabe*, the Arabian word for *amber*, signifies the power of attracting straws. May not ηλεκτρον (ελκετριανος λιθος) come from ελκω, to *draw* or *attract*, and θριξ-τριχος, a *hair* or *filament*, or θριον, a leaf?

History. the hand. By this means he discovered that light and sound accompanied strong electrical excitation, and he compares the light to that which is exhibited by breaking lump sugar in the dark. With this powerful apparatus Guericke verified on a greater scale the results obtained by his predecessors, and obtained several new ones of very considerable importance. He found that a light body, when once attracted by an excited electric, was repelled by it, and was incapable of a second attraction until it had been touched by some other body; and that light bodies suspended within the sphere of influence of an excited electric, possessed the same properties as if they had been excited.

Newton, born 1642, died 1727. To our illustrious countryman Sir Isaac Newton the science of electricity owes some important observations. He seems to have been the first person who constructed an electrical machine of glass. "A globe of glass," says he, "about eight or ten inches in diameter, being put into a frame where it may be swiftly turned round its axis, will in turning shine when it rubs against the palm of one's hand applied to it; and if at the same time a piece of white paper or a white cloth, or the end of one's finger, be held at the distance of about a quarter of an inch or half an inch from that part of the glass when it is most in motion, the electric vapour which is excited by the friction of the glass against the hand will, by dashing against the white paper, cloth, or finger, be put into such an agitation as to emit light, and make the white paper, cloth, or finger, appear lurid like a glow-worm, and in rushing out of the glass will sometimes push against the finger so as to be felt. And the same things have been found by rubbing a long and large cylinder of glass and amber with a paper held in one's hand, and continuing the friction till the glass grew warm."[1] We owe also to Sir Isaac a beautiful experiment on the excitation of electricity on the side of a disc of glass opposite to the side which was rubbed. Having fixed a round disc of glass at the distance of one third of an inch from one end of a brass hoop or ring, and one eighth of an inch from another, he placed small pieces of thin paper within the brass ring and upon a table, so that the lower surface of the glass was one eighth of an inch distant from the table. He then rubbed the upper surface of the glass, and he observed the pieces of paper "leap from one part of the glass to the other, and twirl about in the air." Upon sliding his finger upon the upper side of the glass, he also observed that the pieces of paper, as they hung under the glass, inclined this way or that according as he moved his finger. The Royal Society had ordered this experiment to be tried at their meeting of the 16th December 1675; and, in order to ensure its success, had obtained the above account of it from Sir Isaac. The experiment however failed, and the secretary requested the loan of Sir Isaac's apparatus, and inquired whether or not he had secured the papers from being moved by the air which might have somewhere stolen in. In Sir Isaac's reply, dated 21st December, he recommended them to rub the glass "with stuff whose threads may rake its surface, and if that will not do, to rub it with the finger ends to and fro, and knock them as often upon the glass." By means of these directions, the society succeeded with the experiment on the 13th January 1676, when they used "a scrubbing brush of short hog's bristles, and the heft of a knife made with whalebone."[2]

Hawksbee, A. D. 1705. Mr Francis Hawksbee, one of the most active and ingenious experimental philosophers of his age, added many new facts to the science. In 1705 he communicated to the Royal Society several curious experiments on what he calls "the mercurial phosphorus." He showed that light could be produced by passing common air through mercury placed in a well-exhausted receiver. The air rushing through the mercury, blew it up against the sides of the glass that held it, "appearing all around like a body of fire, consisting of abundance of glowing globules." The phenomenon continued till the receiver was half full of air. When the mercury was made to descend in vacuo from the top to the bottom of a receiver about twenty-one inches high, it fell in minute particles, "like a shower of fire, in a very surprising manner." In repeating this experiment with about three pounds of mercury, and making it break into a shower by dashing it against the crown of another glass vessel, *flashes resembling lightning*, of a very pale colour, and very distinguishable from the rest of the produced light, were dashed from the crown of the glass, sometimes horizontally, and at other times upwards and downwards Mr Hawksbee likewise showed that considerable light may be produced from mercury, by giving it motion before the receiver was quite exhausted; and that even in the open air "abundance of particles of light are discoverable by shaking quicksilver in a glass."

In a subsequent series of experiments on the attraction of bodies in vacuo, he showed that light was generated by the swift attrition of amber on woollen; that a purple light was produced by the attrition of glass on woollen; and that a considerable light was developed by the attrition of glass on glass in vacuo, and in common air, or under water. During the attrition of glass on woollen, Hawksbee "observed the light to break from the agitated glass *in as strange a form as lightning*," particularly when he used some list of cloth that had been drenched in spirit of wine. In all these experiments Hawksbee was not aware that the light which he observed was that of electricity.

Like Sir Isaac Newton, Hawksbee used a glass globe capable of revolving in a wooden frame, and by its assistance he made a great number of experiments, which are not sufficiently important to be given in detail. The following experiment, however, is too interesting to be omitted. Having coated more than one half of the inside of a glass globe with sealing wax, which in some places was an eighth of an inch thick, and therefore absolutely opaque, he exhausted it and put it in motion. When his hand was applied to excite it, the form of his hand was distinctly seen in the concave surface of the wax, as if it had become transparent. The same result was obtained when pitch or common brimstone was substituted in place of sealing-wax.

We have already seen that Hawksbee observed the resemblance between the electric spark and lightning. Dr Wall went a step farther, and compared the crackling and the flash of excited amber to thunder and lightning. The crackling he found to be fully as loud as that of charcoal on fire when the finger was held at a little distance from the amber after it had been drawn gently and slightly through a piece of woollen cloth.

Mr Stephen Gray, 1720-1736. One of the most ardent experimentalists of the present time was Mr Stephen Gray, a fellow of the Royal Society. In his first paper, published in 1720, he showed that electricity could be excited by the friction of feathers, hair, silk, linen, woollen, paper, leather, wood, parchment, and gold-beaters' skin. Several of these bodies exhibited light in the dark, especially after they had been warmed; but all of them attracted light bodies, and sometimes at the distance of eight or ten inches.

The communication of electricity to bodies not capable

[1] *Optics*, query 8th.

[2] Brewster's *Life of Sir Isaac Newton*, p. 307, 308.

History. Dr Wall, A. D. 1708.

of excitation was the next discovery of Mr Gray. An ivory ball, and various other substances of a metallic, animal, and vegetable nature, were made to attract light bodies by connecting them with strings, wires, or pieces of wood, with one extremity of an excited glass tube; and by suspending pack-threads of different lengths with silken threads, he was able to transmit the electrical influence in any direction to distances of 50, 147, 293, and finally 765 and 886 feet.

In order to determine if the electric attraction is proportioned to the quantity of matter in bodies, Mr Gray and Mr White made two cubes of oak about six inches square, the one solid and the other hollow. When suspended by hair lines, and similarly electrified by an excited glass tube, both the cubes attracted and repelled leaf brass at the same time and to the same height. Hence Mr Gray concluded *that it was the surface of the cubes only which attracted.*

The conducting powers of fluids and of the human body were next ascertained by Mr Gray. Having blown a soap bubble with an electrified tobacco pipe, he found that the lower part of the bubble attracted small pieces of Dutch metal; and when a boy eight or nine years old, and weighing 47 lbs., was suspended upon hair lines, he found that every part of his body exercised a strong electrical action upon light bodies, and hence he concluded "that animals receive a greater quantity of electrical effluvia." When an excited tube was held above water or quicksilver placed in little ivory dishes, the fluid was attracted upwards into little conical mounds, accompanied with a snapping noise and a discharge of light from their summit. In sunshine small particles of water rose from the top of the fluid cone, and sometimes a fine stream of water like a fountain, from which there arose a fine steam or vapour. Hot water was attracted much more powerfully, and at a much greater distance, and the steam was more distinctly visible. Mercury did not rise so high as the water; but the snapping noise was louder, and continued much longer, than when water was employed.

Mr Gray now set himself to discover "whether there might not be a way found to make the property of electrical attraction more permanent in bodies." Having procured iron ladles of several sizes, he melted the substances given in the following table. They were then set by in the ladle to cool and harden, and afterwards being replaced on the fire so as to allow what was next the bottom and sides of the ladle to melt, the ladle was inverted, and the substance taken out. These bodies at first would not attract light substances till their temperature was nearly that of a hen's egg; but when cold they attracted ten times farther than at first. In order to preserve these bodies in a state of attraction, he wrapped them up in flannel or white paper or black worsted stockings, and then put them into a large fir box till they were used. The following is Mr Gray's list of the electrics thus formed:—

Names.	Weight Avoird. oz.	oz.	Time when made.
Fine black rosin	2	0	Jan. 31.
Stone pitch, and black rosin	2	2	Jan. 31.
Fine rosin and bees' wax	2	1	Feb. 1.
Stone pitch	1	7	Feb. 1.
Stone sulphur	3	6	Feb. 4.
Shell lack	10	0	Feb. 10.
Fine black rosin	10	4	Feb. 10.
Bees' wax and rosin	9	0	Feb. 12.
Rosin 4, gum lac 1 part	10	0	Feb. 12.
Sulphur	18	0	Feb. 15.
Stone pitch	10	12	Feb. 16.
Black rosin	23	0	Feb. 23.
White rosin	7	12	Feb. 25.
Gum-lac.	11	14	Feb. 26.
Gum-lac and black rosin	9	12	Feb. 26.
Gum-lac 4, rosin 1 part	17	8	Feb. 28.
Gum-lac, fine black rosin	28	4	March 2.
Cylinder of blue sulphur	19	4	March 20.
Large cone of ditto	30	0	March 29.
Cake of sulphur	11	4	April 29.

M. Dufay, A. D. 1733.

Mr Gray continued for thirty days to observe every one of these bodies, and at the end of that time he found that they attracted as vigorously as at the first or second day, and some of them continued to preserve their attraction for more than four months.

While Mr Gray was pursuing his career of discovery in England, M. Dufay, of the Academy of Sciences, and superintendent of the Royal Botanic Gardens, was actively employed in the same researches. He found that all bodies, whether solid or fluid, could be electrified by an excited tube, by setting them on a glass stand slightly warmed, or only dried; and that those bodies which are in themselves least electrical, received the greatest degree of electricity from the approach of the glass tube. He found that electricity was transmitted more easily along packthread when it was wetted, and that it might be supported upon glass tubes in place of silk lines; and in this way he conveyed it along a string 1256 feet long.

M. Dufay repeated Mr Gray's experiments on the human body, by suspending a child on silken strings; but having suspended himself in a similar manner, he discovered that an electrical spark, accompanied with a crackling noise, took place when any other person touched him, and he has described the prickling sensation like the burning from a spark of fire, which is at the same time felt either through the clothes or on the skin. He found that the same effects took place in other living animals; but that if the carcass of an animal was suspended, there were no snippings or sparks, but merely a still uniform light observed in the dark.

Vitreous and resinous electricity.

The great discovery of M. Dufay, however, was that of two different kinds of electricity, to which he gave the name of *vitreous* and *resinous*, and the importance of which he did not fail to recognise. He has given the name of *vitreous* electricity to that which is produced by exciting *glass*, rock crystal, precious stones, hair of animals, wool, and many other bodies; and the name of *resinous* to that which is produced by exciting resinous bodies, such as amber, copal, gum-lac, silk, paper, thread, and a number of other substances. The characteristic of those two electricities was, that a body with *vitreous electricity* attracted all bodies with *resinous electricity*, and repelled all bodies with *vitreous electricity;* while a body with *resinous electricity* attracted all bodies with *vitreous electricity*, and repelled all bodies with *resinous electricity.* Two electrified silk threads, for example, repel each other, and also two electrified woollen threads, but an electrified silk thread will attract an electrified woollen thread. Hence it is easy to determine whether any body possesses vitreous or resinous electricity. If it *attracts* an electrified silk thread, its electricity will be vitreous; if it *repels* it, it will be resinous. This important discovery seems to have been made about the same time by Mr White, by a series of independent observations.

History.

Mr Gray repeated and varied the experiments of M. Dufay, and made many new ones, which our limited space will not permit us to detail. Like Hawksbee and Dr Wall, he recognised the similarity between the phenomena of electricity and those of thunder and lightning; and he expresses a hope "that there may be found out a way to collect a greater quantity of electric fire, and consequently to increase the force of that power, which, by several of these experiments, *si licet magnis componere parva*, seems to be *of the same nature with thunder and lightning*."

Labours of continental philosophers.

The discoveries which we have now recounted began to rouse the activity of the German and Dutch philosophers. To the electrical machine used by Newton and Hawksbee, Professor Boze of Wittemberg added the *prime* conductor, which at first consisted of an iron or tin tube supported by a man standing upon cakes of rosin; but it was afterwards suspended by silken strings. Professor Winkler of Leipsic substituted the *cushion* in place of the hand for exciting the revolving globe; and Professor Gordon of Erfurt, a Scotch Benedictine monk, first used a glass cylinder, eight inches long and four broad, which he caused to revolve by means of a bow and string. By these means electrical sparks of great size and intensity were produced, and by their aid various combustible substances, both fluid and solid, were inflamed. In 1744 M. Ludolph of Berlin succeeded in firing, by the electrical spark, the ethereal spirit of Frobenius. Winkler did the same by a spark from his finger; and he succeeded in inflaming French brandy and other weaker spirits after they had been heated. Mr Gordon kindled spirits by a jet of electrified water. Dr Miles inflamed phosphorus by the electric spark; and oil, pitch, and sealing-wax, when strongly heated, were set on fire by similar means.

Leyden phial, 1745.

These striking effects were all produced by the electricity obtained immediately from an excited electric; but a great step was now made in the science by the discovery of a method of accumulating and preserving the electric fluid in large quantities. The author of this great invention is not distinctly known; but there is reason to believe that a monk of the name of Kleist, a person of the name of Cuneus, and Professor Muschenbroeck of Leyden, had each the merit of an independent inventor. The invention by which this accumulation was effected was called the *Leyden Jar* or *Phial*, because it was principally in that city where it was either invented or tried. Having observed that excited electrics soon lost their electricity in the open air, and that their loss was accelerated when the atmosphere was charged with moisture or other conducting materials, Muschenbroeck conceived that the electricity of bodies might be retained by surrounding them with bodies which did not conduct it. In putting this idea to the test of experiment, they electrified some water in a glass bottle, and a communication having been made between the water and the prime conductor, while the bottle was held by an assistant, who was trying to disengage the communicating wire, he received a sudden shock in his arms and breast, and thus established the efficacy of the Leyden jar.

Sir William Watson.

Sir William Watson made some important experiments at this period of our history. He succeeded in firing gunpowder by the electric spark; and by mixing the gunpowder with a little camphor he discharged a musket by the same power. He also fired inflammable air by the electric spark; and he kindled both spirits of wine and inflammable air by means of a drop of cold water, and even with ice. In the German experiments the fluid or solid to be inflamed was set on fire by an electrified body; but Sir William Watson placed the fluid in the hands of an electrified person, and set it on fire by causing a person not electrified to touch it with his finger.

Sir William Watson first observed the flash of light which attends the discharge of the Leyden phial, and it is to him that we owe the present improved form of the Leyden phial, in which it is coated both without and within with tinfoil. Dr Bevis indeed had suggested the outside coating, and, at Mr Smeaton's recommendation, he coated a pane of glass on both sides, and within an inch of the edge, with tinfoil; but still the idea of coating the jar doubly belongs to Sir William Watson.

Experiments of the Royal Society of London.

A party of the Royal Society, with the president at their head, and Sir William Watson as their chief operator, entered upon a series of magnificent experiments, for the purpose of determining the velocity of the electric fluid, and the distance to which it could be conveyed. The French sçavans had conveyed the influence of the Leyden jar through a circuit of 12,000 feet; and in one case the basin at the Thuilleries, containing about an acre of water, formed part of the circuit; but the English philosophers made a more complete series of experiments, of which the following were the results:

1. That in all their operations, when the wires have been properly conducted, the electrical commotions from the charged phial have been very considerable only when the observers at the extremities of the wire have touched some substance readily conducting electricity with some part of their bodies.

2. That the electrical commotion is always felt most sensibly in those parts of the bodies of the observers which are between the conducting wires and the nearest and the most non-electric substance; or, in other words, so much of their bodies as comes within the electrical circuit.

3. That on these considerations we infer that the electrical power is conducted between these observers by any non-electric substances which happen to be situated between them, and contribute to form the electrical circuit.

4. That the electrical commotion has been perceptible to two or more observers at considerable distances from each other, even as far as two miles.

5. That when the observers have been shocked at the end of two miles of wire, we infer that the electrical circuit is four miles, viz. two miles of wire, and the space of two miles of the non-electric matter between the observers, whether it be water, earth, or both.

6. That the electrical commotion is equally strong, whether it is conducted by water or dry ground.

7. That if the wires between the electrifying machine and the observers are conducted on dry sticks, or other substances non-electric in a slight degree only, the effects of the electrical power are much greater than when the wires in their progress touch the ground, or moist vegetables, or other substances in a great degree non-electric.

8. That by comparing the respective velocities of electricity and sound, that of electricity, in any of the distances yet experienced, is nearly instantaneous.

In the following year these experiments were resumed with the view of ascertaining the absolute velocity of electricity at a certain distance, and it was found, "that through the whole length of a wire 12,276 feet, the velocity of electricity was instantaneous."

One of the most important discoveries of the present period was that of Sir W. Watson, who proved "that the glass tubes and globes had not the electrical power in themselves, but only served as the first movers or determiners of that power." In rubbing a glass tube while standing upon a cake of wax, he was surprised to observe that no spark could be obtained from his body by any other person touching any part of him. But if a person not electrified held his hand near the tube while it was rubbing, the snapping was very sensible. The great discovery of

plus and *minus* electricity which was afterwards made by Franklin, was distinctly announced by Sir W. Watson. He lays it down as a law, that in electrical operations there is an afflux of electric fluid to the globe and the conductor, and also an efflux of the same matter from them. In the case of two insulated persons, the one in contact with the rubber and the other with the conductor, he observed that either of them would communicate *a much stronger spark to the other than to any bystander. The electricity of the one*, he says, *became more rare than it is naturally, and that of the other more dense*, so that the density of the electricity in the two insulated persons differed more than that between either of them and a bystander.

Our limits will not permit us to give a detailed account of the various ingenious experiments which were about this time made by Le Monnier, Nollet, Winckler, Ellicott, Jallabert, Boze, Menon, Smeaton, and Miles. In 1746 Le Monnier confirmed the result previously obtained by Mr Gray, that electricity is communicated to homogeneous bodies in proportion to their surfaces only. M. Boze discovered that capillary tubes which discharged water by drops afforded a continued stream when electrified. The Abbé Nollet ascertained that electricity increases the natural evaporation of fluids, and that the evaporation is hastened by placing them in non-electric vessels. M. Jallabert confirmed the result previously obtained by Watson, that electricity passes through the substance of a conducting wire, and not along its surface. Smeaton found that the red-hot part of an iron bar could be as strongly electrified as the cold parts on each side of it. Dr Miles kindled common lamp spirits by a stick of black sealing-wax excited by dry flannel. Mr Ellicott conceived that the particles of the electric fluid repel each other, while they attract those of all other bodies. Mr Mowbray discovered that the vegetation of two myrtles was hastened by electrifying them; a result which Nollet confirmed in the case of vegetating seeds. The Abbé Menon found that cats, pigeons, sparrows, and chaffinches, lost weight by being electrified for five or six hours, and that the same result was true of the human body; and hence it was concluded that electricity augments the insensible perspiration of animals.

Discoveries of Franklin, A. D. 1747–1760.

Passing over the scientific fables of John Pivati of Venice, we arrive at that auspicious period when Dr Franklin raised electricity to the dignity of a science, and connected it with that tremendous agency which had so often terrified the moral and convulsed the physical world. The thunderbolt had frequently descended from heaven upon its victims; but mortal genius had now learned to bring it down in chains, to disarm its fury, and to convert it into an useful and even a friendly element.

One of the first labours of the American philosopher was to present, in a more distinct form, the theory of plus and minus electricity, which Sir W. Watson had been the first to suggest. He showed that electricity is not created by friction, but merely collected from its state of diffusion through other matter by which it is attracted. He asserted that the glass globe, when rubbed, attracted the electrical fire, and took it from the rubber, the same globe being disposed, when the friction ceases, to give out its electricity to any body which has less. In the case of the charged Leyden jar, the inner coating of tinfoil had received more than its ordinary quantity of electricity, and was therefore electrified *positively* or *plus*, while the outer coating of tinfoil having had its ordinary quantity of electricity diminished, was electrified *negatively* or *minus*. Hence the cause of the shock and spark when the jar is discharged, or when the superabundant plus electricity of the inside is transferred by a conducting body to the defective or minus electricity of the outside. This theory of the Leyden phial Franklin established in the clearest manner, by showing that the outside and the inside coating possessed opposite electricities, and that, in charging it, exactly as much electricity is added on one side as is subtracted from the other. The copious discharge of electricity by points was observed by Franklin in his earliest experiments, and also the power of points to conduct it copiously from an electrified body. Hence he was furnished with a simple method of collecting electricity from other bodies; and he was thus enabled to perform those remarkable experiments which we shall now proceed to explain.

Hawksbee, Wall, and Nollet had successively suggested the similarity between lightning and the electric spark, and between the artificial snap and the natural thunder. Previous to the year 1750 Dr Franklin drew up a statement, in which he showed that all the general phenomena and effects which were produced by electricity had their counterpart in lightning. Like the electric spark, lightning moves in a crooked and irregular direction. Lightning strikes the highest and most pointed bodies, and electricity does the same. They both inflame combustibles, fuse metals, destroy animal life, produce blindness in animals, render common sewing needles magnetic, and reverse the polarity of needles that have been magnetised. Notwithstanding these points of resemblance, direct experiment was still necessary to establish his views. He waited anxiously for the erection of a spire at Philadelphia, by means of which he might bring down the electricity of a thunder-storm; but his patience being exhausted, he conceived the idea of sending up a kite among the clouds themselves. With this view he made a small cross of two light strips of cedar, the arms being sufficiently long to reach to the four corners of a large thin silk handkerchief when extended. The corners of the handkerchief were tied to the extremities of the cross, and when the body of the kite was thus formed, a tail, loop, and string were added to it. The body was made of silk to enable it to bear the violence and wet of a thunder-storm. A very sharp pointed wire was fixed at the top of the upright stick of the cross, so as to rise a foot or more above the wood. A silk ribband was tied to the end of the twine next the hand, and a key suspended at the junction of the twine and silk. In company with his son, Franklin raised the kite like a common one, in the first thunder-storm, which happened in the month of June 1752. To keep the silk ribband dry, he stood within a door, taking care that the twine did not touch the frame of the door; and when the thunder-clouds came over the kite he watched the state of the string. A cloud passed without any electrical indications, and he began to despair of success. He saw, however, the loose filaments of the twine standing out every way, and he found them to be attracted by the approach of his finger. The suspended key gave a spark on the application of his knuckle, and when the string had become wet with the rain, the electricity became abundant; a Leyden jar was charged at the key, and by the electric fire thus obtained spirits were inflamed, and all the other electrical experiments performed which had been formerly made by excited electrics. In subsequent trials with another apparatus, he found that the clouds were sometimes positively and sometimes negatively electrified, and thus demonstrated the perfect identity of lightning and electricity.

Having thus succeeded in drawing the electric fire from the clouds, Franklin immediately conceived the idea of protecting buildings from lightning, by erecting on their highest parts pointed iron wires or conductors communicating with the ground. The electricity of a hovering or a passing cloud would thus be carried off slowly and

History.

silently; and if the cloud was highly charged, the electric fire would strike in preference the elevated conductors.

Death of Professor Richman, A. D. 1753.

The attention of European philosophers was now directed to the great discovery of Franklin, and various individuals fearlessly sought to repeat his experiments. Among these Professor Richman of St Petersburg was one of the most enterprising. He had undertaken a series of experiments on the electricity of the atmosphere, and for this purpose he had erected an electrical gnomon, which consisted mainly of a Leyden jar, communicating with an iron rod, which rose four or five feet above the roof of his house, and an electrometer formed of a linen thread with half a grain of lead, the angular ascent of which on the face of a divided quadrant indicated the force of the accumulated electricity. On the 9th August 1752 Professor Richman obtained from the end of the rod electrical flashes which could be heard at several feet of distance; and if any person touched the apparatus, a sharp stroke was felt in the hand and arm. On the 31st May 1753 the electric fire exploded from the apparatus with such a force that it was heard at the distance of three rooms from the apparatus. On the 6th August 1753 the professor had prepared and adjusted his apparatus, and having heard the sound of distant thunder, he left a meeting of the Academy of Sciences, and took with him his engineer, Mr Sokolow, to draw any interesting phenomena that might occur. On their arrival at the professor's house, the plummet of the electrometer was elevated four degrees from the perpendicular; and while the philosopher was describing to his friend the dangerous consequences that might take place if the thread should rise to 45°, a tremendous burst of thunder terrified the imperial city. Richman leant his head over the gnomon to observe the indications of the electrometer, and in this stooping position, with his head a foot from the iron rod, a huge globe of bluish-white fire, about the size of Mr Sokolow's fist, shot from the iron rod to the professor's head, with a report like that of a pistol. The blow was fatal; he fell back upon a chest and instantly expired. Sokolow was stupified and benumbed by a sort of steam or vapour, and the red hot fragments of a metallic wire struck his clothes and covered them with burnt marks. As soon as he recovered from his surprise, Sokolow ran out of the house, acquainting every person with the accident which had taken place. In the mean time Madam Richman, alarmed by the thunder-stroke, hastened to the chamber, and found her husband apparently lifeless, in the attitude of sitting upon the chest, and leaning against the wall. Medical aid was instantly obtained, but though a vein was opened, from which no blood would flow, and though every attempt was made to restore life by violent friction and other means, they were all fruitless. A small quantity of blood dropped from the mouth when the body was turned, and on the forehead there was a red spot, from the pores of which a few drops of blood oozed out. Several red and blue spots, like leather shrunk by burning, were found on the left side, the back, and other parts of the body. The shoe upon the Professor's left foot was burst open, and a blue mark appeared on the foot beneath the aperture. There was no corresponding hole in the stocking, and the coat was uninjured. When the body was opened, twenty-four hours after death, there was no appearance of injury either in the brain or the cranium: a little extravasated blood appeared in the cavities below the lungs, and in the lungs towards the back, which were of a dark brown colour. The heart, glands, and smaller intestines, were all inflamed; but the entrails were uninjured. About seventy rubles of silver which were in the left coat pocket were not altered by the electric fluid. Immediately after the accident the house was filled with a sulphureous vapour. A clock which stood in the corner of the adjoining room was stopped; the ashes from the hearth were scattered about the room; the door-case of the room was rent asunder, and a piece of the door itself actually torn off. The Leyden jar was also broken, and the metallic filings which it contained thrown about the room.

Labours of Canton, A. D. 1753.

One of the most active and ingenious labourers in the field of electrical science was our countryman Mr John Canton. Before his time it had been assumed as indisputable that the same kind of electricity was invariably produced by the friction of the same electric; that glass, for example, yielded always *vitreous*, and amber always *resinous* electricity. Having roughened a glass tube by grinding its surface with emery and sheet lead, he found that it possessed vitreous or positive electricity when excited with oiled silk, but *resinous electricity when excited with new flannel.* He found, in short, that vitreous or resinous electricity may be developed at will in the same tube, by altering the surfaces of the tube and the exciting rubber, and according as the one or the other is most affected by their mutual friction. This he illustrated by the very beautiful experiment of removing the polish from one half of the tube. In this case the different electricities were excited with the same rubber at a single stroke, and, what is very curious, *the rubber was found to move much easier over the rough than over the polished half.*

Mr Canton likewise discovered that glass, amber, sealing-wax, and calcareous spar, were all electrified positively when taken out of mercury; and hence he was led to the important practical discovery, that an amalgam of mercury and tin was most efficacious in exciting glass when applied to the surface of the rubber. Mr Canton found also that any body placed within the electric atmosphere of another body acquired the electricity opposite to that of the body in whose atmosphere it was placed; and that the whole air of a room could be electrified either positively or negatively, and made to retain it for a considerable time.

Beccaria, A. D. 1753.

Signor Beccaria, a celebrated Italian, kept up the spirit of electrical discovery in Italy; and in his work on natural and artificial electricity, he has given us the results of many important original investigations. He showed that water is a very imperfect conductor of electricity, that its conducting power is proportional to its quantity, and that a small quantity of water opposes a powerful resistance to the electric fluid. He succeeded in making the electric spark visible in water, by discharging shocks through wires that nearly met in tubes filled with water. In this experiment the tubes, though sometimes eight or ten lines thick, were burst in pieces. Beccaria likewise demonstrated that air adjacent to an electrified body gradually acquired the same electricity; that the electricity of the body is diminished by that of the air; and that the air parts with its electricity very slowly. He considered that there was a mutual repulsion between the particles of the electric fluid and those of air, and that in the passage of the former through the latter a temporary vacuum was formed.

Symmer's experiments, A. D. 1759.

The science of electricity owes several practical as well as theoretical observations to our countryman Mr Robert Symmer. In pulling off his stockings in the evening, Mr Symmer had often remarked that they not only gave a crackling noise, but even emitted sparks in the dark. The electricity was most powerful when a silk and a worsted stocking had been worn on the same leg, and it was best exhibited by putting the hand between the leg and the stockings, and pulling them off together. The one stocking being then drawn out of the other, they appeared more

History.

or less inflated, and exhibited the attractions and repulsions of electrified bodies. Mr Symmer's first trials were accidentally made with *black* silk stockings, but he was surprised to find that *white* ones produced no electricity. Two white silk stockings, or two black ones, when put on the same leg and taken off, gave no electrical indications. When a black and a white stocking were put on the same leg, and at the end of ten minutes taken off, they were so much inflated when pulled asunder, *that each of them showed the entire shape of the leg, and at the distance of a foot and a half they rushed to meet each other.* With worsted stockings, also, nothing but the combination of black and white produced electricity. As it was troublesome to electrify the stockings by putting them on and taking them off the leg, Mr Symmer excited the stockings by drawing them on the hand, which, however, produced a weaker degree of electricity. The electricity was in this case more permanent, and the effects were more powerful, when the stockings were new or newly washed. When an excited white and black stocking are presented to each other, they attract one another, inclining to each other at the distance of three feet, catching hold of each other within two feet, and at a less distance rushing together with surprising violence, becoming as flat as so many folds of silk when they are joined. "But what appears most extraordinary is, that when they are separated, and removed at a sufficient distance from each other, their electricity does not appear to have been in the least impaired by the shock they had in meeting. They are again inflated, again attract and repel, and are as ready to rush together as before. When this experiment is performed with two black stockings in one hand, and two white in the other, it exhibits a very curious spectacle; the repulsion of those of the same colour, and the attraction of those of different colours, throws them into an agitation that is not unentertaining, and makes them catch each at that of its opposite colour, at a greater distance than one would expect. When allowed to come together, they all unite in one mass. When separated, they resume their former appearance, and admit of the repetition of the experiment as often as you please, till their electricity, gradually wasting, stands in need of being recruited."

In the course of these experiments Mr Symmer accidentally threw a stocking out of his hands, and some time afterwards he found it sticking to the paper hangings of the room. They stuck also to the painted pannelling, and often continued for a whole hour suspended upon the hangings.

Mr Symmer's attention was next directed to the force of cohesion between stockings of black and white silk, and he found that from ten ounces to nine pounds weight was necessary to separate the stockings, according to their weight, or according as the rough or smooth surfaces were in contact.

Mr Symmer likewise found that a Leyden jar could be charged by the stockings either positively or negatively, according as the wire from the neck of the jar was presented to the black or white stockings. When the electricity of the white stocking was thrown into the jar, and on that the electricity of the black one, or *vice versa*, the jar will not be electrified at all. With the electricity of two stockings he charged the jar to such a degree that the shock from it reached both his elbows; and by means of the electricity of four silk stockings he kindled spirits of wine in a tea-spoon which he held in his hand, and the shock was at the same time felt from the elbows to the breast. Independent of these curious experiments, Mr Symmer had the merit of having first maintained the theory of two distinct fluids, not independent of each other, as Dufay supposed them to be, but co-existent, and, by counteracting each other, producing all the phenomena of electricity. He conceived that when a body is said to be *positively electrified*, it is not simply that it is possessed of a larger share of electric matter than in a natural state; nor, when it is said to be *negatively electrified*, of a less; but that, in the former case, it is possessed of a larger portion of one of these active powers, and in the latter, of a larger portion of the other; while a body, in its natural state, remains unelectrified, from an equal balance of these two powers within it.

Contemporary with Symmer were Delaval, Wilson, Cigna, Kinnersley, and Wilcke. M. Delaval found that the sides of vessels that were perfect conductors, were non-conductors, and that animal and vegetable bodies lost their conducting power when reduced to ashes. Mr Wilson discovered that when two electrics are rubbed together, the harder of the two is generally electrified positively, and the other negatively, but always with opposite electricities. Cigna made many curious experiments by using silk ribbands in place of the silk stockings of Symmer. Kinnersley, the friend of Franklin, made some important experiments on the elongation and fusion of iron wires, when a strong charge was passed through them in a state of tension; and Wilcke brought to light many new phenomena respecting the spontaneous electricity produced by the melting of electric substances.

Pyro-electricity of minerals.

The pyro-electricity of minerals, or the faculty possessed by some minerals of becoming electric by heat, and of exhibiting negative and positive poles, now began to attract the notice of philosophers. There is reason to believe that the *lyncurium* of the ancients, which, according to Theophrastus, attracted light bodies, was the *tourmaline*, a Ceylon mineral, in which the Dutch had early recognised the same attractive property, whence it got the name of *Aschentrikker*, or attracter of ashes. In 1717 M. Lemery exhibited to the Academy of Sciences a stone from Ceylon which attracted light bodies; and Linnæus, in mentioning the experiments of Lemery, gives the stone the name of *Lapis Electricus*. The Duke de Noya had heard at Naples that Count Pichetti had seen at Constantinople a stone called *tourmaline*, which attracted and repelled light bodies; and in 1758 he purchased some of them in Holland, and, assisted by MM. Daubenton and Adanson, he made a series of experiments with them, which were published separately.

Labours of Æpinus.

This curious subject, however, had engaged the attention of M. Æpinus, a celebrated German philosopher, who published an account of them in 1756. Hitherto nothing had been said respecting the necessity of heat to excite the tourmaline; but it was shown by Æpinus that a temperature between 99½° and 212° of Fahrenheit was requisite for the development of its attractive powers. Mr Benjamin Wilson, Priestley, and Canton, continued the investigation; but it was reserved for the Abbé Haüy to throw much light on this curious branch of the science. He found that the electricity of the tourmaline decreased rapidly from the summits or poles towards the middle of the crystal, where it was imperceptible; and he discovered that if a tourmaline is broken into any number of fragments, when excited, each fragment has two opposite poles. Haüy discovered the same property in the Siberian and Brazilian topaz, borate of magnesia, mesotype, prehnite, sphene, and calamine. He also found that the polarity which minerals receive from heat has a relation to the secondary forms of their crystals, the tourmaline, for example, having its resinous pole at the summit of the crystal which has three faces, and its vitreous pole at the summit which has six faces. In the other pyro-electrical crystals above mentioned, Haüy has detected the same deviation from the rules of symmetry

History.

in their secondary crystals which occurs in tourmaline. Mr Brard discovered that pyro-electricity was a property of the axinite; and more recently Sir David Brewster has detected it, as we shall afterwards see, in a variety of other minerals.

In repeating and extending the experiments of Haüy, Sir David Brewster discovered that various artificial salts were pyro-electrical; and he mentions the tartrate of potash and soda, and the tartaric acid, as exhibiting this property in a very strong degree. He likewise made many experiments with the tourmaline when cut into thin slices, and reduced to the finest powder, in which state each atom preserved its pyro-electricity; and he has shown that *scolezite* and *mesolite*, even when deprived of their water of crystallization, and reduced to powder, preserve their property of becoming electrical by heat. When this white powder is heated and stirred about by any substance whatever, it collects in masses like new fallen snow, and adheres to the body with which it is stirred.

Experiments of Æpinus.

In addition to his experiments on the tourmaline, Æpinus made several on the electricity of melted sulphur; and, in conjunction with Wilcke, he investigated the subject of electric atmospheres, and discovered a beautiful method of charging a plate of air by suspending large wooden boards coated with tin, and having their surfaces near each other, and parallel. Æpinus, however, has been principally distinguished by his ingenious theory of electricity, which he has explained and illustrated in a separate work which appeared at St Petersburg in 1759. This theory is founded on the following principles. 1. The particles of the electric fluid repel each other with a force decreasing as the distance increases. 2. The particles of the electric fluid attract the particles of all bodies, and are attracted by them, with a force obeying the same law. 3. The electric fluid exists in the pores of bodies; and while it moves without any obstruction in non-electrics, such as metals, water, &c., it moves with extreme difficulty in electrics, such as glass, rosin, &c. 4. Electrical phenomena are produced, either by the transference of the fluid from a body containing more to another containing less of it, or from its attraction and repulsion when no transference takes place.

Electricity of fishes.

The electricity of fishes, like that of minerals, now began to excite very general attention. The ancients, as we have seen, were acquainted with the benumbing power of the torpedo, but it was not till 1676 that modern naturalists attended to this remarkable property. The Arabians had long before given this fish the name of *raad* or lightning; but Redi was the first who communicated the fact that the shock was conveyed to the fisherman by means of the line and rod which connected him with the fish. Lorenzini published engravings of its electrical organs; Reaumur described the electrical properties of the fish; Kæmpfer compared the effects which it produced to lightning; but Bancroft was the first person who distinctly suspected that the effects of the torpedo were electrical. In 1773 Mr Walsh and Dr Ingenhouz proved, by many curious experiments, that the shock of the torpedo was an electrical one; and Dr Hunter examined and described the anatomical structure of its electrical organs. Humboldt, Gay Lussac, and M. Geoffroy, pursued the subject with success; and Mr Cavendish constructed an artificial torpedo, by which he was able to produce artificially the actions of the living animal. The subject has been more recently investigated by Dr Todd, Sir Humphry Davy, and Dr John Davy.

The power of giving electric shocks has been discovered also in the *Gymnotus Electricus*, the *Silurus Electricus*, the *Trichiurus Indicus*, and the *Tetraodon Electricus*. The most interesting and the best known of these singular fishes is the *Gymnotus* or Surinam eel. Its electrical organs have been minutely described by Hunter and Geoffroy; Dr Williamson, Dr Gordon, and Mr Walsh have published interesting details of its electrical powers; and Humboldt has more recently given the most romantic account of the combats which are carried on in South America between the gymnoti and the wild horses in the vicinity of Calabozo.

Mr Cavendish, born 1731, died 1810.

Among the modern cultivators of electricity, our countryman, the late Mr Cavendish, is entitled to a distinguished place. Before he had any knowledge of the theory of Æpinus, he had composed and communicated to the Royal Society a theory of electrical phenomena nearly the same as that of the German philosopher. As Mr Cavendish, however, had carried the theory much farther, and considered it under a more accurate point of view, he did not hesitate to give his paper to the world.

Mr Cavendish made some accurate experiments on the relative conducting power of different substances. He found that the electric fluid experiences as much resistance in passing through a column of water one inch long, as it does in passing through an iron wire of the same diameter 400,000,000 inches long, and hence he concludes that rain or distilled water conducts 400,000,000 times more than iron wire. He found that the water, or a solution of one part of salt in one of water, conducts a hundred times better than fresh water; and that a saturated solution of sea-salt conducts seven hundred and twenty times better than fresh water. Mr Cavendish likewise determined by nice experiments that the quantity of electricity in coated glass of a certain area increased with the thinness of the glass; and that in different coated plates the quantity was as the area of the coated surface directly, and as the thickness of the glass inversely.

Chemical electricity.

Although electricity had been employed as a chemical agent in the oxidation and fusion of metals, yet it is to Mr Cavendish that we owe the first of those brilliant enquiries which have done so much for the advancement of modern chemistry. By means of the electric spark he succeeded in decomposing atmospheric air. By using different proportions of oxygen and hydrogen, and examining the product which they formed after explosion with the electric spark, he obtained a proportion when the product was pure water. He was equally successful in the more difficult experiment of exploding oxygen and nitrogen; but when he combined seven measures of oxygen with three measures of nitrogen, he obtained from their explosion *nitric acid*. As several foreigners had failed in repeating this interesting experiment, Mr Cavendish, aided by Mr Gilpin, exhibited it publicly before the leading members of the Royal Society on the 6th of December 1787.

The decomposition of water by the electric spark was first effected by MM. Paets, Troostwyk, and Deiman; and improved methods of doing it were discovered and used by Dr Pearson, Mr Cuthbertson, and Dr Wollaston.

Galvanism and Voltaic electricity.

As a chemical agent, however, electricity was now destined to transfer its supremacy to another science. The great discovery made by Galvani in 1790, that the contact of metals produced muscular contraction in frogs, and the invention of the Voltaic pile, in 1800, by M. Volta of Como, have led to the establishment of a new science, called *Galvanism* or *Voltaic Electricity*, which, though now proved to be identical with common electricity, requires to be treated in a separate article. The chemical effects of the Voltaic pile far transcended those of ordinary electricity, and enabled Sir Humphry Davy to decompose the earths

History.

and the alkalies, and thus to create a new epoch in the history of chemistry.

Coulomb, born 1736, died 1806.

Contemporary with Mr Cavendish was M. Coulomb, one of the most eminent experimental philosophers of the last century. Anxious to determine the law of electrical action, he invented for this purpose an instrument called a *torsion balance*, which has since his time been universally used in all delicate researches, and which is particularly applicable to the measurement of electrical and magnetical actions. Æpinus and Cavendish had considered the action of the electrical fluid as diminishing with the distance; but M. Coulomb proved, by a series of elaborate experiments, that it varied like gravity in the inverse ratio of the square of the distance. Our countryman Dr Robison had previously determined, without, however, having published his experiments, that in the mutual repulsion of two similarly electrified spheres, the law was slightly in excess of the inverse duplicate ratio of the distance, while in the attraction of oppositely electrified spheres the deviation from that ratio was in defect; and hence he justly concluded that the law of electrical action was similar to that of gravity.

Adopting the hypothesis of two fluids, Coulomb investigated experimentally and theoretically the distribution of electricity on the surface of bodies. He determined the law of its distribution between two conducting bodies in contact; he measured the density of the electricity in different points of two globes in contact; he ascertained the distribution of electricity among several globes (whether equal or unequal) placed in contact in a straight line; he measured the distribution of electricity on the surface of a cylinder, and its distribution between a globe and cylinder of different lengths but of the same diameter. His experiments on the dissipation of electricity possess also a high value. He found that the momentary dissipation was proportional to the degree of electricity at the time; and that when the electricity was moderate, its dissipation was not altered in bodies of different kinds or shapes. The temperature and pressure of the atmosphere did not produce any sensible change; but the dissipation was nearly proportional to the cube of the quantity of moisture in the air. In examining the dissipation which takes place along imperfectly insulating substances, he found that a thread of gum-lac was the most perfect of all insulators; that it insulated ten times better than a dry silk thread; and that a silk thread covered with fine sealing-wax insulated as powerfully as gum-lac when it had four times its length. He found also that the dissipation of electricity along insulators was chiefly owing to adhering moisture, but in some measure also to a slight conducting power.

Experiments of Laplace, Lavoisier, and Volta, 1781.

Towards the end of the last century a series of experiments was made by MM. Laplace, Lavoisier, and Volta, from which it appeared that electricity is developed when solid or fluid bodies pass into the gaseous state. The bodies which were to be evaporated or dissolved were placed upon an insulating stand, and made to communicate by a chain or wire with a Cavallo's electrometer, or with Volta's condenser, when it was suspected that the electricity increased gradually. When sulphuric acid diluted with three parts of water was poured upon iron filings, inflammable air was disengaged with a brisk effervescence; and at the end of a few minutes the condenser was so highly charged as to yield a strong spark of negative electricity. Similar results were obtained when charcoal was burnt on a chafing dish, or when fixed air or nitrous gas was generated from powdered chalk by means of the sulphuric and nitrous acids.

Volta.

M. Volta, who happened to be at Paris when these experiments were made, and who took an active part in them, had subsequently observed that the electricity produced by evaporation was always negative. He found that burning charcoal gives out negative electricity; and in other kinds of combustion he obtained distinct electrical indications.

Saussure.

In this state of the subject M. Saussure undertook a series of elaborate experiments on the electricity of evaporation and combustion. In his first trials he found that the electricity was sometimes positive and sometimes negative when water was evaporated from a heated crucible of iron; but he afterwards found it to be always positive both in an iron and a copper crucible. In a silver and in a porcelain crucible the electricity was negative. The evaporation of alcohol and of ether in a silver crucible also gave *negative* electricity. M. Saussure made many fruitless trials to obtain electricity from combustion, and he likewise failed in his attempts to procure it from evaporation without ebullition.

Many valuable additions were about this time made to electrical apparatus, as well as to the science itself, by Van Marum, Cavallo, Nicholson, Cuthbertson, Brooke, Bennet, Read, Morgan, and Henley; but our limits will not permit us to do any thing more than thus notice their labours.

Application of analysis to electricity.

The application of analysis to electrical phenomena may be dated from the commencement of the present century. Coulomb had considered only the distribution of electricity on the surface of spheres; but Laplace undertook to investigate its distribution on the surface of ellipsoids of revolution, and he showed that the thickness of the coating of fluid at the pole was to its thickness at the equator as the equatorial is to the polar diameter, or, what is the same thing, that the repulsive force of the fluid, or its tension at the pole, is to that at the equator as the polar is to the equatorial axis.

M. Biot.

M. Biot has extended this investigation to all spheroids differing little from a sphere, whatever may be the irregularity of their figure. He likewise determined analytically that the losses of electricity form a geometrical progression when the two surfaces of a jar or plate of coated glass are discharged by successive contacts; and he found that the same law regulates the discharge when a series of jars or plates are placed in communication with each other.

M. Poisson.

It is to M. Poisson, however, that we are mainly indebted for having brought the phenomena of electricity under the dominion of analysis, and placed it on the same level as the more exact sciences. By assuming the hypothesis of two fluids, he has deduced theorems for determining the distribution of the electric fluid on the surface of two conducting spheres when they are either placed in contact or at any given distance; and the truth of these theorems has been established by experiments performed by Coulomb long before the theorems themselves had been investigated.

Oersted's discovery of electro-magnetism, 1820.

The cultivation of the new science of Voltaic electricity had now withdrawn the attention of experimental philosophers from that of ordinary electricity. The splendour of its phenomena, as well as its association with chemical discovery, contributed to give it popularity and importance; but the discoveries of Galvani and Volta were destined, in their turn, to pass into the shade, and the intellectual enterprise of the natural philosophers of Europe was directed to new branches of electrical and magnetical science. Guided by theoretical anticipations, Professor H. C. Oersted of Copenhagen, in 1820, laid the foundations of the science of *Electro-magnetism*. He found that the electrical current of a galvanic trough, when made to pass through a platina wire, acted upon a compass needle placed below the wire; and upon repeating

History.

the experiment, he discovered the fundamental law, that *the magnetical effect of the Voltaic current had a circular motion round the current*, or round the *conductor*, or the wire through which the current passed. M. Ampere of Paris soon afterwards made the important discovery, that two wires conducting electrical currents, when suspended so as to be capable of motion, *attracted* each other when the currents moved in the *same direction*, and *repelled* each other when they moved in *opposite* directions; or, to express the fact more simply, *two points of electrical currents repel each other by their similar sides, and attract each other by their opposite sides;* so that, as Professor Oersted remarks, *an electric current contains a revolving action, exhibiting every appearance of polarity*.

Discoveries of Ampere.

Discoveries of Arago, Davy, and Seebeck.

In 1820 M. Arago, Sir H. Davy, and Dr Seebeck of Berlin, without being acquainted with each other's labours, discovered the power of the electric current to impart magnetism to iron and steel needles; but the most singular discovery on this branch of the subject was made by M. Savary, who found that small steel needles placed at different but very short distances from a wire conducting an electrical current, are magnetised in different directions. Needles in contact with the wire are magnetised in the usual or *positive* direction; while needles at the distance of 1·1 millimeter, or $\frac{1}{24}$th of an inch, are magnetised in an opposite direction, which he calls *negative*. At the distance of two inches from the wire there was a neutral line in which the needles were not magnetised at all. When the distance of the unmagnetised needle was increased from three to eight millimeters it again became positively magnetic, the maximum effect taking place at the distance of $5\frac{1}{2}$ millimeters. Between the distance of 8·6 and 21·4 millimeters the magnetism was a second time negative, the effect increasing from 8·6 to 14·6, and again reaching the vertical or zero point at 21·4. Beyond the distance of twenty-three millimeters the magnetism was again positive. With different conducting wires M. Savary found, that within certain limits the maximum intensity is produced at a greater distance from the wire, and the number of alternations of positive and negative direction is also greater in proportion, as the wire is shorter in proportion to the length of the helix. When needles are placed parallel to the axis of a helix of narrow windings, they all receive the same kind of magnetism; but when the electrical charge is increased from one jar to a battery of twenty-two superficial feet, six alternations, viz. three positive and three negative, are obtained. When Voltaic electricity is substituted for ordinary electricity, the alternations are destroyed by a continued current, but appear when the current is established only for an instant.

Discoveries of M. Savary.

Discoveries of Professor Erman.

These curious experiments were followed by those of Professor Erman of Berlin, who found that when an electrical discharge passes through the centre of a circular disc of steel, and in a line perpendicular to its surface, no apparent magnetism is developed; but when a slit is made in the plate, or a sector cut out of it, the side of the disc opposite to the slit, or the sectoral opening, exhibits the opposite magnetism. MM. Gay Lussac and Welther obtained the same result with a steel ring.

Discoveries of Dr Seebeck, 1822.

The discovery of thermo-electricity by Dr Seebeck in 1822 gave a new impulse to this branch of science. In studying the influence of heat in Galvanic arrangements, he was led to believe that magnetism might be developed in two metals forming a circuit when the equilibrium of heat in them was disturbed. He accordingly joined a semicircular piece of bismuth with a similar piece of copper, so as to form a circle by their union; and when one of the junctions was heated an electrical current was produced, which could show its existence only by the magnetic needle, and which exhibited all the magnetical properties of an electrical current.

Dr Faraday's discoveries.

In the same year in which Dr Seebeck made this remarkable discovery, the rotation of a magnetical needle round an electrical current, and of a body transmitting an electrical current round a magnet, were exhibited in a series of beautiful and highly ingenious experiments by Dr Faraday, whose subsequent discoveries place him at the head of the cultivators of this most interesting science.

Experiments of Arago and others.

These experiments were followed by those of Arago, Barlow, Seebeck, Herschel, and Babbage, in which a revolving plate of copper gives a rotatory motion to a magnetic needle conveniently suspended; but notwithstanding the ingenuity and talent with which this subject was treated by these eminent individuals, it is to Dr Faraday that we owe a complete analysis and explanation of this curious phenomenon.

Discovery of magneto-electricity by Dr Faraday.

This explanation was founded on the great discovery of the evolution of electricity from magnetism, by which Dr Faraday laid the foundation of the new science of magneto-electricity. By means of a series of simple and beautiful experiments with the celebrated magnets of Dr Gowin Knight, and with the powerful magnet of Professor Daniel, Dr Faraday obtained the most unequivocal and striking electrical effects, though the intensity of the electricity was very feeble, and its quantity small. He obtained a distinct though feeble spark; he succeeded in convulsing the limbs of a frog by means of a magnet; and he perceived also the sensation on the tongue and the flash before the eyes, but he could not effect chemical decomposition by magnetism. Besides obtaining these important results, Dr Faraday has clearly established the laws according to which a magnet developes magnetic currents. He applies these laws to the explanation of the reciprocal action of revolving magnets and metals, and he adduces unquestionable proofs of the production of electricity by terrestrial magnetism.

These important results have been more recently extended by Dr Faraday and others. M. Pixii observed attractions and repulsions in the electricity evolved by magneto-electric induction; and by an ingenious and powerful apparatus he obtained a great degree of divergence in the gold leaves of an electrometer. At the meeting of the British Association at Oxford in June 1832, Dr Faraday, by means of Mr Snow Harris's electrometer, subsequently described, succeeded in heating a wire by magneto-electric induction. By means of the magneto-electric apparatus of M. Pixii already referred to, he and M. Hachette decomposed water, and obtained the oxygen and hydrogen in separate tubes.

Identity of the various electricities established by Dr Faraday.

In the progress of his electrical researches, Dr Faraday found it necessary for their further prosecution to establish either the identity or the distinction of the electricities excited by different means; and in a paper of great value, he has established beyond a doubt the identity of common electricity, Voltaic electricity, magneto-electricity, thermo-electricity, and animal electricity. The phenomena exhibited in these five kinds of electricity do not differ in kind, but merely in degree; *and in this respect they vary in proportion to the variable circumstances of quantity and intensity, which can at pleasure be made to change in almost any one of the kinds of electricity, as much as it does between one kind and another.* Dr Faraday has given the following interesting table of the experimental effects common to the electricities derived from different sources.[1]

[1] The cross indicates that the effect at the top of this table is produced by the electricity mentioned in the column at the side.

History.

	Physiological Effects	Magnetic Deflection.	Magnets made.	Spark.	Heating Power.	True Chemical Action.	Attraction and Repulsion.	Discharge by Hot Air.
1. Electricity, Statical	×	×	×	×	×	×	×	×
2. Electricity, Dynamic or Voltaic	×	×	×	×	×	×	×	×
3. Magneto-Electricity	×	×	×	×	×	×	×	
4. Thermo-Electricity	×	×	×	×	×	×		
5. Animal Electricity	×	×	×	×	×	×		

Relation by measure of ordinary and voltaic electricity.

Dr Faraday was anxious to determine the relation by measure of ordinary and voltaic electricity; and after various excellent experiments, he obtained as an approximation, and judging from magnetical force only, "that two wires, one of platina and one of zinc, each one-eighteenth of an inch in diameter, placed five-sixteenths of an inch apart, and immersed to the depth of five-eighteenths of an inch in acid consisting of one drop of oil of vitriol, and four ounces distilled water at a temperature about 60°, and connected at the other extremities by a copper wire eighteen feet long and one-eighteenth of an inch thick (being the wire of the galvanometer coils), yield as much electricity in eight beats of my watch, or in $\frac{8}{150}$ths of a minute (or 3·2 seconds), as the electrical battery (of fifteen jars) charged by thirty turns of the large machine in excellent order. The same result was found to be true in the case of chemical force."

Dr Faraday's new law of electrical conduction.

In the course of his investigations relative to electro-chemical composition, Dr Faraday was led to observe the effects due to a very general law of electric conduction which had not formerly been recognised. He found that solid bodies assume the power of conducting electricity during liquefaction, and lose this conducting power during congelation. The voltaic electricity produced by a battery of fifteen troughs, or a hundred and fifty pairs of four-inch plates powerfully charged, was incapable of passing through a thin film of ice three-sixteenths of an inch thick; but when the ice was melted, the electricity passed in such quantities as to deflect the magnetic needle 70°. This insulation, however, exhibited by ice is not effective with electricity of exalted intensity. In making this experiment with other solid bodies, Dr Faraday chose those which, being solid, at common temperatures, were fusible, and of such a composition as, for other reasons connected with electro-chemical action, led to the conclusion that they would be able to replace water. When the electric current passed through the solid body employed, there was no chemical decomposition; but when the body was liquefied or fused, the decomposition took place. The bodies which Dr Faraday found to be subject to this law will be found in our section on Electrical Conduction. The degree of conducting power conferred upon bodies by liquidity is generally very great. In water it is the feeblest of all; and in the various oxides, chlorides, salts, &c. it is given in a much higher degree, some a hundred times greater, than in the case of pure water.

Faraday's theory of statical electricity.

In studying the phenomena of induction, Mr Faraday has been led to a beautiful theory of inductive action, which throws a new light upon every department of electricity. While Cavendish, Poisson, and other distinguished cultivators of the science have considered induction as a force excited at a distance, and in straight lines, he has been led to regard it as an *action of contiguous particles*, or particles near each other, consisting of a species of polarity in the particles of the *dielectric* or insulating medium through or across which the electric forces are acting. When an electrified body induces electricity in a conductor, it does it by *polarizing* all the intermediate particles of the dielectric, that is by exciting the opposite electricities in the particles near it, and by these particles producing the same effect from particle to particle, till it is transferred to the conductor. The particles which are thus polarized are not supposed to be material atoms of the dielectric, but merely points or centres of force pervading all space and penetrating all material bodies. When such contiguous particles communicate their forces slowly to one another, *insulation* or *coercion*, as it has been called, is produced; and when rapidly, conduction is the result. This polarization of dielectrics has been placed beyond a doubt by the experiments of Faraday and Matteucci in the case of solids and fluids, if not for air and the gases. By means of this fine theory, which has been confirmed by recent experiments, M. Mosotti has succeeded in explaining the law of electrical forces discovered by Coulomb.

Researches of M. Plana.

In an able memoir published at Turin in 1845, M. Plana has given the results of his researches on the distribution of the electric fluid on the surface of conductors. Without taking into consideration the cause of the retention of electricity on the surface of conductors, he has treated the problem of its distribution in three cases,—in the case where the spheres are in contact, in the case where they are separated by any interval, and in the case where the separation is very small compared with the distance of their centres. He has also given a more rigorous demonstration of certain principles, on the relations which exist between the thickness of the electric wire and the forces which emanate from it. From the simple fact, that free electricity distributes itself on the surface of conductors, he demonstrates that the repulsive force in the case of simple physical points is inversely as the square of the distance.

Researches of Cavendish.

The distribution of electricity on spherical conductors has been successfully pursued by English mathematicians. Our celebrated countryman Mr Cavendish had, so early as 1773, made great progress in the inquiry. He demonstrated the remarkable proposition, that unless the electrical force was in the inverse proportion of the square of the distance, the electricity would be distributed through the interior of a charged conductor; and consequently that this law must be true, as the electricity is confined to an infinitely thin film on its surface. We owe also to Cavendish an approximation to the true theory of the Leyden phial, and a determination of the effects produced by connecting conductors with fixed wires.

Researches of Mr Green.

It is by our countryman Mr Green, a self-taught mathematician, that the greatest advances have been made in the mathematical theory of electricity.[1] "His researches," as Professor William Thomson has observed, "have led to the elementary proposition which must constitute the legitimate foundation of every perfect mathematical structure that is to be made from the materials furnished in the experimental laws of Coulomb. Not only do they afford a natural and complete explanation of the beautiful quantitative experiments

[1] *Essay on the application of Mathematical Analysis to the Theories of Electricity and Magnetism*, Nottingham, 1828.

History.

which have been so interesting at all times to practical electricians, but they suggest to the mathematician the simplest and most powerful methods of dealing with problems which, if attacked by the mere force of analysis, must have remained for ever unsolved." One of the simplest applications of these theorems was to perfect the theory of the Leyden phial, a result which (if we except the peculiar action of the insulating solid medium since discovered by Mr Faraday) we owe to his genius. He has also shown how an infinite number of forms of conductors may be invented, so that the distribution of electricity in equilibrium on each may be expressible in finite algebraical terms,—an immense stride in the science, when we consider that the distribution of electricity on a single spherical conductor, an uninfluenced ellipsoidal conductor, and two spheres mutually influencing one another, were the only cases solved by Poisson; and, indeed, the only cases conceived to be solvable by good mathematical writers.

Researches of Prof. William Thomson.

The work of Mr Green, which contained these fine researches, though published in 1828, had escaped the notice not only of foreign, but even of British mathematicians; and it is a singular fact in the history of science, that all his general theorems were rediscovered by Professor William Thomson of Glasgow, MM. Charles and Sturm of Paris, and M. Gauss of Göttingen. Professor Thomson, however, pushed his researches much farther than his fellow-labourers. He pointed out in 1845 the consistency of Mr Faraday's experiments with the new theory; and, guided by an analogy between the uniform motion of heat and the distribution of electricity on conductors, or the attractive and repulsive forces excited by electrified bodies, he has shown how the peculiar electric polarization discovered by Mr Faraday in dielectrics, or solid insulators subjected to electric force, is to be taken into account in the theory of the Leyden phial, so as to supply the deficiency in Green's investigations.[1]

From the elementary propositions of Mr Green, Mr Thomson was led to the beautiful principle of what he calls *electrical images*, which is a new and admirable method of treating a great variety of problems in reference to the distribution of electricity on spherical conductors. "The effect," says Mr Thomson, "of a body electrified in any given manner upon an uninsulated sphere, is shown to be completely represented by what may be called *the image* of the *electrified body in the sphere;* and a simple geometrical construction is given by which this image may be described. When an electrified body is placed in the neighbourhood of two uninsulated spheres, an inductive effect is produced which may be represented by an infinite series of *successive images* in each sphere. An algebraic expression of this result leads to solutions, by means of converging series, of the various problems which occur with reference to the distribution of the induced electricity, and the attractions exerted by the two spheres. Or, when a single conductor, bounded by segments of two spherical surfaces cutting at an angle which is a submultiple of two right angles, is electrified by the influence of a charged body, the effect may be represented by a finite number of images disposed in a symmetrical manner in the circumference of a circle passing through the exciting body, and cutting the two spherical surfaces at right angles. The principle of electrical images in these two cases may be illustrated by a reference to the successive images of a candle placed between two parallel plane mirrors, and to the symmetrically arranged images which are seen in the kaleidoscope."[2]

Mr Armstrong's hydro-electric machine.

One of the most remarkable discoveries in electricity which has been made in our own day is that of the hydro-electric machine, which we owe to Mr Armstrong of Newcastle. On the 29th September 1840 William Paterson, who attended a steam-engine at Cramlington Colliery, 8 miles from Newcastle, happening to take hold with one hand of the lever of the safety valve of the boiler, while his other hand was in the steam which was issuing from a fissure, received an electric shock. The same effect was produced if he touched any part of the boiler, or any iron work connected with it. The engine-man also found that when one hand was immersed in the jet of steam he gave a shock to every person he touched with the other, whether the person was in contact with the boiler or merely stood on the brick-work which supports it, though the shock was greater when the person touched the boiler. Having heard of these remarkable facts, Mr Armstrong went to Cramlington Colliery and observed the phenomena, and having constructed a steam apparatus, he found that the place where the electricity was produced was that at which the steam was subjected to friction, and that when the boiler was of wrought iron the electricity was always *positive*, excepting when he made the steam pass to the discharging aperture through a considerable surface of polished brass. In this case the electricity became very feeble; but when the inside of the brass tube was moistened with dilute nitric acid, the steam from the iron boiler became for the first time *negatively* electrified. By an insulated brass discharging-rod, consisting of a metallic plate at one end and a brass ball at the other, he obtained from 60 to 70 powerful sparks in a minute, the plate being plunged in the issuing steam, and the ball brought into contact with the boiler. Mr Armstrong was thus led to construct a hydro-electric machine, which gives sparks 22 inches long, and so large, dense, and rapid that they frequently resembled a continuous flame. This machine, with a boiler $6\frac{1}{2}$ feet long by $3\frac{1}{2}$ feet wide, was constructed for the Polytechnic Institution, where it has long excited the admiration of the public.

Mr Faraday's explanation of the hydro-electric machine.

Mr Armstrong at the very commencement of his inquiry communicated his discovery to Mr Faraday, who, with his usual ability, investigated the theory of the machine. He found that the electricity was produced by the friction of the particles of water upon the discharging tube, and that it was not the electricity caused by evaporation. When tubes of glass, metal, or wood were used, the electricity of the steam was always negative, and that of the boiler positive, but when a quill tube or a tube of ivory was employed, "the boiler received scarcely any charge, and the stream of steam was also in a neutral state," showing that the electricity was not produced by evaporation. Mr Faraday also found that the electricity of the issuing current was *negative*, and that of the boiler *positive*, when oil or oil of turpentine was carried forward by the current of steam. When acetic acid was used in the steam globe, the electricity was neutralized.

Researches of Sir Snow Harris.

Among the able and active cultivators of electrical science, Sir Snow Harris deserves a prominent place. He was the first who introduced accurate quantitative measures into the investigation of the laws of statical electricity—the unit measure by which quantity is minutely estimated—and the hydro-electrometer and scale-beam balance by which its intensity and the laws of attractive forces at all distances are demonstrated. Of not less value is the thermo-electrometer, by which the heating effects of given quantities of electricity are measured and rendered comparable with the varying conditions of quantity and intensity. Besides these instruments, we owe to the same philosopher the discovery of a new reactive force, by which repulsion and other small physical forces are investigated and determined by means of his bifilar balance, founded upon the reactive force of two vertically suspended parallel threads when twined upon each

[1] See *Cambridge and Dublin Mathematical Journal*, Nov. 1845; and *Phil. Mag.*, July 1854, pp. 42–62.

[2] *Reports of the British Association*, 1847, Trans. Sect., pp. 6, 7.

Phenomena and Laws.

other at a given angle, and acted upon by a suspended weight. With the aid of these ingenious instruments he has carried on a variety of successful inquiries into the laws of electrical forces, and the laws and operations of electrical accumulation. In studying the laws of electrical discharge in the form of lightning, Sir Snow Harris was led to the invention of a permanent system of conductors for ships, so perfect that during the last twenty-five years in which they have been introduced into the British navy no instance has occurred of the least damage by lightning. Although the nation has thus gained many thousand pounds per annum, and hundreds of valuable lives been saved, Sir Snow Harris has received only the paltry reward of L.5000. Our limits will not permit us to enumerate the various individuals by whom the science of statical electricity has been advanced, either by their researches or their inventions. Among these we may mention the distinguished names of Peltier, Pouillet, Becquerel, Matteucci, Fusinieri, Grove, Wheatstone, Delarive, Melloni, and Dubois Remond.

PART I.

PHENOMENA AND LAWS OF ELECTRICITY.

Elementary Phenomena and Definitions.

Elementary phenomena and definitions.

1. If a smooth glass tube, or the glass of a watch, or a piece of sealing-wax, or amber, be rubbed upon the sleeve of a cloth coat, or, what is still better, if it be rubbed with a piece of dry flannel or woollen cloth, it will be found to have acquired from this friction a new physical property. This property will be exhibited by holding the body which has been newly rubbed above small shreds of paper, gold leaf, or any thin light substances placed upon the table. These bodies will be instantly *attracted* to it, some of them adhering to its surface, others falling back to the table, and others being thrown off from the body as if they were repelled from it.

The property which has thus been communicated by friction is called *electricity*, the body which acquires the property is called the *electric*, the attraction which it exercises over light bodies is called *electric attraction;* and when the attractive power is produced by friction, the body *rubbed*, or the *electric*, is said to be *excited* by friction, or *electrified* or *electrized*, and the body by which it is excited is called the *rubber*.

2. In order to study these phenomena with more precision, let a small ball B,[1] the size of a pea, made of cork, or the dry pith of elder, or, what is better still, of the finely porous pith of the sola tree from India, be suspended from a stand ACD by a dry silk thread AB, or a fibre of raw silk. Having rubbed a large glass tube with a piece of dry silk, present it to the ball B, and the ball will be instantly attracted to the tube, and will adhere to it. After they have continued in contact for a second or two, withdraw the glass tube, taking care not to toucn the ball with the finger. If the excited glass tube is now a second time brought near the ball, the ball will recede from it, or will be *repelled* by the tube. If, after touching the ball with the finger, so as to deprive it of its electricity, the above experiment is accurately repeated with a stick of *sealing-wax* in place of glass, the very same phenomena will be exhibited; the ball will, in the first instance, be *attracted*, and on the second application of the sealing-wax it will be *repelled*. Hence we draw two conclusions, *first*, that both *glass* and *sealing-wax* attract the ball B before they have communicated to it any of their own electricity; and, *second*, that both these electrics repel the ball after each of them has communicated to it some of their own electricity.

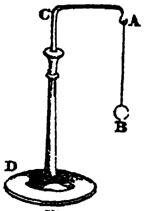


Fig. 1.

3. Let us now examine what takes place when the excited sealing-wax is presented to the ball after the ball has received electricity from the excited glass, and *vice versa*. For this purpose excite the glass tube, present it to the ball B, and after it has been a few seconds in contact, withdraw it. The ball has now received electricity from the glass tube. Let the sealing-wax be now excited and presented to the ball, the ball, in place of being *repelled*, will be *attracted* by the wax. Reverse this experiment, by first presenting the excited wax to the ball, and then the excited glass, and it will be in like manner found that the glass *repels* the ball. Hence it follows that

Excited glass *repels* a ball electrified by excited glass.
Excited wax *repels* a ball electrified by excited wax.
Excited glass *attracts* a ball electrified by excited wax.
Excited wax *attracts* a ball electrified by excited glass.

From which we conclude that there are two opposite electricities, namely, that produced by excited glass, to which the name of *vitreous* or *positive* electricity has been given, and that produced by excited wax, to which the name of *resinous* or *negative* electricity has been given.

4. If, when the pith ball B is electrified, either with excited glass or wax, we touch it with a rod of glass, its property of being subsequently attracted or repelled by the excited glass or wax will suffer no change; but if we touch it with a rod of metal it will lose the electricity which it had received, and will be attracted both by the excited glass or wax, as it was when they were first applied to it. Hence the rod of glass and the rod of metal possess different properties, the former being incapable, and the latter capable, of carrying off the electricity of the pith ball. The metal is therefore said to be a *conductor*, and the glass a *non-conductor*, of electricity.

In the few elementary experiments which we have now described, the electricity has been produced by *friction;* but the pith ball could have been electrified by a great variety of other methods, which will be explained in a subsequent part of this article. In all these cases the effects are precisely the same, whatever be the source from which the electricity is obtained; but as friction is the simplest means of generating electricity, and as machines and apparatus have been invented, by means of which it can be thus produced in great abundance, and accumulated in large quantities, we shall proceed to describe the phenomena and laws of electricity as produced by friction.

CHAP. I.—ON THE PHENOMENA OF ELECTRICITY PRODUCED BY FRICTION.

SECT. I.—*Description of the Electrical Machine for generating Electricity.*

Although the friction produced by the strength of the human arm is sufficient to produce abundance of electricity for ordinary experiments, yet the aid of mechanism has been found essential for carrying on electrical investigations, and producing powerful electrical effects. The various forms which have been given to the electrical machine will be described in the second part of this article, under the head of Electrical Apparatus, so that we shall chiefly confine our attention at present to a description of the plate-glass machine.

This machine, in its common form, is represented in Plate CCXXII., fig. 1, where AB is a circular disc of plate- Plate CCXXII., fig. 1.

[1] Light hollow metallic balls, or pith balls covered with gold or silver leaf, are preferable in certain experiments.

Phenomena and Laws.

glass from eighteen inches to two or more feet in diameter, and from two to three eighths of an inch thick. This disc is fixed perpendicular to a horizontal axis, supported by two uprights E, F, of a mahogany frame, and is capable of being turned round with any ordinary degree of velocity, by means of the handle or winch W. The rubbers by which this disc of glass is rubbed or excited are placed at the upper and lower end of the disc, as seen in the section, fig. 2. The two upper rubbers above A, viz. G, H, are suspended from the top of the frame, and are fixed by screws to two flat pieces of wood *m*, *m*, which can be pressed together or slackened by turning the screw *s* so that the rubbers G, H may be made to press with the requisite degree of force against the disc AB which revolves between them. The lower rubbers M, N below B, are supported upon the stand, and are similarly put together. The rubbers are generally flat cushions of silk or soft leather stuffed with hair.

Rubbers.

Prime conductor.

The prime conductor CD is a semicircle of hollow brass, supported on the upright E by means of the solid glass cylinder R. The two extremities of this conductor, one of which is seen below A, and the other above B, carry each a row of brass points, and the transverse piece of brass tube in which the points are inserted terminates in a varnished wooden ball.

Silk flaps.

From the upper rubbers an oil silk flap, embracing both surfaces of the plate, extends to a little above the row of points on the conductor; and from the lower rubbers a similar flap extends to a little below the other row of points. One of these flaps is seen in the figure, but the other is partially hid by the upright F.

Amalgam.

As it has been found that electricity is developed more copiously when the rubbers are covered with an amalgam of one part of tin and two of mercury, various compositions have been tried by philosophers.[1] The following amalgam, recommended by Singer, is equal in efficacy to any that has yet been proposed. Melt two ounces of zinc and one of tin, and pour into the crucible six ounces of mercury. Shake the whole together till it is cold, in an iron or thick wooden box; and when it has been reduced to a fine powder in a mortar, mix it with as much lard as will form it into a paste. The amalgam thus formed must then be thinly spread on the surface of each cushion; and when the disc of glass has been well cleaned from dust, and from black specks or lines, by means of a little spirits of wine, the mixture is ready for use.

When a very powerful excitation is required, it is usual to cover a piece of smooth leather, four or five inches broad, with the amalgam, and apply it with the hand to the revolving disc; and it has been found very useful to apply previously a rag with a little tallow, so as just to give a slight dimness to the glass.

Ronalds' cylinder machine.

Although the plate-glass machine is generally regarded as the best, yet, from its greater cheapness and facility of construction, the cylinder machine is most commonly used. We shall therefore describe at present one of those machines as improved by Mr F. Ronalds.. This machine is represented in fig. 3, where A is a cylinder of blue glass about a quarter of an inch thick, supported by the two mahogany uprights B, B, fixed to the box or case C, which forms the base of the machine. D D is a copper pipe which supports the semicylinder E, which is also hollow, and into which the pipe D opens. This semicylinder carries on its flat side the cushion or rubber, the surface of which is made concave to suit the convexity of the cylinder AA. A small spirit-lamp F, the burner of which consists only of a single cotton thread, is placed, as shown in the figure, immediately beneath the mouth of the copper pipe DD. The prime conductor G, which stands parallel to the cylinder, is a cylindrical tube of thin copper, rounded at both ends, and carrying at its middle a row of metallic points, which nearly touch the surface of the glass cylinder. The conductor G is supported by a hollow glass support H, opening into the hollow conductor G. Its lower end at H is fixed to the wooden case C by means of three screws, one of which is seen at *a* passing through a circular piece of hard boxwood, the inside of which, as well as that of the perforation in the case C, is lined with leather. The lower end of the glass tube H terminates, like that of D, within the case C, and a spirit-lamp is in like manner placed beneath it.

Fig. 3.

By these ingenious contrivances the rubber and the conductor[2] are kept warm and dry, and in damp weather, or in a close room, where the air is rendered moist by the breath of the audience, the machine will be found always effective and in working order. Mr Ronalds is of opinion that the excitation of the cylinder is promoted by the excitation of the amalgam by means of the heat. If similar means are not taken to heat the interior of the glass cylinder, the development of electricity may be promoted by holding a hot piece of cloth or flannel beneath the cylinder while it is in operation.

Ozone or the electrical odour.

In using an electrical machine a singular but not disagreeable odour is invariably felt, which increases with the number of sparks taken from the conductor or from electrical jars and batteries. The same smell is felt when lightning strikes terrestrial objects, and particularly objects in the interior of an apartment. The origin of this remarkable odour has been discovered by M. Schoenbein of Basle, the discoverer of gun cotton, and he has given the name of *ozone* to the substance which produces it. Ozone is highly odoriferous, and is nothing more than oxygen gas possessing a particular chemical activity which it receives from electricity. It has very remarkable properties as a chemical agent which are not possessed by pure oxygen, into which it is converted at a temperature of 300° Centigrade.

SECT. II.—*On the Phenomena of Electrical Attraction and Repulsion.*

Electrical attraction and repulsion.

If the electrical machine, when thus prepared, is put in motion, the two rows of points will collect the electricity which is generated by friction, and the brass conductor CD, fig. 1, will be filled with the electricity thus produced. By means of this electricity the following experiments may be readily performed.

Exp. 1. If we suspend a pith ball by a slender wire, and bring the ball near the conductor, it will be instantly attracted by, and adhere to, the conductor, as long as there is any electricity left. In this case the electricity imparted to the ball by the conductor is carried off by the conducting wire to the hand, and through the body to the earth.

If the pith ball is suspended by a dry silk thread, and held near the conductor, it will at first be attracted to it as formerly; but after it has received as much as it can take, it will then be repelled by the conductor, from the repulsive action of the two similar electricities, and it will not again approach the conductor, till either its own electricity or that of the conductor has been carried off by the contact of some conducting body. In either of these cases the pith ball will be again attracted by the conductor.

Exp. 2. Suspend a little brass ball by a silk thread, and bring the ball near the conductor, so as to receive electricity from it, and be repelled, as in experiment 1. Then with the other hand bring another brass ball near to the first, but on the side of it opposite to the conductor. The first ball will now be attracted to the conductor in conse-

[1] Mosaic gold and the deuto-sulphuret of tin is a good amalgam.

[2] It would be easy to improve this construction by introducing the heated air of other two spirit-lamps into each end of the cylinders.

Phenomena and Laws.

quence of having given out its electricity to the second ball; but having received a new charge of electricity, it will be repelled from the conductor and attracted to the hand or fixed ball. In this way it will oscillate like a pendulum between the conductor and the fixed ball. If in place of the fixed ball we substitute a bell, the ball will oscillate as before, and cause the bell to ring by its successive strokes.

Electrical bells. Plate CCXXII., fig. 4.

Exp. 3. The beautiful experiment of the *electrical bells* is exhibited in fig. 4, where AB is a solid glass rod surmounted by a brass ball A, and supported upon a wooden stand. Two arms of brass crossing at right angles are also supported by the glass rod, and, by means of wires or chains hanging from their extremities, are suspended four bells *b, b, b, b*. From the middle part of each of these cross arms is suspended a brass ball by silk threads, so that each ball when put in motion and made to oscillate in a plane passing through its own cross arm, may strike alternately the middle bell *b'* and the one adjacent to it. If the brass ball is now placed close beneath the brass knob of the prime conductor, or made to communicate with it, the electricity of the conductor will be transmitted through the brass arms to the balls, and the balls giving out their electricity to the bells, will strike them alternately, and cause them to ring, the electricity passing off through the central bell *b'* into the earth.

The experiment may be made more simply by suspending three bells, one from the middle, and one from each extremity of a brass rod, which is hung by its middle part from an electrified conductor. Two brass balls are hung by a silk thread between the central bell and the outer ones. The outer bells are supported by a wire or chain, and the central one by a silk thread. This central bell, however, must communicate with the ground by a chain. When the machine is put in motion, the electricity passes to the outer bells, and the insulated balls, being attracted and repelled, strike the outer bells and the inner one, by which last the electricity passes into the earth.

A still simpler form of the experiment consists in placing two small bells on separate glass stands, at a quarter of an inch distance, one of the bells communicating with the prime conductor, and the other with the ground. A brass ball is then suspended between them by a silk thread, and when the machine is wrought, the electricity will pass to the earth through the bells and the ball, the latter oscillating between them, and ringing them, as long as the current of electricity is kept up.

Exp. 4. Take a dozen of threads about a foot long, and having tied them together at both ends, hang them, by a loop attached to the upper knot, to the prime conductor. When the machine is wrought, the threads will separate from each other, swell out at the middle, and assume a form approaching to that of a sphere. If the threads are merely joined at each end, so that their extremities point to two poles, which may easily be done, they would swell out, and form, as it were, the meridians of a hollow globe. This pretty experiment we owe to Mr Wheler.

Exp. 5. Having fastened a piece of sealing-wax to a wire, and inserted the wire in the hole at the end of the prime conductor, soften the sealing-wax by the flame of a candle, and work the machine;—fine fibres of wax like those of wool will be thrown off, and may be received on paper. By gently heating the paper, the result of the experiment may be fixed. These fibres are thrown off by the repulsion of the electrified particles of wax, which becomes a conductor when melted. The same experiment might no doubt be made with melted sugar, rosin, and other substances.

Exp. 6. The experiment of the dancing figures is one of the finest illustrations of electrical attraction and repulsion. Take two circular discs of wood or pasteboard, E, F, like

Fig. 5.

those shown in fig. 5. Cover them with tinfoil, and having suspended the uppermost from the prime conductor (or from the end D of a metallic rod CD insulated by the glass stand AB, and whose other extremity C communicates by a chain with the prime conductor), place the other upon a stand G, so that, by means of the screw nut *n*, it can be raised or depressed. Place, upon the lower disc small painted figures cut out of paper, and as soon as the machine is wrought the figures will spring upon their feet, and execute the most extraordinary movements, sometimes dancing on their heads, sometimes hanging by the upper plate, and sometimes flying into each other's arms. If these figures are cut out of the pith of the sola tree, and if the arms and legs are made separate, and attached by threads to the body, the effect surpasses all description. The circular discs will answer equally well if made of metal.

Exp. 7. Suspend from the prime conductor a small metallic cup nearly full of water, and having placed in it the shorter end of a syphon made with a capillary glass tube, of such a bore that the water will with difficulty drop from it. When the water is electrified by working the machine, it will be discharged in a continuous stream from the larger arm of the syphon; and if the electricity is powerful, the current of water will divide itself into several branches. In like manner, if a condensed air fountain is electrified, the jet will subdivide itself into minute parts, and suffer great expansion; but the moment the machine stops it resumes its original form. In like manner, if a sponge filled with water discharges the fluid only by drops, it will, when electrified, let fall an abundant shower, which in the dark will be luminous.

Exp. 8. In a metallic cup place a piece of lighted camphor, and when the cup communicates with the electrified conductor, the camphor will throw off numerous ramifications, shooting forth its branches like a vegetable in growth.

An immense number of similar experiments may be made by placing pith balls under inverted tumblers, and thin balls of glass within metallic rings; and when the tumblers and the rings are electrified, the most varied movements are produced; and the effect is greatly heightened by the accompanying luminosity, which displays itself in the dark.

The theory of the phenomena which we have now described will be given in a subsequent section.

SECT. III.—*On the Phenomena of Positive and Negative Electricity.*

Positive and negative electricity.

We have already seen that there are two opposition electricities, which have received the name of *positive* or *vitreous*, and *negative* or *resinous* electricity, the former being generated by excited *glass*, and the latter by excited *wax*.

In order to examine the properties of these two kinds of electricity, take four stands like that shown in page 577, consisting of a vertical rod of glass fixed in a wooden base. From the top of each stand suspend a single pith ball by a slender wire, and place the four stands, which we shall call P, P' and N, N' at some distance from each other on a table. Electrify the pith balls on P, P' by excited glass, so as to make them *positively* electrical; and the pith balls on N, N' with excited wax, so as to make them *negatively* electrical. The following phenomena will then be observed. If the balls P, P' or N, N' are brought near each other, they will *repel* one another, but if P or P' is brought near to N or N', the balls will attract each other. Hence it follows,

Properties of positive and negative electricity.

That two SIMILARLY *electrified bodies P, P' or N, N'* REPEL *each other, while two* DISSIMILARLY *electrified bodies P, N or P', N'* ATTRACT *each other.*

If, in place of electrifying the balls with the glass and the sealing-wax, we had electrified them with the rubber with

Phenomena and Laws.

which they had been excited, we should have found that the rubber which excited the glass gave out *resinous* electricity, and the rubber which excited the wax *vitreous* electricity. Hence we learn,

That in electrical excitation positive and negative electricity are simultaneously produced.

In all electrical machines, therefore, where the plate or cylinder is made of glass, the conductor which takes the electricity from the glass will be charged with *positive* electricity; and as the rubber is negatively electrified, we may obtain negative electricity from it in the same abundance, by placing a conductor behind the rubber, and insulating them both by a glass stand. In the cylinder machine this is easily done, as shown in fig. 6, which represents a machine driven by a wheel and pulley, where E is the negative conductor placed at the back of the rubber R, and S the glass stand by which they are both supported and insulated.

Plate CCXXII., fig. 6.

Van Marum's machine. Plate CCXXIII., figs. 1-5.

In the plate-glass machine it is more difficult to unite a conductor to the rubbers. In Van Marum's beautiful electrical machine, shown in fig. 1–5 of Plate CCXXIII. and which will be more minutely described afterwards, the *positive* and *negative* electricity can be obtained only in succession; but Dr Hare, of the university of Pennsylvania, has removed this difficulty by the very ingenious contrivance shown in fig. 7, of making the plate revolve horizontally, and thus allowing the positive and negative conductors B, F to stand like arches in two vertical planes at right angles to each other.

Dr Hare's machine, Plate CCXXII., fig. 7.

The circumstances of surface and structure under which bodies yield the two opposite electricities by friction are still very imperfectly understood. Mr Canton found that the same body gave out opposite electricities when rubbed with different substances. *Polished glass*, for example, was always *positively* electrified when excited with flannel or silk; but always *negatively* electrified when excited by the back of a cat. But, what was still more strange, he found that *rough glass* acquired *negative* electricity when excited by flannel, and *positive* electricity when excited by dry oiled silk. Rough quartz has been found to exhibit the same difference.

A still more extraordinary and instructive anomaly was observed by Haüy, in exciting a mineral called *kyanite*. Some of the crystals he found to acquire positive electricity by friction, while others acquired negative electricity. Saussure had announced that they were negatively electrified by friction; and when Haüy obtained an opposite result in his first experiment, he was led to examine the subject more carefully, and to make his trials both with the natural faces and with those produced by cleavage. "I have," he remarks, "in my collection a crystal whose opposite faces have presented me with these opposite effects (*electricities*), and I can assign no other cause for this singular result than a certain alteration in the contexture of one of the surfaces." Hence Haüy has given the name of *disthene*, or *two powers*, to this mineral. The remarkable property which Haüy discovered in the individual crystal above referred to may have arisen from some composite structure which he did not recognise.

As the property of giving positive or negative electricity by friction has been used as a mineralogical character, we shall lay before our readers a general view of the experiments which have been made on the subject, which we have collected from a great variety of sources.

Names of the Excited Substances.	Nature of the Electricity produced.	Substances used for Excitation.
Smooth Glass	Positive	Every substance yet tried but the back of a cat and mercury.
	Negative	Back of a cat, and sometimes caoutchouc. (Nich. *Journ.* xxviii. p. 11.)
Rough Glass	Positive	Dry oiled silk, metals, wax, and resinous matters.
	Negative	Woollen cloth, human hand, back of a cat, wood, paper, quills.
Quartz, smooth	Positive	Flannel, &c.
Quartz, rough	Negative	Flannel, &c.
Topaz, smooth	Positive	Flannel, &c.
Topaz, rough	Negative	Flannel, &c.
Back of a living cat	Positive	Every substance yet used.
Hare skin	Positive	Human hand, silk, leather, metals, paper, baked wood, and loadstone.
	Negative	Other finer furs.
White Silk	Positive	Black silk, black cloth, metals.
	Negative	Human hand, weasel's skin, paper, hair.
Black silk	Positive	Sealing-wax.
	Negative	Hare's, weasel's, and ferret's skin, white silk, human hand, brass, silver, iron, loadstone.
Woollen cloth	Positive	Zinc, silver, bismuth, copper, lead, oligist iron.
	Negative	Platina, gold, tin, antimony, grey copper, grey cobalt, tellurium, &c.
Sealing-wax	Positive	Rough glass, white wax, sulphur, and all metals except iron, steel, plumbago, lead, and bismuth.
	Negative	Hare's, weasel's, and ferret's skin, human hand, leather, smooth glass, flannel, wood, paper, iron, steel, plumbago, lead, and bismuth.
Baked wood	Positive	Silk, paper, rough glass, wax, lead, sulphur, and the metals.
	Negative	Flannel, hare's skin, smooth glass, quills.
Sulphur	Positive	All metals but lead.
	Negative	Lead and all other substances.
Resinous bodies	Positive	All resinous substances.
	Negative	All bodies but resinous ones.

Electricity of minerals.

The most accurate and numerous observations on the development of electricity by friction were made by the Abbé Haüy in reference to the discovery of new characters of minerals. He rubbed the minerals on a woollen cloth, and when it was necessary to insulate them, he fixed them by wax to the end of a stick of gum-lac or Spanish wax. In this way he divided the mineral kingdom into four classes of bodies in reference to the electrical character of the minerals.

Class. I.—*Containing minerals which possess the insulating property,*[1] *and acquire vitreous electricity by friction.*

Boracite.	Carbonate of lime.
Topaz.	Carbonate of magnesia.
Axinite.	Arragonite.
Tourmaline.	Apatite.
Mesotype.	Fluate of lime.
Prehnite.	Gypsum.
Oxide of zinc.	Anhydrite.
Sphène.	Sulphate of barytes.

[1] That is, that they do not require to be insulated or placed upon a substance which does not conduct or carry off electricity, in order to exhibit their electricity.

Phenomena and Laws.

Sulphate of strontian.	Feldspar.
Carbonate of barytes.	Apophyllites.
Carbonate of strontian.	Actinote.
Sulphate of magnesia.	Tremolite.
Siliceous borate of lime.	Diopside.
Nitrate of potash.	Epidote.
Sulphate of potash.	Stilbite.
Muriate of soda.	Analcime.
Glauberite.	Nepheline.
Hyalin quartz.	Kyanite.
Zircon.	Mica.
Corundum.	Macle.
Cymophane.	Talc transp.
Spinelle.	Diamond.
Emerald.	Carbonate of lead.
Euclase.	Sulphate of lead.
Cordierite.	Tungstate of lead.
Garnet.	Carbonate of zinc.
Essonite.	Oxide of tin.
Idocrase.	

CLASS II.—*Containing minerals which possess the insulating property (excepting anthracite), and acquire resinous electricity by friction.*

Sulphur.	Amber.
Bitumen.	Mellite.
Retinasphaltum.	Anthracite.

CLASS III.—*Containing conducting substances which acquire, when they are insulated and rubbed, the one order vitreous electricity, and the other resinous electricity.*

Order 1. Substances which acquire vitreous electricity.

Pure silver.	Copper coin.
Native silver.	Pure zinc.
Silver coin.	Brass.
Pure lead.	Native bismuth.
Pure copper.	Native amalgam.
Native copper.	

Order 2. Substances which acquire resinous electricity.

Pure platina.	Sulphuret of lead.
Native platina.	Copper pyrites.
Palladium.	Grey copper.
Pure gold.	Sulphuret of copper.
Native gold.	Graphite.
Gold coin.	Common sulphuret of iron.
Pure nickel.	White sulphuret of iron.
Native iron.	Magnetic sulphuret of iron.
Hammered iron.	Sulphuret of tin.
Pure tin.	Sulphuret of bismuth.
Amalgam of tin and mercury.	Sulphuret of manganese.
Native arsenic.	Sulphuret of antimony.
Pure antimony.	Sulphuret of molybdena.
Native antimony.	Chromate of iron.
Tellurium of Naygag.	Oxide of iron.
Antimonial silver.	Jenite.
Arsenical nickel.	Black oxide of cobalt.
Arsenical iron.	Oxidulated uranium.
Oxidulated iron.	Wolfram.
Metalloidal oxide of manganese.	Tantalite.
	Yttro-tantalite.
Sulphuret of silver.	Black oxide of cerium.

CLASS IV.—*Containing Substances which acquire resinous electricity by friction. The insulating property is limited to the very transparent varieties.*

Ruby silver.	Arseniate of copper.
Sulphuret of mercury.	Dioptase.
Red copper ore.	Phosphate of copper.
Oligist iron ore.	Hydrate of copper.
Sulphuret of arsenic.	Sulphate of copper.
Titanite.	Phosphate of iron.
Anatase.	Arseniate of iron.
Muriate of mercury.	Sulphate of iron.
Chromate of lead.	Sulphuret of zinc.
Phosphate of lead.	Red cobalt.
Molybdate of lead.	Green oxide of uranium.
Green carbonate of copper.[1]	White oxide of antimony.
Blue carbonate of copper.	Red oxide of cerium.

As the causes which determine the production of positive or negative electricity by friction are wholly unknown, and require to be carefully investigated, we must warn the philosopher against the implicit adoption of all the preceding determinations. Different results have in many cases been obtained by different observers, and even by the same observer while using the same materials; and we could have greatly enlarged the first of the preceding tables had we inserted the opposite results of different observers. There are two points, however, which require to be attended to in such inquiries: *1st*, There is a tendency to the production of negative electricity in the substance which has the least extent of surface; and, *2dly*, there is a tendency to the production of an opposite electricity when the surface of the body is even minutely scratched.

Faraday's Experiments.

Besides the chemical nature of the bodies, the kind of electricity produced by friction depends on various physical circumstances in the two bodies. Polish, for example, tends to produce vitreous, and heat resinous electricity. Mr Faraday obtained interesting results by rubbing together the substances in the following table in pairs.

1. Calfskin and Bearskin.	9. White Silk.
2. Flannel.	10. The hand.
3. Ivory.	11. Wood.
4. Quill.	12. Lac.
5. Rock crystal.	13. Metals—Iron, copper, brass, tin, silver, platinum.
6. Flint Glass.	14. Sulphur.
7. Cotton.	
8. Linen, Canvas.	

If any one of these substances is rubbed against the substance *above* it, it becomes *negatively* electrified, and if against the substance *below* it, the electricity is *positive*. Mr Faraday, however, found many exceptions to this rule. One part of a cat's skin, for example, was very negative to another part, and even to rock crystal, and different pieces of flannel also differed much from each other; a change in the mode of rubbing, too, made a great difference. A feather struck lightly against a dry canvas becomes strongly negative, while the same feather drawn with a little pressure between the folds of the same canvas will be strongly positive. When a piece of flannel is halved, and the two pieces drawn across each other, the electricity of the two will be of a different kind irregularly; or the same piece will have both electricities in different parts; or, sometimes, both pieces will be negative, in which case Mr Faraday thinks that the air must have been rendered positive and then dissipated.

When we come to describe the hydro-electric machine, we shall find that water is positive when carried through tubes of wood and metal by a stream of steam, the tubes becoming positive; and Mr Faraday thinks it will probably be found to stand above all other substances, even cats' hair and oxalate of lime.

Mr Wilson had found that a stream of air directed against a tourmaline, or glass, or resin, electrified these substances positively; but Mr Faraday has shown that no electrical effect is produced unless the air is damp, or holds dry powders in suspension. In these cases, the electricity is produced by the friction of the particles of water in the one case, and the particles of powder in the other.

In order to account for the production of electricity by friction, Dr Wollaston ascribed it to an oxidation; but this cannot be the cause of it, as electricity is produced by friction in vacuo, as was shown long ago by Stephen Gray; and what is a still more decisive objection to this theory, Gay Lussac found that electricity could be developed by friction in dry carbonic acid.

SECT. IV.—*On Electrical Conduction.*

Electrical conduction.

It is obvious, from all the phenomena described in the preceding sections, that electricity is communicated from

[1] This salt has often the insulating property, and acquires vitreous electricity by friction.

Phenomena and Laws.

one body to another. The excited glass or wax communicate, as we have seen, their electricity to a pith ball; and the electricity of the machine is conveyed first to the prime conductor, and from that to the bells or other apparatus which have been already described. If we touch an electrified pith ball, or any other electrified body, with a rod of metal of any kind, the electricity of the pith ball will be instantly carried off; but if we touch it with glass or wax it will not be carried off. Hence metals are said to be *conductors*, and glass and wax *non-conductors*, of electricity.

Bodies vary greatly in the degree in which they conduct electricity; and many of them owe their conducting power to the water which they contain. The conducting power of any substance depends on the state of the atmosphere at the time with regard to humidity, and on the intensity of the electricity employed. The following tables of conductors and non-conductors have been collected from different authors. The bodies are placed in the order of their conducting or non-conducting power; but it is probable that this order would be greatly changed if the bodies were all submitted to a new and uniform examination.

List of Conductors.

All metals.	River water.
Silver.	Ice above − 13° Fahr.
Copper.	Snow.
Lead.	Living vegetables.
Gold.	Living animals.
Brass.	Flame.
Zinc.	Smoke.
Tin.	Steam.
Platina.	Soluble salts.
Palladium. }	Rarefied air.
Iron heated. }	Vapour of alcohol.
Iron cold. }	Vapour of ether.
Charcoal well burned.	Moist earths and rocks.
Plumbago.	Anthracite.
Concentrated acids.	All the substances and minerals in the third class of Haüy's list, as given in Sect. II.
Powdered charcoal.	Powdered glass.
Diluted acids.	Flowers of sulphur.
Saline solutions.	Resins rendered fluid by heat.
Metallic ores.	Glass heated to redness.
Animal fluids.	
Hot water.	
Sea water.	
Spring water.	

List of Non-Conductors or Electrics.

Gutta percha.	Dry paper.
Shell-lac.	Parchment.
Amber.	Leather.
Resins.	Air, and all dry gases.
Sulphur.	Baked wood.
Wax.	Dry vegetable bodies.
Jet.	Porcelain, }
Glass.[1]	Dry marble, and }
Vitrifications.	Siliceous and argillaceous stones in Class I. of Haüy's list. }
Mica, }	Camphor.
Diamond, }	Caoutchouc.
Transparent gems, and }	Lycopodium.
All the minerals in Class I. of Haüy's list. }	Dry chalk.
Raw silk.	Lime.
Bleached silk.	Phosphorus.
Dyed silk.	Ice at 0° Fahr.
Wool.	Ashes of animal bodies.
Hair.	Ashes of vegetable bodies.
Feathers.	Oils, the heaviest being the best conductors.
Dry metallic oxides.	Steam of high elasticity.
	Gun cotton.[2]

Insulators.

The most perfect *non-conductors* of electricity are also called *insulators*, from their power of insulating an electrified body, or preventing any of its electricity from escaping along its support. It is to Coulomb that we owe the useful discovery that *shell-lac* is the most perfect of all insulators; and hence it is of great value in electrical inquiries. Coulomb found that the electricity of a pith ball five or six lines in diameter could be completely insulated by a cylinder of sealing-wax or gum-lac about half a line in diameter, and eighteen or twenty lines long; that a very fine silk thread, penetrated and covered with melted wax so as to form a cylinder one-fourth of a line in diameter, had the same insulating power when its length was five or six inches; and that an equal degree of insulation could not be obtained by a fine thread of glass five or six inches long, or by a hair or a fibre of silk, unless the electricity insulated was very weak, or the air very dry. Coulomb found also that the density of electricity insulated by a fibre of gum-lac was ten times as great as that which could be insulated by a silk fibre of the same length and diameter; and he established the following general law, *that the densities of electricity insulated by different lengths of fine cylindrical fibres, such as those of gum-lac, hair, silk, &c., vary as the square root of the lengths of the fibre.*

Conduction of positive and negative electricity.

In examining whether or not positive and negative electricity were conveyed with equal facility by conducting bodies, M. Erman found that there were some bodies which completely obstructed the passage of one kind of electricity, while they afforded a ready passage to the other. As this result, however, was obtained by weak galvanic electricity, the question is still open to examination in reference to ordinary electricity.

Although some bodies are said to be perfect non-conductors, yet this is not strictly true. A strong electrical charge can be made to pass through a thin film of the worst conductor. Dr Ritchie found that electricity permeated thin balls of blown glass; and though in one case he found that a small invisible aperture had been made in the glass, yet in other experiments he could not by any known method detect the smallest perforation.

Influence of heat in promoting conduction.

It has been long known that imperfect conductors have their conducting power increased by heat; gases, charcoal, glass, ice, and resins when melted, are proofs of this. Dr Ritchie,[3] on the authority of some accurate experiments, is of opinion, that if the body be naturally a pretty good conductor, the ratio of its conducting power will not be so much increased by heat as in the case of a less perfect conductor. Marianini found this to be true with fluid conductors, and Dr Ritchie thinks that it is universally true.

Plate CCXXVII., figs. 1 & 2.

An interesting paper on this subject by Sir Snow Harris, will be found in the *Edinburgh Transactions* for 1832; in which the author describes a new electrometer, and measures the degree of heat excited in metallic bodies by voltaic electricity. The results of his inquiries are—"That for certain given small forces the differences in the conducting powers of the several metals vanish, each metal being equally efficient. 2d. That differences in conducting power become more apparent within a certain limit, as the

[1] Glass of soda is the best conductor, and glass of potash the worst. M. Mathiessen found a species of glass which was absolutely incapable of receiving any electric charge, and he found it to be a glass of soda almost entirely free of potash. The conducting power of glass increases with its temperature. M. Buff has found from very accurate experiments that the glass of tubes used for chemical experiments, which is a good insulator, had its insulating power increased by heat nearly as in the following table:

Temp. Cent.	Insulating power.	Temp. Cent.	Insulating power.
200°	2582	350°	12
250	158	400	8
300	17		

[2] When made in large quantities this substance preserves the form of the sheet of cotton-wool from which it is made. When it is well dried a cloud of sparks will be produced by drawing it through the hand.

[3] *Philosophical Transactions*, 1828, p. 376.

Phenomena and Laws.

Influence of heat in promoting conduction.

force of the battery increases:" the exact proportions in which the differences increase with the increased power the author had not accurately ascertained. In reasoning on the several experimental results arrived at, our author traces the source of these phenomena to certain unknown relations subsisting between the causes of heat and electricity, and is led to adopt the principle advocated by Sir H. Davy, that the excitation of heat in the metal diminishes its conducting power. He found by several striking experiments that the electrometer became most sensibly affected by changes of temperature in the wire transmitting the charge, and that whether by the common means of heat or cold directly applied to it, or otherwise by means of an electrical current; so that it does not appear to be of any consequence how the heat is derived by which the conducting power is diminished. Hence it follows that the heat excited in a metallic body during the time of its conduction would tend to impede the transmission of the electrical current. In certain cases, therefore, of electricity of low tension, the heat excited in different metals may be so small as not to interfere with the transmission of the current, and they may all appear to conduct equally well in that particular case. With respect to currents differing in intensity, he found that when the force was very considerable, the best conductor became the most heated, from the circumstance of its permitting a larger quantity of electricity to pass through it. When the force of the battery became less, then the inferior conductor became the most heated; because it is now capable of transmitting the whole current.

There is however a contingency attendant on experiments of this kind, which, as observed by Sir Snow Harris in his inquiries into the Elementary Laws of Electricity,[1] demands very especial attention. The author has shown, in the course of these investigations, that rarefied air does not restrain the electrical discharge to the same extent as dense air. He found that a given accumulation on coated glass would strike through twice the distance in air of half the density; and, further, that an electrical accumulation was transmitted with much greater facility over a wire when the atmospheric pressure was removed from its surface; so much so, that an extremely fine steel wire became beautifully luminous in a closely exhausted receiver, in transmitting without fusion a powerful accumulation which in the atmosphere would dissipate the metal in red-hot balls. When an electrical discharge therefore is caused to pass over a heated surface in the atmosphere, as for example, that of iron heated to redness, we have to take into the account the necessarily rarefied state of the air in contact with the metal, and which may permit a free passage along its surface, thereby more than compensating for any diminished power of conduction in the metal itself. Unless therefore such experiments be conducted in a space devoid of air, or nearly so, they can not be well received in opposition to a large class of well established facts, and must be always more or less inconclusive.

A question arises here, bearing on the relations between heat and electricity, of no small interest to these branches of physical science. Is the source of heat material, and if a material element, is heat a conductor or insulator of ordinary electrical action? The following are some singularly interesting experiments relative to this question, by Sir Snow Harris, communicated to the Royal Society in 1834.[2] Having examined the laws of electrical discharge of high tension in air varying in density, and having fully shown that the resistance of the atmosphere to the passage of free electricity is not greater through one discharging distance than through another, and in no case greater than the existing atmospheric pressure; he proceeds to examine the influence of an atmosphere of variable density and temperature in arresting the progress of electrical discharge; and he finds, 1. That the quantity requisite to force a given interval, varies in a simple ratio of the density, so that when the density was only one-half as great, the discharge occurred with one-half the quantity accumulated. 2. That the distance through which a given accumulation could discharge was in a simple inverse ratio of the density. Thus, as already observed, in air of half the density the discharge from a given accumulation occurred at twice the distance. Having determined this, the author endeavours to find whether the influence of heat was such as to impair or augment the insulating power of the air, which he does by forcibly retaining a given volume of air within a glass receiver, and causing given electrical accumulations to discharge through it, under very considerable variations of its temperature, viz., from 50 to 300 degrees of Fahrenheit.

Apparatus used by Sir Snow Harris.

The manipulation and apparatus by which all these experiments were effected may be thus briefly explained:—Two smooth balls of brass of about an inch and a half in diameter were directly opposed to each other within a large glass receiver connected with an effective air-pump. These balls could be set at given measured distances between their nearest points, by means of a sliding brass rod passing through an air-tight collar and glass plate on the top of the receiver acted on by a micrometer screw and index. The air-pump was fitted with a long mercurial gage and a delicate Fahrenheit thermometer placed within the receiver. Given quantities of electricity, measured by the unit jar (Plate CCXXIX., fig. 17), were accumulated on coated glass, the thermo-electrometer (Plate CCXXVII., figs. 1 and 2) for measuring the effect of the discharge occasionally placed in the circuit, and discharges caused to pass between the brass balls within the receiver under a variety of different circumstances. The temperature of the air contained within the receiver was raised at pleasure, by means of an external metallic envelope and a lamp, so contrived as to be removed at pleasure without disturbing the fixed pieces, which, under the ordinary pressure of the atmosphere without, resisted the expansive power of the air contained within the receiver, when the volume was required to be the same under different temperatures, and at the density of the external air.

Plate CCXXVII., figs. 1 & 2.

As a preliminary experiment, a given quantity of electricity was accumulated and discharged between the brass balls within the receiver in air of constant temperature, but varying in density. By diminishing the density, the distance of discharge within the receiver could be extremely increased. The results of thirty successive experiments give an invariable effect on the wire of the thermo-electrometer, at whatever distance the discharge passed between the brass balls; showing that the resistance to the passing shock must have been in each case alike. In order to effect discharges between the balls in the receiver within the limit at which the accumulated electricity could force a passage, the battery was discharged externally to the receiver by a drop ball falling with force on a small plate of varnished glass resting on an opposed ball, in connection with the positive coating; thus impeding the discharge of the battery up to a given instant. The experiments being now arranged solely with reference to heat, an accumulated quantity was effected adequate to discharge over a certain distance between the balls in the receiver, in a volume of air of a noted temperature. This being determined, and the volume fixed by closing the stop-stock connected with the receiver, the temperature within was varied from 50° to 300° of Fahrenheit, but without in any way affecting the result. The discharge of the battery invariably occurred when the same quantity had accumulated, or very nearly. The experiments were sufficiently approximative to show that the heat had in no degree affected the restraining or insulating power of the air.

[1] *Phil. Trans.* for 1834, p. 230.

[2] On some Elementary Laws of Electricity, First Series.

Phenomena and Laws.

The heated air was now permitted to expand, by opening the stop-cock under the receiver, and allowing an escape through the long mercurial gage from beneath the surface of the mercury below. When full expansion had taken place, the cock was again closed. This done, the quantity of accumulated charge in the battery now requisite to pass between the balls in the receiver was again determined, which, although necessarily reduced, was found still constant through all succeeding depressions of the temperature, from 280° down to the temperature of the external air. When this was reached, the cock was again opened so as to allow the mercury to rise in the gage, by which the final density could be pretty well ascertained. The comparative quantitative accumulations were then found to be as the diminished density, or very nearly so.

The author describes several other forms of these experiments on the power of heated air to restrain electrical discharges, but the results were found the same. The insulating power of the air was found quite independent of the temperature, and to have reference only to the condition of density.

The author thinks that we may fairly conclude from these experiments—

1. That heated air is not, as frequently stated, a conductor of electricity; and that heat in no way facilitates electrical discharge through air, except by affecting its density.

2. Supposing the cause of heat to be a material element, it must necessarily be an electric or non-conductor; because the incorporation of a conducting with a non-conducting substance is always found to impair its insulating property—as for example in the case of air charged with free vapour; whereas in the intimate union of two non-conductors the insulating power is in no way impaired. Since, then, heat does not impair the insulating property of a given volume of air, heat, if a substance, should therefore be an electric, and have insulating properties.

The converse of this reasoning furnishes additional evidence of this. It is a well-known fact, as we shall hereafter find, that the excitation of heat in good conductors, such as the metals, greatly impairs their conductibility; a result invariably attendant on the mixture of a conducting with an insulating substance, and even evinced on amalgamating a good conducting metal with a metal low in the scale of conducting power.

Experiments of Delarive.

It appears from some recent experiments made by Professor Delarive of Geneva, that the degree of conductibility of bodies for electricity *depends on the quantity of electricity which traverses them.* Hence it follows, that, of two conducting bodies, that which is the most perfect for an electric current of a given intensity may be the worst conductor for either a stronger or a weaker current. The conducting powers of bodies, therefore, ought to be re-examined in reference to electric currents of different intensities; and when such experiments are made with accuracy, we may expect that they will lead to great improvements in our electrical apparatus.

Dr Faraday's new law of conduction.

Much light has been recently thrown on the conducting power of bodies by the researches of Dr Faraday, of which we have already given a general account in our history of electricity. He found that a great number of solid bodies which were incapable of conducting electricity of low tension, acquired by liquefaction or fusion the power of conducting it in a very high degree. The following is a list of the bodies which possessed this property:

Water.

Oxides. Potassa, protoxide of lead, glass of antimony, protoxide of antimony, oxide of bismuth.

Chlorides of potassium, sodium, barium, strontium, magnesium, manganese, zinc, copper (proto-), lead, tin (proto-), antimony, silver.

Iodides of potassium, zinc, and lead; protiodide of tin, periodide of mercury, fluoride of potassium, cyanide of potassium, sulpho-cyanide of potassium.

Salts. Chlorate of potassa; nitrates of potassa, soda, baryta, strontia, lead, copper, and silver; sulphates of soda and lead; proto-sulphate of mercury; phosphates of potassa, soda, lead, copper, phosphoric glass, or acid phosphate of lime; carbonates of potassa and soda, mingled and separate; borax, borate of lead, perborate of tin; chromate of potassa, bichromate of potassa; chromate of lead; acetate of potassa.

Sulphurets. Sulphuret of antimony, sulphuret of potassium made by reducing sulphate of potassa by hydrogen, ordinary sulphate of potassa.

Silicated potassa; chameleon mineral.

In those substances which soften before they liquefy, Dr Faraday found it highly interesting to watch the increase of conducting power as they approached to perfect fluidity. When borate of lead, for example, is heated by the lamp upon glass, it becomes as soft as treacle, without gaining the power of conduction; and it was only when brought to a fair red heat by the blowpipe that it conducted. When it was quite liquid, it conducted with extreme facility.

The following bodies were found by Dr Faraday to acquire no conducting power when they assumed the liquid state.

Sulphur.	Adipocire.
Phosphorus.	Stearine of cocoa-nut oil.
Iodide of sulphur.	Spermaceti.
Periodide of tin.	Camphor.
Orpiment.	Naphthaline.
Realgar.	Resin.
Glacial acetic acid.	Gum sandarach.
Mixed margaric and oleic acids.	Shell-lac.
	Perchloride of tin.
Artificial camphor.	Chloride of arsenic.
Cafeine.	Hydrated do.
Sugar.	

Boracic acid and green bottle glass raised to the highest heat by an oxyhydrogen flame acquired no conducting power. Flint glass conducted a little when so heated.

When a solid becomes fluid it loses almost wholly its power of conducting heat, and gains in a high degree that of conducting electricity, and *vice versa;* and hence Dr Faraday concludes that there is a natural dependence between the two classes of facts.

Dr Faraday concludes his very interesting researches on this subject with the following summary of conditions of conduction in bodies, which, though they apply chiefly to voltaic electricity, are yet true within certain limits for ordinary electricity.

Conditions of electrical conduction.

1. All bodies conduct electricity in the same manner, from metals to lac and gases, but in different degrees.

2. Conducting power is in some bodies powerfully increased by heat, and in others diminished, yet without our perceiving any accompanying essential electrical difference, either in the bodies or in the changes occasioned by the electricity conducted.

3. A number of bodies insulating electricity of low intensity when solid, conduct it very freely when fluid, and are then decomposed by it.

4. There are many fluid bodies which do not sensibly conduct electricity of this low intensity; there are some which conduct it and are not decomposed, nor is fluidity essential to decomposition.

5. There is but one body yet discovered (periodide of mercury) which, insulating a voltaic current when solid, and conducting it when fluid, is not decomposed in the latter case.

6. There is no strict electrical distinction of conductors which can as yet be drawn between bodies supposed to be elementary and those known to be compounds.

The experiments of Dr Faraday with ice, in which it

Phenomena and Laws.

appeared that electricity of exalted intensity passed through it, while it completely stopped voltaic electricity, confirms the observations of M. Delarive on the relation between the conducting power and the quantity of electricity which traverses the conductor; and the phenomena seem to indicate that the electric fluid or matter may consist, like solar light, of different parts possessing different powers of conductibility and other properties, which may facilitate or obstruct their passage through solid, fluid, or gaseous bodies. An electric current, composed of different currents, may have some of its component currents entirely stopped by some bodies, while other currents are transmitted with the greatest facility, in the same way as certain rays both of light and heat are entirely absorbed by coloured bodies, while other rays are copiously transmitted. Non-conductors, like black bodies, stop every electrical current. Perfect conductors, like colourless transparent bodies, may transmit every electrical current, or absorb a small portion of all of them in an equal degree; while there may be imperfect conductors, which, like coloured bodies, stop some currents and transmit others. If this should prove correct, two bodies which, when used separately, conduct electricity, would be insulators when joined so as to transmit the electricity in succession, in the same manner as two transparent coloured bodies which separately transmit light copiously are opaque when combined, the light which each transmits being absorbed by the other.

Absorption of electricity.

Distance to which electricity has been conducted;

We have already seen that electricity was conveyed through a distance of four miles. On the ground that these experiments were made imperfectly, and that an electric charge will prefer a short passage through air to a passage of twenty or thirty feet through thin wire, Mr Singers has expressed his conviction that the results of the experiments referred to are incorrect. We are unable, we confess, to appreciate the reasons on which this opinion is founded; but, even if they have any force, the original fact has been more than confirmed by Mr F. Ronalds, who erected at Hammersmith an electrical telegraph on which the inflections of the wire composed *one continuous length of more than* EIGHT *miles*. "When a Canton's pith-ball electrometer was connected with each extremity of this wire, and it was charged by a Leyden jar, both electrometers appeared to diverge suddenly at the same moment; and when the wire was discharged by being touched with the hand, both electrometers appeared to collapse as suddenly. When any person took a shock through the whole length of wire, and the shock was compelled to pass also through two insulated inflammable air pistols, one connected with each extremity of the wire, *the shock and the explosion seemed to occur simultaneously*. But when the shock was compelled to pass through the gas pistols, and any one closed his eyes, it was *impossible* to distinguish more than one explosion, although both pistols were discharged. When people did not look at the pistols, and when I sometimes charged only one highly, and sometimes both lowly, they could never guess, except by mere chance, whether one or both were fired. *Thus, then, three of the senses, namely, sight, feeling, and hearing, seemed to receive absolute conviction of the instantaneous transmission of electrical signs through my pistols, my* EIGHT *miles of wire, and my own proper person*."[1]

through telegraphic wires and submarine cable.

These results, interesting as they were some years ago, sink into insignificance compared with the extraordinary facts with which the operations of the electric telegraph have made us acquainted. The transmission of electricity through hundreds of miles of wire passing through the atmosphere, and through 300 miles of submarine wires stretching from Dover to Ostend, are facts familiar to everybody. Experiments have not yet been made to ascertain the distance to which a given electric force will pass through wires of different lengths and diameters, when insulated and uninsulated; but from the opportunities which we now possess from the extension of the telegraphic system, we may expect that very interesting results will ere long be obtained. The completion of the electric current, too, through immense distances in the ground and in water—as first noticed through distances of a few miles by Sir William Watson—is a remarkable fact which requires farther investigation in reference to Mr Lindsay's proposal of a transmarine telegraph.[2]

Velocity of electricity.

Various attempts have been made to measure or rather to estimate the velocity of electricity in passing along a conducting wire. Sir William Watson considered it to be less than any measurable portion of time in passing through a distance of 12,276 feet or 2¼ miles, or as he expressed it, that it passed instantaneously through such a length of wire. The first attempt to measure the velocity of electricity by any accurate method, was made by Mr Wheatstone, who, by an ingenious apparatus, concluded that it moved along a copper wire at the rate of 288,000 miles in a second. According to the experiments of MM. Fizeau and Gonelli, it moves through a similar wire at the rate of 112,680 miles per second, and through an iron wire at the rate of only 62,000 miles. Professor Mitchell of Cincinnati found its velocity to be only 28,500 miles in a second; and Professor Walker of the United States only 16,000 miles through an iron wire. Along the copper wire between Greenwich and Edinburgh, its velocity was only about 6500 miles per second; and along the copper wire (a great part of which was plunged in water), between Greenwich and Brussels, only 2300 miles in a second. Dr Faraday ascribes the enormous differences in these measures, to a certain extent, to the influence of the conducting bodies in contact with the wire; and he is of opinion that the velocity may vary more than the hundredth of its velocity according as the electricity passes through a wire immersed in water, or through one suspended at a great distance from the ground, or one carried along a solid conducting wall. These experiments on the electric telegraph wires confirm, in a remarkable degree, the sagacious anticipation of Dr Faraday, who announced, at the time of the publication of Wheatstone's experiments, that *the velocity of electricity in the same metallic* would vary much "with the tension or intensity of the first urging force, which tension is charge and induction. So if the two ends of the wire in Professor Wheatstone's experiment were immediately connected with two large insulated metallic surfaces exposed to the air, so that the primary act of induction, after making the contact for discharge, might be in part removed from the internal portion of the wire at the first instant, and disposed for the moment on its surface, jointly with the air and the surrounding conductors, then I venture to anticipate that the middle part would be more retarded than before; and if these two plates were the inner and the outer coating of a large jar or a Leyden battery, then the retardation of that spark would be still greater."[3]

Experiments of Faraday.

These interesting anticipations have been proved by a series of fine experiments made by Dr Faraday with the telegraphic lines of wire between London and Manchester. This wire, which is 1400 miles long, is buried in the ground, and consists of four wires, each 350 miles long. At the Manchester station the extremities of the first and second wire were united, and also the extremities of the third and fourth. At the London station a galvanometer was attached to the end of the first wire, the ends of the second and third wire were united by a second galvanometer, and at the end of the fourth wire was attached a third galvanometer commu-

[1] *Description of an Electrical Telegraph, &c.*, p. 4. Lond. 1823.
[2] See *North British Review*, No. xliv., p. 547.
[3] *Experimental Researches, &c.*, vol. i., No. 1, 1833.

Phenomena and Laws.

nicating with the ground. The first galvanometer was then put in connection with one of the poles of a pile, the other pole of which communicated with the ground. The needle of the first galvanometer immediately deviated, but that of the second did not move till after a sensible interval, and that of the third a little later still. About two seconds elapsed before the electric current was propagated from the first to the third galvanometer. Upon cutting off the communication between the first galvanometer and the pile, the needle of the first galvanometer immediately returned to zero, that of the second was not displaced till after a short time, and that of the third still later. By establishing or cutting off the communication between the first galvanometer and the pile, at intervals not very distant, we may in some degree project along the wire successive electric waves, so that the three galvanometers are traversed at the same instant with three different waves. Finally, if after cutting off the communication between the pile and the first galvanometer, we connect this galvanometer with the ground, the electricity with which the wire is charged will discharge itself simultaneously by its two extremities, so that the first and the third galvanometer are traversed by electric currents in opposite directions. With a telegraph wire suspended in the air, the three galvanometers deviate from and return to zero almost exactly at the same instant.

Dr Faraday on the velocity of electricity.

Mr Bain's telegraph.

Similar results were obtained by Dr Faraday by the beautiful experiment of using three of Bain's telegraphic apparatuses, in which messages are written chemically by lines or strokes of different lengths. When the circuit was interrupted, as before, at intervals not very distant, the apparatus nearest the pile traced a discontinuous line, composed of full and distinctly separated strokes, thus, — - — — produced during the intervals when there was a communication with the pile. The second and third apparatus, on the contrary, gave a line composed of full and distinct strokes united by very delicate ones, thus, ———————; which showed that the electricity took a certain time to escape from the wire. When the interruptions of the current are very near one another, the fine lines become equal to the full ones, and a continuous line ——————— is produced.

Sect. V.—*On the Electric Spark.*

Electric spark.

Since the discovery of electric light by Otto Guericke and Dr Wall, the subject has attracted the particular attention of philosophers. In exciting a glass tube, or in working an electrical machine in the dark, sparks and streams of light are distinctly visible; but the phenomenon is best seen when the knuckle or a brass ball is brought near to an electrified conductor. A bright light, called the *electric spark*, passes from the conductor to the knuckle or ball, and exhibits a great variety of phenomena, varying with the nature and intensity of the electricity, and with the form, magnitude, distance, and nature of the bodies between which it passes.

The electric spark is produced by the action of the positive electricity in the conductor, upon the neutral electricity in the knuckle or ball that receives the spark, the former decomposing the latter. When the attraction between the two electricities is sufficiently powerful to overcome the resistance of the air, the two fluids on the knuckle recombine with a noise, accompanied by a brilliant spark like the forked lightning in a thunderstorm. This mode of discharging the electricity of conductors is called the *disruptive discharge*, and the distance of the bodies between which it is made is called the *striking distance*.

Form of the spark.

Exp. 1. Having screwed into the prime conductor a brass ball about two inches in diameter, and projecting about three inches, electrify the conductor positively, and hold another ball near the first. Long ramified zigzag sparks will pass between the two balls, as shown in fig. 6, where *pos.* is the *positively* electrified ball, and *nat.* the one held in the hand in a natural state of electricity. If the ball on the conductor is very small, the spark will become a faint divided brush of light. If the ball on the conductor is electrified negatively, the spark will be as shown in fig. 7, clear, straight, and more luminous. If one of the balls is *positively*, and the other *negatively* electrified, the forms shown in fig. 6 and 7 will be combined, as in fig. 8. When, in this last experiment, the distance of the balls is not too great, the positive zigzag spark will strike the negative straight spark about one-third of the length of the latter from its point, the other two-thirds becoming very luminous. Sometimes the positive spark strikes the negative ball at a distance from the negative spark.

Plate CCXXIII., figs. 6, 7, 8.

Exp. 2. If two conductors P, M, fig. 9, three-fourths of an inch in diameter, and having spherical ends, are placed parallel to each other, at the distance of two inches, so as to have their ends pointing in different directions six or eight inches asunder; then, if P is positively electrified, its spark will strike the other conductor M in its natural state, as in fig. 9. If M is electrified negatively, and P connected with the earth, the conductor M will send the negative spark to P, as in fig. 10; and if the conductors have opposite electricities, the positive spark will appear at one end, and the negative at the other, as shown in fig. 11.

Fig. 9.

Fig. 10, 11.

Exp. 3. Upon the brass stem *bc*, fig. 12, having a fine point at *c*, place a brass ball A, about three inches radius, so that the point *c* can be protruded to any distance beyond the ball, or be drawn within it, as shown in the figure. In this last state the point produces no effect and the zigzag spark appears between the balls.

Fig. 12.

In proportion, however, as the point is protruded, its transmitting power is increased, and it may be made to have the same effect as any ball, from the smallest size to one three inches radius. When the point projects to a particular distance, it acts as if no ball were present.

Exp. 4. Hold an insulated sheet of paper at a small distance from a *positively* electrified conductor, and a beautiful star with distinct radiations will be thrown upon the paper. If the conductor is *negatively* electrical, a cone of rays, with its base on the paper and its apex on the conductor, will replace the star.

Exp. 5. If the point of a needle is presented to a positively electrified conductor in the dark, the point will be illuminated with a star; but if the conductor is *negative*, the needle will exhibit a pencil or brush of light.

The following experiment illustrates the effect of distance on the spark.

Exp. 6. Fix a sharp-pointed wire to the end of the prime conductor, and having electrified it positively, hold an uninsulated ball of metal very near the metallic point; a succession of small and *brilliantly white* sparks will pass between them. The white colour will tend to red as the distance of the ball and the point is increased, and at a certain distance the sharp explosions will cease, and a feeble violet light will diverge from the extremity of the point, covering with its base the nearest half of the sphere.

Influence of distance on the spark.

The influence of the form of the body upon the spark which it gives is considerable. Professor Hildebrand of Erlang found that an obtuse cone with an angle of 52° gave a much more luminous spark than one with an angle of 36°, and he found that the parabolic rounding of the summit, or slight inequalities of surface, are particularly advantageous in the production of a strong light. The influence of points on the spark has been already described.

Influence of form on the spark.

The nature of the body by which the spark is taken exercises also an influence upon its magnitude and its colour. Professor Hildebrand made some interesting experiments on this subject. The pieces of metal had a

Influence of substance on the spark.

Phenomena and Laws.

conical form, and of the same shape and size. When they were fixed in the same manner at the end of an insulated conductor, the sparks which they yielded differed much in extent. The following table exhibits the results of these experiments, the metals at the head giving the greatest sparks.

Regulus of antimony.	Sulphuret of copper.	Lead.
Gold.	Tin.	Steel.
Silver.	Zinc.	Tempered steel.
Brass.	Iron.	

When the spark is *white* by taking it with a metallic body, it will under the same circumstances be *violet* if taken with the finger. If the spark is taken with ice or water, or a green plant, its light will be red; and if it is taken with an imperfect conductor, such as wood, the light will be emitted in faint red streams.

Influence of the medium on the spark;

The medium through which the spark is transmitted exercises also a remarkable influence on its colour and form. A spark capable of passing through only half an inch in common air, will pervade six inches of the Torricellian vacuum. The apparatus used by Sir H. Davy for examining the influence of a vacuum, &c. is shown in fig. 13, where ABC is a bent glass tube, A the wire for communicating electricity, D the surface of quicksilver or fused tin for producing a vacuum, B the tube to be exhausted by the stop-cock C, after being filled by means of the same stop-cock when necessary with hydrogen, and EF the moveable tube connected with the air-pump. Sir H. Davy found, that in all cases when the mercurial vacuum was perfect, it was permeable to electricity, and rendered luminous either by the common spark or the charge of a Leyden jar. The intensity of these phenomena varied with the temperature. When the tube ABC was very hot, the electric light appeared on the vapour of the mercurial vacuum of a bright green colour, and of great density. As the temperature diminished it lost its vividness. At 20° below zero of Fahrenheit it was perceptible only in considerable darkness. When the minutest quantity of rare air was introduced into the mercurial vacuum, the colour of the electric light changed from *green* to *sea green*, and by increasing the quantity, to *blue* and *purple*. At a low temperature the vacuum became a much better conductor. A vacuum above fused tin exhibited nearly the same phenomena. At temperatures below zero the light was yellow, and of the palest phosphorescent kind, just visible in great darkness, and not increased by heat. When the vacuum was formed by pure olive oil, and by chloride of antimony, the electric light through the vapour of the chloride was more brilliant than that through the vapour of the oil; and in the last it was more brilliant than in the vapour of mercury at common temperatures. The light was of a *pure white* with the chloride, and of a *red* inclining to *purple* in the oil.

Plate CCXXIII, fig. 13.

and of temperature.

Colours of the spark.

Upon rarefying the air five hundred times in a glass vessel a foot long and eight inches in diameter, Mr Smeaton made the vessel revolve rapidly on a lathe, at the same time exciting it with the palm of his hand. A large quantity of lambent flame appeared under his hand, *variegated with all the colours of the rainbow*. Though the light was steady, every part of it was continually changing colours.

In carbonic acid gas the light of the spark is white and brilliant, and in hydrogen gas it is red and faint. When the sparks are made to pass through balls of wood or ivory they are of a *crimson* colour. They are *yellow* when taken over powdered charcoal, *green* over the surface of silvered leather, and purple from imperfect conductors.

Experiments on electrical light.

The following experiments on the spark and electrical light are both instructive and entertaining.

Exp. 1. Cover a metallic wire with silk, and form it into a close flat spiral of not more than twenty-four revolutions, with the different coils in contact. When a considerable electric charge (of about two square feet of coated surface) is passed through it, a vivid light resembling that of an artificial fire-work will be seen, even in daylight, originating in the centre of the spires. M. Nobili considers this light as electro-magnetic light, on account of its relation to the magnetic state of the spiral, and as similar to the aurora borealis.

Exp. 2. Take a bound book covered with rich gilding, and, holding it in one hand, bring it near the prime conductor. The spark will immediately shoot along the gilding in sparks or streams of green light, and will exhibit the pattern in the dark, and enable the observers to read the gilt title of the book.

Exp. 3. In the preceding experiment the letters themselves were covered with a metallic film; but if we construct an apparatus like that in fig. 14, on which the word LIGHT is left blank in a continuous line of narrow tinfoil pasted upon glass, and forming several parallel lines, and apply the ball B to an electrified prime conductor, the word LIGHT will be seen in the dark in luminous letters formed by the electric spark passing from one piece of tinfoil to the opposite one. Figures of all kinds may in a similar manner be delineated electrically.

Plate CCXXIII, fig. 14.

Exp. 4. Another beautiful experiment, called the *luminous spiral tubes*, is shown in fig. 15, where a number of round pieces of tinfoil are pasted spirally upon four glass tubes *a*, *b*, *c*, *d*, fixed on a board round a central rod of glass AB, supporting horizontally a wire *mn* with brass balls, and capable of turning round the pivot A. Electrify by sparks the wire at A, and pushing the wire *mn* gently round, the ball at the top of each tube will receive electricity from *a* or *b*, and a brilliant line of light will appear to surround each ball in succession, in consequence of the spark appearing between each of the small circles of tinfoil.

Luminous spirals, fig. 15.

Exp. 5. The *luminous jar* shown in fig. 16 is a still more beautiful experiment. In one which is now before us, fifty-five squares of tinfoil an inch square, and each perforated with a hole four-tenths of an inch in diameter, are pasted in five rows on the outside and inside of a glass jar AB, fig. 16, about five inches in diameter and eleven inches high. The diagonals of the square pieces are placed horizontal and vertical, and their points or angles are separated by about one-twelfth of an inch. The rows of the tinfoil squares are similarly placed on the inside of the jar, with this difference only, that their horizontal points nearly touch one another at the centres of the circular holes of the outer squares. The brass ball A communicates with the inside squares by a wire, and when it is charged by the prime conductor, a hundred and ten sparks will be seen at once in a horizontal, and a hundred and ten in a vertical direction, when the jar is discharged.

Luminous jar, fig. 16.

Exp. 6. Take a glass cylinder three inches wide and three feet long, so fitted up that a brass plate may be let down from the top of the cylinder, so as to stand at any distance from another brass plate fixed at the bottom of the cylinder. When the cylinder is exhausted of air in the usual manner, and the upper plate communicates with the prime conductor, and the lower one with the ground, a brilliant sheet of light will pass from the upper to the lower plate. If the distance of the plates is ten inches, and if the charge of a Leyden jar is made to pass from the one to the other, a continuous body of the most brilliant fire will pass between them.

The course taken by the electricity in the disruptive discharge is always in the line of least resistance, or that in which there is the smallest amount of insulating power; and if a number of bodies of different degrees of conducting power lie in its path, it will find its way through some and avoid others, as if it had the power of choosing the easiest and shortest line. The annexed drawing, taken from an experiment made by Sir W. Snow Harris, is an excel-

Phenomena and Laws.

lent illustration of this interesting property. In figure A, *a*, *b*, *c*, *d*, &c., are detached fragments of leaf gold laid down on a sheet of paper. A charge of about ten square feet of coated glass is then passed through this interrupted circuit from P to N, and the effect produced is shown in fig. B, where the shaded parts are the portions of the leaf gold burned up, and marking the path of the electricity, or the line of least resistance, P, *b*, *d*, *e*, *f*, *g*, *h*, *i*, N. The pieces *c* and *k* are left untouched, and also the white portions of the other pieces, while the portion *h* and N are wholly destroyed. This experiment finely illustrates the course taken by the lightning which strikes buildings and passes through the apartments of a house.

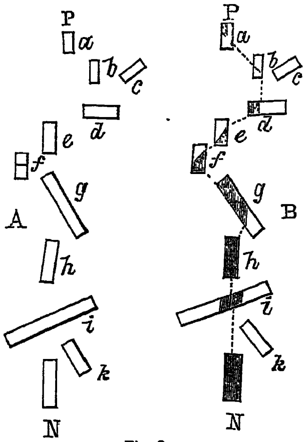


Fig. 2.

From ordinary electrical machines, sparks ten or twelve inches long have been obtained in rapid succession, by affixing a ball about two inches in diameter to the conductor, and projecting three or four inches from it, and then presenting to it a large ball connected with the earth or with the opposite conductor. When the discharge is made from a single jar, the striking distance is generally about an inch; but if we arrange a number of equal and similar jars, as shown in the annexed figure, where the course of the

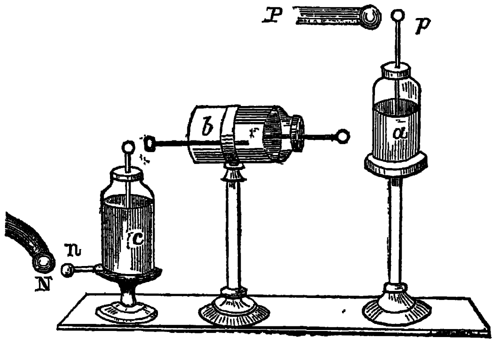


Fig. 3.

discharge is *P*, *p*, *a*, *b*, *c*, *n*, N, we obtain a long striking distance between the outer coating of the last jar and the knob of the first. Professor Dove of Berlin has shown that when such a succession of positive and negative surfaces is used the length of the spark increases with the square of the number of jars. If the jars are charged separately and equally, as suggested by Mr Baggs, and placed quickly as above directed, very near one another, but so as not to be in contact, a spark of great length and brilliancy will be produced.

Convective discharge.

When the electricity is discharged by pointed conductors, Dr Faraday has given it the name of the *convective* or *carrying discharge*, which consists in the motion of charged particles either of insulating or conducting matter from place to place.

Conductive discharge.

Another species of discharge, called the *conductive discharge* by Dr Faraday, takes place when the electricity is carried off by the intervening dielectric communicating their forces either rapidly as in the metals, or slowly as in spermaceti, air, glass, shell-lac, &c.[1]

A very pretty experiment has been made to show the short duration of the light of a spark. The experiment was, we believe, first made by Mr Wheatstone by painting three unequal sectors of a circular disc with the three prismatic colours, *yellow*, *red*, and *blue*. When it is made to revolve rapidly round its centre, the colours are mixed and form a grayish white tint. But if we darken the room and illuminate the revolving disc with an electric spark, the three colours will be distinctly seen. During the brief duration of the flash there was not time for the colours to make a combined impression on the retina and obliterate their individual action. This very interesting effect is not owing to the velocity of the electric light, but to its short duration, and may be produced by the flash of a copper cap or even of gunpowder. If we inclose a bright light, or even a candle, in a box having an aperture in one of its sides prolonged so that it can pass instantaneously before the light, and allow it to fall on the revolving disc, the same effect will be obtained.

This experiment is much more interesting when we use the revolving discs of the phenakistoscope, or when we place upon any one of them a few large and distinct letters. If a light of short duration is thrown upon the revolving discs when every figure or word is obliterated, the figures and words will be distinctly seen.

In like manner a current of fluid or of solid particles discharged with such a velocity as to appear a continuous stream, would if illuminated in the dark be exhibited in separate and distinct portions. The same effect is produced in daylight or any other light by viewing through revolving apertures a continuous stream of this kind, or the shoot flame of a coal fire, all of which derive their continuity from the duration of the impression made on the retina by the successive action of their different portions.

SECT. VI.—*On the Nature and Origin of Electrical Light.*

Nature of electrical light. Wollaston.

Dr Wollaston seems to have been the first person who made an accurate examination of electric light, and the following is all that he has published as the result of his experiments. "When the object viewed is a *blue* line of electric light, I have found the spectrum to be separated into several images; but the phenomena are somewhat different from the preceding (viz. the spectrum of the blue portion of the flame of a candle). It is, however, needless to describe minutely appearances which vary according to the brilliancy of the light, and which I cannot undertake to explain."[2] M. Biot, in speaking of electric light, remarks, "that if we look through a prism at the sparks which pass between two conductors oppositely electrified, we shall find all the colours which compose common light."[3]

Biot.

Fraunhofer.

M. Fraunhofer examined the electric spark in a more philosophical manner. In order to obtain a continuous line of electrical light, he brought to within half an inch of each other two conductors, and united them by a very fine glass thread. One of the two was connected with an electrical machine, and the other communicated with the ground. In this manner the light appeared to pass continuously along the fibre of glass, which consequently formed a fine and brilliant line of light. When this luminous line was expanded by refraction, Fraunhofer saw that, in relation to the lines of its spectrum, electric light was very different both from the light of the sun and from that of a lamp. In this spectrum he met with several lines partly very clear, and one of which in the green space seemed very brilliant compared with other parts of the spectrum. He saw in the orange another line not quite so bright, which appeared to be of the same colour as that in lamp-light spectra; but in measuring its angle of refraction, he found that its light was much more strongly refracted,

[1] Faraday's *Electrical Researches*, vol. i. p. 418.

[2] *Phil. Trans.*, 1802.

[3] *Traité de Physique*, tom. ii., p. 459.

Phenomena and Laws.

and nearly as much as the yellow rays of lamp light. In the red rays towards the extremity of the spectrum, he saw a line of very little brightness, and yet its light had the same degree of refrangibility as the clear line of lamp light. In the rest of the spectrum he saw other four lines sufficiently bright.[1] In a subsequent paper read at Munich in 1823, Fraunhofer observes, that, by means of the large electrical machine in the cabinet of the Academy of Munich, he obtained a spectrum of electric light, in which he recognised a great number of light lines, and that he had determined the relative places of the lightest lines, and the ratios of their intensities. What these positions and ratios were we have no means of knowing, as we believe that this distinguished philosopher has not given them to the public.

Brewster.

The nature of electric light has been more recently examined by Sir David Brewster. He had long ago shown that the light of electricity was refracted singly and doubly, and polarized exactly like all other light; but his recent observations were made, like those of Fraunhofer, on the dark and luminous lines which appear in the spectrum formed from it by a prism. Fraunhofer examined the electric light produced in the manner he has described. In this *species* of electric light Sir David Brewster observed the lines described by Fraunhofer, and also its remarkable difference from that of the sun and a lamp in relation to the fixed lines of the spectrum. This difference he found to arise from the fact that certain *colorific* rays which exist in solar light do not exist in electrical light, though, in some parts of the spectrum, other rays of equal refrangibility are visible. The extreme red space, for example, is wanting, and, generally speaking, much of the red and yellow light. Hence the light of the electric spectrum is *green* at a line or point of a given refrangibility, where it is *yellow* in the solar spectrum. These facts confirm in a remarkable manner the discovery that the spectrum consists of three superimposed spectra of blue, yellow, and red light, of equal lengths,[2] and receive from that discovery a complete explanation.

Sir David Brewster examined electric light of various colours, and produced under different circumstances, and he found it to differ in its composition in a very remarkable manner, each variety of electric light varying in the number, intensity, and position of its bright and defective rays. One species of electric light is as different from another as the coloured lights produced in the flame of alcohol in which different saline substances have been dissolved. It would require almost the lifetime of an individual to examine and make drawings of this class of phenomena while the light passes from a violet, through blue, green, yellow, and red, up to white light. The bright lines which occur in the green space have a most singular appearance. They shine, in reference to the rest, with the metallic brilliancy of silver; and each successive spark, obtained under nearly the same circumstances, will often present to us these lines under different intensities and characters.

Origin of electrical light.

It has been the general opinion of philosophers that the electric spark was the electric fluid itself, or, as Biot expresses it, "a modification of electricity itself, which had the faculty of becoming light at a certain degree of accumulation." This eminent writer, however, considered this opinion as erroneous, and has devoted a whole chapter to prove that electric light has the same origin as the light disengaged from air by mechanical pressure, "*and that it is purely the effect of the compression produced on the air by the explosion of electricity.*" In order to establish this

Theory of M. Biot.

theory, M. Biot has stated, on the authority of several experiments, "that the intensity of electric light depends always on the ratio which exists between the quantity of electricity transmitted and the resistance of the medium; and he has shown, by an experiment with Kinnersley's air thermometer, "that at each spark the air of the cylinder, driven by the repulsive force, presses on the surface of mercury, which rises suddenly in the small tube, and falls back again immediately after the explosion." "This indication," he adds, "proves the separation produced between the particles of the mass of air where the electricity passes; and from what we know of its extreme velocity, it is certain that the particles exposed immediately to its shock ought in the first moment to sustain individually all the effect of the compression. They ought, then, from this cause alone to disengage light as when they are subjected to any other mechanical pressure. *Thus one part at least* of the electric light is *necessarily* due to this cause; and this being the case, there is no experiment which can lead us to conjecture that it is not all due to this cause."[3]

These arguments, whatever may be their weight, carry no conviction to our mind. When we possess two series of accurate experiments, by which it is proved that light produced by mechanical pressure in air and gases, of different bulks, and of different degrees of temperature, rarefaction, and condensation, has the same colour, the same composition, and the same general character, as the light produced by electricity in passing through air and gases under the very same circumstances, we shall regard this theory as deserving of consideration.

M. Biot, anticipating the objection that electrical light is produced in the best vacuum, replies, that a vacuum such as we can produce is filled with vapours and gas, and that the barometric one is filled with mercurial vapour. Still, however, the light produced is not produced by air, and it should be shown that mechanical pressure is capable of eliciting light in such a vacuum; at all events, the light ought to bear some proportion to the degree of rarefaction, whereas Sir H. Davy obtained a bright light in the best vacuum with mercury, and the same light in the best vacuum with melted tin.

Anticipating another objection from the fact that the electric spark, when intense, passes through water, M. Biot gives a double reply, 1*st*, that the water itself is probably compressible, and therefore, we presume, gives out light during its compression; and, 2*dly*, that water always contains in combination a certain quantity of air, which may also contribute to the result. It would be desirable, therefore, to ascertain if water, and water with much air, give out light by mechanical compression.

In explaining the fact that electrical light is *violet* when the electricity is *feeble*, and of a *brilliant whiteness* when it is produced by a violent discharge, M. Biot remarks that "this variation of tints discloses still further the origin of the light; for we observe it in substances which burn according as the combustion is slow or rapid; that is to say, according as the oxygen of the air which this combustion absorbs is more or less rapidly condensed. The light which sulphur disengages when it begins to inflame is as *violet* as that of feeble electricity, but that of sulphur in vigorous combustion is *white*." The views upon which this argument is founded are themselves hypothetical. It is by no means made out that the colour passes from *violet* to *white* as the intensity of combustion increases; and, in the very case of *sulphur* referred to by M. Biot, Sir John Herschel has proved, that when it is inflamed in a white hot crucible, it gives out neither *blue*, *green*, nor *red* rays, but solely *homogeneous yellow light*, of a very definite refrangibility, and which contains few of the elements of *white* light.

Sir H. Davy's theory.

A more philosophical view of the probable origin of electrical light has been hinted at by Sir Humphry Davy, in

[1] Fraunhofer, *Bestimmung*, &c., 1814–15, p. 29.

[2] *Edin. Trans.*, vol. xii.

[3] *Traité de Physique*, tom. ii., p. 463.

Phenomena and Laws.

his paper of 1822, already quoted. "The circumstance," says he, "that the intensity of the electrical light in the mercurial vacuum diminishes as it is cooled to a certain point, when the vapour must be of infinitely small density, and is then stationary, seems strongly opposed to the idea that it (electrical light) is owing to any permanent vapour emitted constantly by the mercury. The results with tin must be regarded as more equivocal; because, as this substance cannot be boiled in vacuo, it may be always suspected to have emitted a small quantity of the rare air or gas to which it has been exposed; yet, supposing this circumstance, such gas must be at least as highly expanded as the vapour from cooled mercury, and can hardly be supposed capable of affording the *dense* light which the passage of the charged Leyden phial through the vacuum produces.

"When the intense heat produced by electricity is considered, and the strong attractive powers of differently electrified surfaces, and the rapidity of the changes of state, it does not seem at all improbable that the superficial particles of bodies, which, when detached by the repulsive power of heat, form vapour, may be likewise detached by electrical powers, and that they may produce luminous appearances in a vacuum, free from all other matter, by the annihilation of their opposite electrical state.

"In common cases of electrical action, the quantity of the heat generated by the annihilation of the different states depends upon the nature of the matter on which it acts; and in cases where electrical sparks are taken in fluids, vapour or gas is always generated; and in elastic fluids, the intensity of the light is always greater the denser the medium."[1]

Discoveries of Dr Fusinieri.

About the same time that Sir H. Davy was occupied with these researches, Dr Fusinieri was engaged in those beautiful experiments on electric light which have added so greatly to our knowledge of its nature and origin. The results of these experiments, which seem to have been commenced in 1821, were published in successive years. In 1825 there appeared in the Journal of Pavia a most interesting communication, of which the following is a brief abstract, relative to the transport of ponderable matter in the electrical discharges of ordinary machines; and, in 1831, another of equal importance on the transport of ponderable substances by lightning.

Dr Fusinieri has proved that the electric spark which issues from a *brass* conductor, and traverses air, contains brass in the state of fusion, and incandescent molecules of zinc.

When the spark issues from a globule of *silver*, it contains in its passage through air silver in fusion, and incandescent molecules of the same metal.

If the spark which issues from silver traverses a plate of copper, the silver which it contains passes also through the copper in perforating it, and in traversing even a space of several centimeters, if the passage is oblique from the one surface to the other.

In this passage a portion of the transported silver is detained in the aperture which is made in the copper, and another portion follows the current, and penetrates the ball which receives the electric spark.

When the electric spark issues from a ball of *gold*, and passes into air, it contains gold in a state of fusion, and also incandescent molecules of gold.

If the spark from *gold* traverses a plate of *silver*, the gold contained in the spark traverses the plate in piercing it; and in traversing a space of several centimeters in the silver, if the direction of the passage is oblique, a part of the transported gold remains in the silver, and spreads itself over the two surfaces of the plate, and another part accompanies the electric current, and penetrates the ball which receives the spark. The gold spread over the polished surface of the silver appears in the form of a thin circular stratum upon the surface where it enters, and upon the surface where it leaves the plate. The very same result takes place if the spark passes from brass to silver.

These strata or metallic spots are so exceedingly thin, that after a certain time they are volatilized and disappear.

Dr Fusinieri also found that in each passage of the spark there was an opposite and reciprocal transport of the two metals. In a spark from silver to copper, part of the copper is transported to the silver, as well as the silver to the copper; and the same reciprocal transfer takes place in a spark from gold to silver.

Accompanying this reciprocal transport, there are two strong and opposite percussions produced by the transported metal, one at the point where it is detached, the other at the point where it enters the other metal. These two percussions show themselves, by two opposite cavities which contain the same metal, in such a state as to indicate fusion. Here the transported metal exerts two pressures in opposite directions.

In passing from one metal to another, the electric current leaves the first metal in the second, and takes with it a small quantity of the second.

The electric spark which issues from a metal into air contains a group of molecules, the most central of which are in a state of simple fusion, and the exterior ones are in a state of greater or less combustion, from their contact with oxygen, according as the metal is more or less oxidable; and the matter thus contained in the spark is endowed with a force of spontaneous expansion.[2]

From these highly interesting facts Dr Fusinieri draws the following important conclusions respecting the nature and origin of electric light. 1. The electric spark is not formed by a pure fluid, or by any imponderable fluid. 2. The heat and light of the spark proceed from the ignition and combustion of the particles of ponderable matter. 3. The presence of air produces on the spark two distinct effects, the one to hinder its free expansion in space, the other, by supplying oxygen, to promote the combustion of the exterior molecules of the group, while the central molecules are luminous from ignition and fusion alone. 4. In gases without oxygen, the material molecules which compose the spark ought to be simply in a state of incandescence and fusion, without any combustion of the exterior particles of the group, in the same manner as this takes place for the central parts of the spark in common air. 5. In gases deprived of oxygen, as well as in a vacuum, the molecules which compose the spark ought to be incandescent; that is, in a state which fits them to emit light and heat; a phenomenon of the same kind as those inflammations which chemical experiments prove to take place even without the aid of oxygen, in so great a number of other combinations, or even without there being any new combinations, by the sole effect of division of parts.

In a later memoir on the transport of ponderable substances by lightning, published in the *Ann. delle Scienze del Regno Lomb. Veneto* for 1831, Dr Fusinieri has shown, by a series of laborious and beautiful observations, that lightning leaves in houses and on trees traces of ferruginous and sulphureous substances which it contains; and he infers that iron exists in the clouds, having been attracted[3] from the earth, and principally from mountains, where the mines

[1] *Phil. Trans.*, 1822, pp. 72, 73.

[2] Dr Fusinieri likewise found that the electric spark obtained between the two poles of the voltaic pile, terminated either by metals or charcoal, contains also particles of these substances extremely divided, and in a state of combustion.

[3] The iron may be carried off by the lightning which issues from the ground in cases where the clouds are negatively electrified.

Phenomena and Laws.

are more abundant, and where storms generally begin to form. Hence, as Dr Fusinieri supposes, we may connect this fact with meteoric stones, and with the magnetic currents which surround the globe.

That the electric spark *is a flame*, and consists, like all other flames, of incandescent molecules in a state of minute subdivision, will, we think, be now admitted by every philosopher; and it cannot fail to be observed how singularly this result harmonizes with the varied composition of electric light of different kinds and colours, as ascertained by Sir David Brewster by means of prismatic analysis;—and from the comparison which he is making between the composition of electric light consisting of different ponderable substances, and that of flames in which the same ponderable substances exist in a state of incandescence, there is reason to expect that these two widely separated classes of phenomena may be strictly identified.

Sect. VII.—*On the Law of Electrical Attraction and Repulsion, and the Attraction of Spheres and Planes.*

Law of electrical attraction and repulsion.

It is obvious, from the simplest experiments, that the force of electrical attraction and repulsion diminishes with the distance. In the theories of Æpinus and Cavendish nothing more than this simple fact has been assumed. Newton had supposed that the forces of electricity and magnetism decreased with the cube, or some higher power, of the distance. Lord Stanhope inferred, from reasonings not very conclusive, that the law was the same as that of gravity; and Dr Robison, so early as 1769, ascertained, from more than a hundred experiments, that the repulsive force diminished according to a power of the distance whose exponent was 2·06, or very nearly as the square of the distance.

Coulomb's torsion balance.

The accurate determination, however, of the law of electrical attraction and repulsion was left to Coulomb. The apparatus which he employed for this purpose, and which is known by the name of the *torsion balance*, is represented in Plate CCXXIV., fig. 1, where ABCD is a glass cylinder, which is covered with a plate of glass AB thirteen inches in diameter. This plate is perforated with two holes *e* and *a*, the former being intended to receive a tube of glass *e*G two feet high, carrying on its upper end a torsion micrometer, consisting of a graduated circle MN, an index M, and a pair of pincers, opened and shut by a ring, for holding a slender silver wire GH, whose lower end H is also grasped by a similar pair of pincers made of copper, and about a line in diameter. Through a hole in these copper pincers there passes a horizontal needle *cd*. This needle consists of a silk thread or a straw covered with sealing-wax, but the end of it, at *d*, about eighteen lines long, is a cylinder of gum-lac. It is terminated at *c* by a ball of the pith of elder about two or three lines in diameter, and at *d* by a vertical plane of paper covered with turpentine. A circular band of paper EF, divided into 360°, is pasted round the cylinder on a level with the needle, and at the hole *a* there is introduced a small cylinder *ab*, the lower end of which, made of gum-lac, carries another ball *b* of the pith of elder. The instrument is adjusted when a line passing through the centre of the silver wire GH at P passes also through the centres of the balls *b* and *c*, and points to the zero of the graduated circle EF.

Plate CCXXIV., fig. 1.

Law of the repulsive force. Fig. 2.

Having fixed a brass pin BC, fig 2, with a large head B, into a handle of sealing-wax AC, and having electrified the ball B, Coulomb communicated its electricity to the balls *b*, *c*. They accordingly repelled each other, and the needle *cd* turned round through a certain arch. By turning, however, the micrometer button in the direction NP, he twisted the wire GH, and caused it to return to its first position, and point to the zero of the scale. When this is done, the force of torsion has been made to balance the repulsive force of the two balls *b*, *c*; so that, by comparing the forces of torsion which balanced the repulsive forces at different distances of the balls, he obtained measures of the repulsive force at these distances. When the distances were 36°, 18°, and $18\frac{1}{2}$°, he found the angle of torsion, or the force of torsion, which is proportional to the angle, to be 36°, 144°, and $575\frac{1}{2}$; that is, at *half* the distance the force is *four* times greater, and at a *fourth* of the distance the force is nearly *eight* times as great. Hence he concluded that *the repulsive force of two small globes charged either with positive or negative electricity is inversely as the squares of the distances of the centres of the globes.*

Law of the attractive force.

In applying the same method to determine the law of the attractive force which takes place between two oppositely electrified bodies, M. Coulomb met with a difficulty, arising from the attractive force increasing in a greater ratio than the force of torsion. From this cause it was difficult to prevent the balls from coming into contact, and a delay was created, during which part of the electricity had escaped. By providing against this difficulty, he obtained results which led to the conclusion *that the attractive force of two small globes, one electrified positively and the other negatively, was in the inverse ratio of the squares of the distances of their centres.*

In order, however, to confirm this result by an entirely different method, he employed the apparatus shown in fig. 3, where BC is a vertical stand of wood, carrying a horizontal arm of wood AB, divided into inches, upon which there slides another piece of wood ED, to which is suspended, by a fibre of silk *fe*, a horizontal needle of gum-lac *cd*, fifteen lines long, carrying at one end, and perpendicular to the needle, a circle of gilt paper *d*, seven lines in diameter, and at the other end a ball *c* of gum-lac. A globe of copper a foot in diameter, or a globe of paper covered with tinfoil, resting on four insulating cylinders of glass, coated with sealing-wax, is then placed upon a stand, so that it can be raised or depressed, and fixed in any position, its horizontal diameter passing through *dc*. Fig. 3.

This apparatus is adjusted by placing the globe so that, when the moveable piece E is at *zero* of the scale on BA, the centre of the circle *d* may just touch the globe. When this is done, place the piece E at three inches on the scale, so that the distance of *d* from the globe will be three inches, and then the distance of *d* from the centre of the globe will be nine inches. Let the globe be now electrified by the spark of a Leyden jar; then, if a conductor is made to touch the plate *d*, the globe will communicate to it the opposite electricity upon removing the conductor, and the globe and the plate will attract one another. Cause the needle *cd* to oscillate through an arch of about 20° or 30° from the line where the force of torsion is nothing, and observe the time in which a given number of oscillations, suppose fifteen, is performed. Repeat the very same experiment when the piece E is placed at twelve and eighteen inches on the scale; that is, when the distances of the centres of the attracting bodies are eighteen and twenty-four inches. In doing this, Coulomb obtained the following results:

Distances of centres.	Number of oscillations.	Time in which they were performed.
9	15	20
18	15	40
24	15	60

As the oscillations in the preceding experiments are produced by the attraction of the globe and plate *d*, in the same manner as the oscillations of a pendulum are produced by the force of gravity; then, since the time in which a given number of oscillations is performed is inversely as the square root of the attractive force, and if we assume that the attractive force is inversely as the squares of the distances, or 9, 18, 24, or 3, 6, 8, then it will follow that the time of oscillation is proportional to

Phenomena and Laws.

these distances. These times will consequently be 20″, 41″, and 54″, if the attractive force is inversely as the square of the distance; but by experiment the times were 20″, 40″, and 60″. The difference is, therefore, almost nothing at 18 inches of distance, but it is nearly $\frac{1}{10}$th at 24 inches. Coulomb has applied a correction to the number 54″, in consequence of the loss of electricity by the two bodies during the four minutes which the experiment occupied. He found by experiment that the action was diminished $\frac{1}{40}$th of the whole per minute, and consequently $\frac{1}{10}$th of the whole in four minutes. Hence, $\sqrt{10} : \sqrt{9} = 60'' : 57''$, a result which now differs only $\frac{1}{20}$th from 60″, the time determined by experiment. Hence it follows, that by both methods of observation, the law of action is the same for attractive as it is for repulsive forces.

We are not aware that these experiments of Coulomb have been repeated and confirmed by other philosophers. Experiments with the torsion balance and contact plane are very difficult and precarious, and it is almost impossible to estimate with accuracy the loss of electricity in the two charged conductors during the performance of the experiment.

Experiments of Sir Snow Harris.

Under these circumstances, Sir Snow Harris of Plymouth has resumed the subject, and, by new methods of observation and instruments of great accuracy, he has confirmed the law given by Coulcomb, both in the case of simply electrified conductors, and in bodies upon which given quantities of electricity have been accumulated. A more particular account of these instruments, and of the method of applying them, will be given in a subsequent part of this article.

The law of the attractive force is easily obtained when the opposed surfaces are parallel planes or rings; but in the case of spherical conductors and bodies of other forms, the conditions become more complicated. Considering the distribution of the electricity on the spheres to be uniform, and the whole force exerted to be as the number of attracting points directly, and as the squares of the distances between the respective points inversely, Sir Snow Harris has shown that *the forces between two spheres will be inversely as the distances between their nearest points multiplied into the distances between their centres.*

Harris's experiments on the attractions of spheres and planes.

In order to submit this result to the test of experiment, he used two spheres whose radius was an inch, and obtained by means of his electrical balance the following results:

Distance of Centres of Spheres.	Distance of nearest Points by experiment.	Calculated Distance of the Points in each Sphere in which the Force may be supposed to be collected.	Force in Grains.
2·2	0·2	0·664	12·0
2·5	0·5	1·117	4·25
2·8	0·8	1·496	2·25
3·0	1·0	1·732	1·75

These results confirm the law deduced from theory, and Sir Snow Harris has established its truth more completely by extending it to several new cases, the most important of which, with the deductions, are as follows:

1. Two spheres at the distances in column 1, exert the same force as two circular planes of equal areas at the distances in column 3.

2. The attractive force of two opposed conductors is not influenced by the form or disposition of the unopposed portions. The attractive force, for example, is the same, whether the opposed bodies are merely circular planes, or planes backed by hemispheres or cones. Two hemispheres also attract each other with the same force as the spheres of which they are hemispheres.

3. The force between two opposed bodies is directly as the number of attracting points, the distance being the same. Thus two circular planes of unequal diameter do not attract each other with a greater force than that of two similar areas, each equal to the lesser. In like manner, the attractive force between a ring and a circular area of the same diameter is equal to that exerted between two similar rings, each equal to the former.

4. The attractive force between a spherical segment and an opposed plane of the same curvature, is equal to that of two similar segments on each other.

Sect. VIII.—*On the Dissipation of Electricity by the Contact of Air, and by Imperfect Insulation.*

Dissipation of electricity by air.

If we place an electrified body upon a mass of gum-lac, which is the worst of all conductors, or the best insulator of electricity, we shall find that, in a certain time, the whole of its electricity has disappeared. In like manner, if we suspend the same body under the same circumstances by a long fibre, or very small cylinder of gum-lac, we shall also find that in this last case the electricity will wholly disappear in a certain time; but the time in this last case will be much longer than in the first case. If we perform the same experiments in rarefied, moist, or hot air, we shall find that the electricity disappears faster than in condensed, dry, and cold air.

In all these cases the electricity is said to be *dissipated;* and it becomes an interesting as well as a most useful inquiry to determine the separate influence of these different causes in carrying off the electricity of electrified bodies.

The only observations which we possess on this subject we owe to the ingenuity and industry of M. Coulomb.

By means of the torsion balance he determined, in four days—two in May, one in June, and the last in July—the ratio of the electric force lost per minute to the total mean electrical force of the body, the electrical density varying in the five or six experiments which were made in each day. The following were the results:—

May 28. Ratio of the Force Lost.	May 29. Ratio of the Force Lost.	June 22. Ratio of the Force Lost.	July 2. Ratio of the Force Lost.
$\frac{1}{40}$	$\frac{1}{56}$	$\frac{1}{13\frac{1}{2}}$	$\frac{1}{14}$
$\frac{1}{38}$	$\frac{1}{61}$	$\frac{1}{11}$	$\frac{1}{19}$
$\frac{1}{42}$	$\frac{1}{54}$	$\frac{1}{13}$	$\frac{1}{30}$
$\frac{1}{42}$	$\frac{1}{58}$	$\frac{1}{13\frac{1}{2}}$	$\frac{1}{19}$
	$\frac{1}{54}$		
Mean, $\frac{1}{40\frac{1}{2}}$	$\frac{1}{56\frac{3}{4}}$	$\frac{1}{12\frac{3}{4}}$	$\frac{1}{20\frac{1}{2}}$

Hence, in reference to the state of the atmosphere on the days of observation, we have

	Mean Ratio of Force Lost per Minute.	Barometer Inches.	Thermometer of Reaumur.	Hygrometer of Saussure.
May 28	$\frac{1}{40\frac{1}{2}}$	28·3	15½°	75°
May 29	$\frac{1}{56\frac{3}{4}}$	28·4	15½	69
June 22	$\frac{1}{12\frac{3}{4}}$	27·11	15¾	87
July 2	$\frac{1}{20\frac{1}{2}}$	28·2	15¾	80

Phenomena and Laws.

By examining the results for each day in the first of the preceding tables, it will appear that the ratio of the electric force to the whole force is a constant quantity during the same day, or when the air has the same degree of moisture. Hence it follows,

1st, *That the loss of electricity is proportional, in the same state of the air, to the electrical density;* from which it follows, as Coulomb has shown,

2d, *That the ratio of the force lost in a minute to the total force, is double of the ratio of the loss of intensity of each body to the total density.*

From a great number of experiments made with balls of different magnitudes, and when the quantity of electricity, as well as the electrical density of each ball, were very different, he found,

3d, *That the ratio of the dissipation of the electric force during a minute, to the total force, is uniformly a constant quantity.*

By using a globe a foot in diameter, cylinders of all lengths and magnitudes, circles of paper and of metal, &c., he found,

4th, *That when the air was dry, and the degree of electricity not great, the ratio of the decrease of the electrical density to the density itself is always a constant quantity, whatever be the form or the magnitude of the electrified body.*

By using *pith balls*, and balls of *copper* and *sealing-wax*, he found,

5th, *That the law of dissipation is not influenced by the nature of the body.*

It appears, from the second of the preceding tables, that the dissipation increases with the degree of moisture, as indicated by Saussure's hygrometer; and, by comparing the observations, he concluded,

6th, *That the diminution of the repulsive force, or, what is the same, of the electric density, is proportional to the cube of the weight of the quantity of water dissolved in a given quantity of air.* He found also,

7th, *That the dissipation of electricity increases with the temperature.*

In the course of these valuable researches Coulomb ascertained that there was no dissipation along the fibre which supported the electrified bodies which he employed; and he found also that there were other causes of dissipation, which produced effects of a considerable amount, and which yet remain to be discovered.

Effect in a vacuum.

But though electricity is thus retained on the surface of bodies by the bad conducting power of air, it is not, as might have been expected, entirely dissipated in a vacuum. M. Becquerel has proved that in a vacuum so perfect that where the atmospheric pressure is only the 25th of an inch, a body preserved its electricity for ten days; and he has more recently shown in his Treatise on Electro-Chemistry by means of a gold-leaf electroscope, that if an electrified body is placed in a perfect vacuum, at a distance from objects that could act upon it electrically by influence, such a body will preserve a certain quantity of electricity for an indefinite time.

Dissipation by imperfect insulation.

Having thus determined the laws of dissipation by the contact of air, Coulomb proceeded to inquire into the causes of dissipation along imperfectly insulating bodies. The experiments which he performed for this purpose were made on the same days with those made on the dissipation by air, so that he was able to determine by calculation the portion which was lost by aërial contact, and the portion lost by imperfect insulation.

When a highly electrified ball was suspended by a silk fibre, the dissipation of its electricity was much more rapid than it should have been by the contact of the air, and therefore a part of it was owing to the imperfect insulating power of the silk thread. But when the intensity of the electricity was diminished to a certain degree, the silk fibre was as good an insulator as the gum-lac. A cylinder of gum-lac eighteen lines long did not cease to insulate perfectly till the degree of electricity was nearly *triple* of that which is insulated by the silk fibre.

Coulomb likewise found, that when a silk thread, or hair, or any fine cylindrical electric, began to insulate perfectly, the electrical density of the body which was insulated was proportional to the square root of the length of the support; that is, if a silk fibre *one* foot long insulates perfectly when the electrical density is D, it will require a fibre *four* feet long to insulate perfectly when the electrical density is 2 D, or double.

M. Coulomb's experiments seem to have been made only with one kind of electricity. M. Biot, however, found that the dissipation was nearly the same, whether the insulated body was electrified negatively or positively.

Sect. IX.—*On the Distribution of Electricity.*

Distribution of electricity.

When any body is electrified by presenting it to the prime conductor, the electricity, though it enter at one part of the body, is obviously distributed over the whole of it, as every part of the body gives distinct indications of its new state. It becomes an interesting inquiry, therefore, to ascertain by what powers the electricity is thus distributed over the body; to determine whether it is distributed throughout the substance of the body, or only on its surface; and to discover the laws of its local distribution, whether it exists on single bodies, on two or more equal or unequal bodies placed in contact, and on bodies of different forms.

These various topics have been treated by Coulomb with that ingenuity and sagacity which distinguish all his labours; and his torsion balance is the principal apparatus which was found necessary.

In order to determine whether electricity was distributed over conductors by a repulsive force between the particles of the electric fluid, or by some affinity or electric attraction for one body in preference to another, he found, by using a pith ball and a ball of copper, that the pith ball received exactly one-half of the electricity of the ball of copper, and that the ball of copper had no more affinity or electric attraction for the electric matter than the pith ball. This experiment was varied by using a disc or circle of iron ten lines in diameter, and a paper disc of the same size. In this case also he found that the electricity was equally distributed between the two discs; and he obtained the same result by using various other substances, and performing the experiments with a large torsion balance, with globes of five or six inches diameter.

In all experiments of this kind, the two balls must be allowed to remain a short time in contact, as several seconds elapse before an imperfectly insulating ball is capable of acquiring from the other half of its electricity. When the experiment is made with circular discs, the surface of the one must be placed symmetrically on the surface of the other.

Superficial distribution of electricity.

In order to determine whether the electricity pervaded the whole substance of the conductor, or was distributed on its surface, Coulomb provided an electrometer, consisting of a small circle of tinsel, suspended by a fibre of gum-lac, which, when suspended in a cylinder of glass, is so extremely sensible that a force equal to the *sixty thousandth* part of a grain was sufficient to repel the ball of the needle through an arch of more than ninety degrees.

The conductor whose electrical state he proposed to examine was a solid cylinder of wood four inches in diameter, and pierced with several holes four lines wide and four deep. This cylinder was then supported upon an insulating stand, and electrified by sparks from a leaden jar. He

Phenomena and Laws.

then took a small circle of gilt paper called the *proof plane*,[1] one and a half line in diameter, and about the eighteenth part of a line in thickness, and he insulated it at the extremity of a cylinder of gum-lac a line in diameter.

Having electrified the tinsel of his electrometer, he brought the proof plane into contact with the surface of the electrified wooden cylinder, and upon presenting the circle to the electrometer it repelled the tinsel with great force. The proof plane was then introduced into one of the holes of the cylinder, so as to come in contact with the bottom of the hole, and rest upon it. When it was taken out, without touching the sides of the hole, and presented to the electrometer, it gave no indications of electricity. In the first case, the proof plane carried off electricity from the part of the surface which it touched; but in the second case it carried off none, so that their was no electric matter in the interior of the cylinder, even at the depth of four lines.

Experiments by Biot; Plate CCXXIV., fig. 4.

These curious results, thus established by accurate observation, may be proved by two very pretty experiments, which have been given by Biot. Let S, fig. 4, be a spheroid of conducting matter, suspended by a perfectly insulating fibre A of gum-lac. Form two cups B, C, made of gilt paper or tinfoil, or any other conducting material, so as to fit exactly the spheroid when united, and fix to each of them an insulating handle L, L of gum-lac. Electrify the spheroid S, and holding a cup in each hand by the handles L, L, apply them, as in the figure, to the surface of the spheroid. Upon withdrawing the cups, it will be found that they have abstracted from the spheroid S all its electricity, and that so completely, that it will not affect the most delicate electrometer, while the cups will be found to possess the same quantity of electricity which originally existed in the spheroid.

Fig. 5.

The other experiment of M. Biot is shown in fig. 5, where A B is an insulated cylinder, moveable round a horizontal axis, and which may be turned by the winch H, composed of several rods of glass. Around the cylinder there is wrapped a metallic ribband CD, whose extremity D terminates in a semicircle, and is attached to a silk cord F. This apparatus is made to communicate with an electroscope E, composed of two linen threads carrying two-pith balls. When the metallic ribband is electrified, the balls and the threads will diverge. Upon unrolling the metallic ribband, by pulling the silk thread F, the pith balls at E collapse, and indicate a diminution of the electrical repulsion; and if the ribband be sufficiently long, compared with the electric charge given to the apparatus, the separation of the balls may become quite insensible; but they will again diverge, and indicate an increase of electrical intensity, if we again roll up the ribband upon the cylinder.

by Faraday.

Dr Faraday has demonstrated the superficial distribution of electricity by some elegant experiments. Having made a cylinder of metallic gauze, or a trellis of iron wire with meshes not very wide, he places it on a horizontal disc of metal resting on a pillar of glass. When the interior surface of the cylinder is electrified, the electricity passes to its exterior surface notwithstanding its easy communication with the inner surface. If the cylinder is so powerfully electrified as to yield vivid sparks, a mouse or any other animal placed within it will experience no shock.

The same truth is finely demonstrated by another experiment of Dr Faraday. By means of a ring of wire AB, he forms a conical muslin bag ACB, and supports it upon a glass stand BD. When the bag is electrified, its interior surface is found by the proof plane to be entirely free of electricity; but if by means of the insulated silk thread S′ C, we pull it outside in, it will be found that the electricity has passed to the outside of the cone. In like manner, if by means of the thread C S we pull it back to its first position, we shall find that the electricity has again passed into the outer surface of the bag.

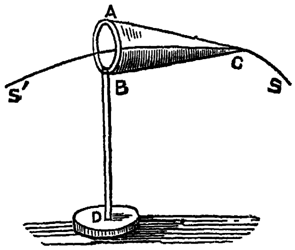


Fig. 4.

Method of measuring the distribution of electricity.

Having thus ascertained that electricity occupies the surfaces of conductors, the next point to determine is the law of its distribution in bodies of different forms, that is, to ascertain its intensity, or the electrical density, at different points of the surface.

Plate CCXXIV., fig. 6.

The following was the method used by Coulomb for this purpose: In the balance with which he made his first experiments he suspended his needle by a fine silver wire. He then took a cylinder of gum-lac, and having bent it as shown at *ced*, he attached to it a circle of gilt paper *d*, five or six lines in diameter, and the eighteenth part of a line thick. Having electrified the body whose electrical density was to be ascertained, he electrified the disc, carried by the needle by means of an insulated pin as formerly, and then touched the circle *d* with any part of the body where he wished to ascertain the electrical density. This circle was then placed in the balance, and the quantity of its electricity measured. Hence, as the quantity which the circle acquires by its tangential contact with the body is either the same as that of the point which it touches, or proportional to it, it became easy to ascertain the electrical density of different points of conductors, by touching those points with the circle *d*, and subsequently measuring its electricity. During the time, however, which elapses between different observations, a part of the electricity will be dissipated, so that an error is necessarily introduced in comparing the electrical density of any two points *a* and *b*. In order to correct this error, he proceeds thus: Having measured the electricity in *a*, he then, after an interval, suppose of three minutes, measures the electricity in *b*. He then re-measures the electricity in *a* three minutes after he measured the electricity of *b*, and the mean of these two measures for *a* will be the electrical density of *a* at the time when that of *b* was measured.

Distribution of electricity on a globe; and on the surface of a cylinder.

By the method now described Coulomb measured the distribution of electricity on a conducting sphere, and he found that the electrical density was the same on every part of it.

In a similar manner Coulomb found that the electrical density on the middle of a cylinder is to that of its extremity as 1·00 is to 2·30; that the density of the middle was to that of a point two inches from the extremity, as 1·00 to 1·25; and that the density in the middle was to that of a point situated in the hemisphere which terminated the cylinder, and one inch from its extremity, as 1·00 to 1·80. Hence it appears that the electricity is very much condensed upon the two last inches at the extremity of the cylinder, and that it varies very slightly from the middle to within two inches of the extremity.

Relative electrical densities of two globes in contact.

From various experiments, conducted in a way analogous to that already described, Coulomb obtained the following results relative to the manner in which the electrical fluid distributes itself between two globes A, B, of different diameters, after they have been placed in contact, and se-

[1] The employment of the proof plane, shown in Plate XXII., fig. 6, as used by Coulomb, has been objected to by Sir Snow Harris. M. Delarive agrees with Sir Snow that in bodies of an irregular form it may not give correct results, and proposes to use a simple electroscope with a very light ball, and having the same electricity as the body to be examined. The degree of repulsion which it experi nces at different points will be the measure of their electricity.—*Treatise on Electricity*, vol. i., p. 81.

Phenomena and Laws.

parated, so that the electricity is distributed uniformly over their surfaces.

Ratio of the Radii of the Globes. A B	Ratio of the Surfaces of the Globes. A B	Ratio of Electrical Densities. A B
1 to 1	1 to 1	1 to 1
1 ... 2	1 ... 4	1·08 ... 1
1 ... 4	1 ... 16	1·30 ... 1
1 ... 8	1 ... 64	1·65 ... 1
1 ... Infinity.	1 ... Infinity.	2·00 ... 1

In order to explain this table, we shall take the case of two globes $6\frac{1}{4}$ inches and 24 inches, which were actually used by Coulomb. The small globe of $6\frac{1}{4}$ inches having been electrified, it was touched with the other globe of 24 inches, and when they were separated, so that the electricity of each was uniformly diffused over their surfaces, it was found that the *quantity* of electricity possessed by the large globe was to that possessed by the small one as 11·1 to 1; but as the surfaces of the two globes are as 14·8 to 1, a greater ratio than the other, it follows that the two globes are not charged with electricity in a ratio as great as that of their surfaces; that is, a given area on the small globe contains a greater quantity of electricity, or has a greater electrical density, than the same area in the large globe. The electrical densities in the third column are therefore found by dividing the ratio of their surfaces by the ratio of the quantities of fluid which they contain, and the quotients will be the ratio of the densities given in the third column. Thus, in the present case, $14·8 \div 11·1 = 1·3333$, the electrical density of the small globe $6\frac{1}{4}$ inches in diameter, that of the large one of 24 inches being 1.

Such is the electrical state of two electrified globes when placed at a distance. It now becomes a curious point to ascertain how the electricity is distributed when one or more equal or unequal globes are in contact. When two equal globes are in contact, the thickness of the stratum of electricity, if it varies in thickness, or the electrical density if it is equally thick, is nothing at the point of contact, but increases from the point of contact equally in different azimuths to the opposite point of the globes, where it is a maximum. This law of increase varies with the ratio of the diameters of the globe.

Two equal globes.

In the case of two equal globes, the electrical densities at different distances from the point of contact were as follows:—

Distances from the Point of Contact.	Ratio of Electrical Densities.
0°	0
20	0
30	1
60	3·72
90	4·78
180	5·03

Two unequal globes.

When two unequal globes are in contact, the one being *twice* the size of the other, the density of the small globe was almost nothing at 30°. From 60° to 90° it increased in the ratio of 10 to 17, and from 90° to 180° in the ratio of 75 to 100.

When the one globe was *four* times the size of the other, the density of the *small one* was nothing up to 30°, from 30° to 45° it rose to 1, at 90° it was 4, and at 180° it was 5·72. The density of the *large globe* was nothing to the fourth or fifth degree from contact. From this point it increased rapidly, and from 30° to 180° it was almost uniform.

If we separate the two unequal globes, a curious phenomenon takes place. At a certain distance, which is not great, the point of the little globe which was in contact with the larger globe, and which had no electricity, now shows *negative* electricity till they are farther separated. At a certain distance the electricity becomes again nothing, and at a greater distance the same point becomes *positive*.

When the large globe is eleven inches in diameter, and the small one eight, and both positively electrified, the point of the large globe which touched the small one is always positively electrified, whatever be the distance of the two. The similar point of the small globe, however, will be negatively electrified till the distance of the two is *one* inch, at which distance the electricity becomes nothing, and beyond it it becomes positive. If the small globe is only four inches in diameter, the same phenomena take place, but at the distance of two inches and five lines.

Several equal globes.

When *six* equal globes, two inches in diameter, were placed in one line in contact, and electrified, and then examined by the torsion balance, Coulomb found that the electrical density of the *first* was to that of the second as 148 to 100, and that of the *first* to that of the *third* as 156 to 100. When twelve similar globes were similarly placed, the density of the *first* was to that of the *second* as 150 to 100, and that of the *first* to that of the *sixth* as 170 to 100. When twenty-four similar globes were similarly placed, the electric density of the *first* was to that of the *second* as 156 to 100, and to that of the *twelfth* as 175 to 100. At equal distances from the extremities of the row the electric densities were equal, and the density always least in the middle.

A globe and a cylinder.

The last series of Coulomb's experiments which we shall notice at present, are the higly important ones relative to the distribution of electricity between a globe and cylinder. When the globe was *eight* inches in diameter, and the cylinder thirty inches long, he obtained the following results:—

Diameter of Cylinder.	Mean Electric Density of the Globe to that of the Cylinder.
24 lines	1 to 1·30
12	1 ... 2·00
2	1 ... 9·00

Hence the electrical densities of different cylinders are in the inverse ratio of the power $\frac{4}{5}$ths of their diameter, which approaches very much to unity when the diameter of the globe is very much greater than that of the cylinder.

Different globes and same cylinder.

When the globes are different, and the cylinders remain the same, the electric density of the cylinders will vary as the diameters of the globes, if their diameters are much greater than that of the cylinder. Hence, calling D the mean electric density of the globe, d that of the cylinder, R the radius of the globe, and r that of the cylinder, we have $d = \frac{mDR}{r^{\frac{4}{5}}}$ or $d = \frac{mDR}{r}$, when R is much greater than r. Coulomb found the constant co-efficient m to be $\frac{9}{48}$.

Sect. X.—*On the Action of Points, and on Electrical Rotations.*

Action of points.

The influence of points in silently drawing off electricity from a conductor has already been mentioned, and also their influence in discharging electricity from any conducting body in which they are fixed. Both these effects are distinctly seen if a person insulates himself by standing on a stool with glass feet, placed near an electrified prime conductor. If he takes in his hand a rod of metal with a ball at one end and a sharp point at the other, and holds the point at a certain distance from the conductor, he will be able to electrify himself in consequence of drawing the electricity from the conductor, whereas if he holds the ball at the same distance, he will receive no electricity at all. On the contrary, if he connect himself with the prime conductor by a chain till he is charged with electricity, and then throws aside the chain, he will not be able to discharge the electricity quickly from his body by holding out the ball, whereas if he holds out the rod with the point, the electri-

Phenomena and Laws.

city will be rapidly discharged from it, and will be seen streaming out from it in the dark.

Action of points explained.

The experiments contained in the preceding section afford a beautiful and satisfactory explanation of the action of points. We have already seen that the electricity communicated to a cylinder is so distributed that the electrical density of the extremity is 2·30, while that at the middle is 1; and that when the electrical density of a globe is 1, that of a cylinder two lines in diameter and thirty inches long is 9. But we may consider points as cylinders of small diameter and great length, and, following the result now mentioned, we shall find that the electrical density at the rounded extremity of a cylinder two lines in diameter will be $9 \times 2{\cdot}3 = 20{\cdot}7$, while that of the globe which the cylinder touches is only one. In order to make this plain, we have represented in fig. 7 a cylinder or rod AB, in which the ordinates of the curve M*c*N represent the electrical density at different points of the cylinder, or the thickness of the stratum of electricity at these points. The ordinate *cd* being 1, the ordinates AM and BN will be 2·3. But it may be shown, from the law of repulsion, that the re-action of the electric fluid upon the adjacent air varies as the square of the thicknesses of the electric strata, or as the squares of the electric densities. Hence the squares of the ordinates *cd*, AM, or 1, and $2{\cdot}30 \times 2{\cdot}30 = 5{\cdot}27$, will represent the re-action at *d* and A; that is, the electric fluid will have five times the tendency to escape at A, from what it has at *d*.

Plate CCXXIV., fig. 7.

Fig. 8.

When the point A is connected with a ball B, as in fig. 8, the tendency of the electric fluid to escape at A will be seen from the ordinates of the curve BM, the ordinate at A being very great. We have already seen that the ordinate AM, or the electrical density at A, is 20·7 times as great as the electrical density at B. Hence $20{\cdot}7 \times 20{\cdot}7 = 428{\cdot}49$ will represent the tendency of the electricity to escape from A, the tendency to escape from B being only one. But this tendency to escape is resisted by the air: and as the amount of resistance varies with the density, moisture, and temperature of the air, there will obviously be some degree of electrical density which will overcome that resistance. This result experience completely confirms, for even in the common state of the air a very great quantity of electricity is not necessary to make its way from a pointed conductor.

This tendency of points to discharge their electricity against the resisting air, enables us to perform some beautiful electrical experiments, in which a motion of rotation is effected.

Electrical rotation, fig. 9.

Exp. 1. If one, two, or any other number of wires are placed, as in fig. 9, so as to have beneath their centre of gravity, A, a hollow cup, which rests on the top of an insulated stand AB; and if the points *m*, *o*, *n*, *p* of these wires are made short, and are turned in the same tangential direction; then, if we connect them with the prime conductor by a chain C, so as to electrify them, the electricity will issue from each point; and as it will be resisted by the air against which it presses, the arms will turn round in a direction opposite to that in which the electric fluid is discharged, in the very same manner as the rotatory motion is effected in Barker's mill. In the dark a stream of light will exhibit the discharge of the electricity, and when the velocity of rotation becomes sufficiently great, the four streams will form a beautiful circle of light.

Electrical orrery, fig. 10.

Exp. 2. The *Electrical Orrery*, as it is called, is founded on the same principle. A spherical ball of metal S, fig. 10, representing the sun, has its inner concave surface supported on a pivot on the top of an insulated stand CD. From the ball S extends a wire SE, the turned-up extremity of which supports upon a pivot another ball E, which represents the earth, having a wire passing through it, and carrying at one end a small ball M, representing the moon, while the other end is bent into a sharp point *m*. A sharp point H is also fixed to the arm EF. If these balls are electrified as in the last experiment, by a chain A connecting them with the prime conductor, the discharge of electricity from the point H will give a rotatory motion to the arm CE and the earth E, while the electrical discharge from the point *m* will give a rotatory motion to the moon M round the earth E. In this manner the moon revolves round the earth, while the earth and moon are together carried round the sun.

Electrical bells.

Exp. 3. By the same principle a chime of bells may be rung in a more elegant manner than that which is exhibited in fig. 4, Plate CCXXII. Five cross arms of wire are made to revolve upon the pivot A of an insulated stand AB, as shown in fig. 11, and each wire has its extremity pointed and turned in the same direction. To one of these arms C, which is purposely made longer than the rest, is suspended a glass ball or clapper *b*, by a silk thread *ab*, and immediately behind it a rod CD. Eight bells are placed upon the stand, and if a chain connects the point A with the prime conductor, the discharge of the electricity from the points will move the cross arms round, and cause the clapper *b* to ring the bells during its revolutions.

Fig. 11.

Electrical inclined plane, fig. 12.

Exp. 4. The electrical inclined plane, shown in fig. 12, acts upon the same principle. Two straight parallel wires, MO, NP, are stretched upon the insulating stands M, N, O, P, fixed on a base of wood. Across these wires is placed a wire *ab*, having another wire *cd* at right angles to it, terminated by two bent points lying in a plane passing through *cd*, and at right angles to *ab*. When the apparatus is electrified by a chain, the electricity is discharged at the points *a*, *b* in a vertical plane, the wires revolve, and the wire *cd* rolls up the inclined plane, in opposition to the force of gravity.

Sect. XI.—*Explanation of the Phenomena of Electrical Attraction and Repulsion.*

Electrical attraction and repulsion.

In order to explain the phenomena of attraction and repulsion which have been already described, we must avail ourselves of several principles which have been either previously deduced from experiment, or which may be readily proved.

1. The electric fluid has a tendency to escape from all electrified bodies, whether conductors or non-conductors, in consequence of the mutual repulsion of its particles.

2. The electric fluid is prevented from escaping from bodies so rapidly as it would otherwise do, by the pressure of the air with which they are surrounded, and which is itself a bad conductor of electricity.

3. If the pressure of the air is increased, the escape of the electricity is diminished; and if the pressure of the air is diminished, the escape of the electricity is increased.

4. In *conductors* the electric fluid passes with the utmost facility and rapidity among the material particles, and does not seem to be in any way acted upon by them.

5. In *non-conductors* the electric fluid escapes from them, and moves among their material particles with difficulty; so that there is some force by which the electric fluid adheres to or is detained by the material particles of non-conducting bodies.

With the aid of these principles, we are now able to explain the three different cases of electrical attraction and repulsion.

Plate CCXXIV., fig. 13.

1. *When the two bodies are non-conductors.* Let A be a fixed electrified non-conducting body, and B another of the same kind capable of moving. The particles of the electric fluid in A will repel each other; but this repulsive force cannot produce any motion on the centre of gravity of the ball, as their united tendency is to produce rest. The same is true of the repulsive force of the electric fluid

Phenomena and Laws.

in B. Let us suppose that A and B are both electrified *positively*, or both *negatively*, then the repulsion between the electric fluid in A and that in B will cause B to recede from A, because the electric fluid in B adhering as it were to the particles of B, cannot recede from A without taking the body along with it. In like manner, if A is *positive* and B *negative*, or *vice versa*, the attraction of the positive electric fluid for the negative electric fluid will cause the electric fluid in the moveable body B to approach to that in A, and by its bringing the material particles along with it, will produce the phenomena of attraction.

Hence it follows that the attractions and repulsions of non-conducting bodies are produced by the attractions and repulsions of the electric fluid, which, from its adhesion to their matter, causes them to partake in its motion.

Figs. 14 & 15.

2. *When the one body is a non-conductor, and the other a conductor.* Let A, fig. 14 and 15, be a fixed and *non-conducting* body, and B a moveable and conducting body. When these two spheres are separate, the electric fluid is distributed on the surface of each in a stratum or thin shell of equal thickness; but when they are brought near each other, the fluid is distributed as in fig. 14, when A and B are *oppositely* electrified, and as in fig. 15, when they are *similarly* electrified; the space between the dark circles and the dotted outlines representing the section of the stratum of electrified fluid upon each sphere. The arrangement of the fluid in fig. 14 is produced by the attraction of the fluid in A for the fluid in B, and *vice versa*, producing an accumulation of it on each sphere on the sides nearest one another; and the arrangement of the fluid in fig. 15 is produced by the repulsion of the two opposite fluids, producing an abstraction of the fluid from the sides nearest one another, and an accumulation of it on the sides farthest from each other. But since the non-conducting sphere A is fixed, the adhesion of its fluid to its material particles cannot produce any motion; and since there is no adhesion between the fluid in the conductor B and its material particles, these particles, or the body which they compose, cannot move along with the fluid. The accumulated fluid, however, at the points O, O, figs. 14 and 15, tends to escape from the spheres in virtue of the mutual repulsion of its own particles; but it is restrained by the pressure of the air, which re-acts upon it. But the pressure of the air is an uniform force on every part of the sphere; and as the force with which the electric fluid resists this uniform pressure is greatest at the sides O, O, the ball B, in fig. 14, will recede in virtue of this force from A; and the ball B, in fig. 15, will from the same cause approach to A. The *attraction*, therefore, of the two *opposite* fluids in fig. 14 produces, through the agency of the atmosphere, a *repulsion* of the moveable sphere; and the *repulsion* of the *similar* electric fluids in fig. 15 produces, through the same agency, an *attraction* of the moveable to the fixed sphere.

Hence it follows that the attractions and repulsions of two bodies, one a conductor and the other a non-conductor, are merely apparent, and are produced solely through the agency of the atmosphere.

3. *When the two bodies are conductors.* In this case the phenomena will be nearly the same as in the last; for, by making A a conductor, we have only removed the adhesion between its fluid and the particles of which the body is composed, a force which was not brought into play in case 2, owing to A being fixed.

In the preceding observations we have taken no notice of the decomposition of the natural electricities of the two bodies, as the reader is not yet prepared for this consideration. We have supposed one of the spheres to be fixed and the other moveable, merely to simplify our illustrations; but it is obvious that the same effects would have been produced, but only with different degrees of intensity, if the two spheres had been moveable.

Phenomena and Laws.

In order to show that apparent attractions and repulsions may be produced by the mere resistance of the air, and without any mutual action between the particles of the two bodies which are attracted and repelled, M. Biot has employed a very happy illustration, on which we have ventured to make a slight improvement. Let B, fig. 16, be a glass globe filled with water, and suspended by a string A. Make a hole in two opposite points of it C and D, from which the water can flow, and having closed them with wax, fill the globe with water. With a burning mirror MN, whose focus is at C, condense the sun's rays RR, and melt the plug of wax at C. The water will instantly rush out, and the globe B will move away from M as if it had been repelled by the mirror. Repeat the same experiment by placing the mirror at M′N′, and throwing the sun's rays upon the opposite plug D by reflexion from the plain mirror *mn*. The plug D being melted, the water will flow out at D, and the globe B will approach to M, N, the mirror having appeared to repel the globe in the first case, and to attract it in the second, though the motion in both cases arises neither from attractive nor repulsive forces, but merely from an unbalanced pressure at D when the water flowed out at C, and an unbalanced pressure at C when the water was discharged at D.

Sect. XII.—*On Electrical Induction, or the Decomposition of the Combined Electricities by Actions at a distance.*

Electrical induction.

In the preceding sections we have considered the phenomena of electricity as produced by friction, and as communicated or transmitted by conductors to other bodies. But it has been found that electricity may be developed in bodies by the mere influence of an electrified body placed at a distance, and we shall now proceed to investigate the laws which regulate this interesting class of phenomena.

Plate CCXXV., fig. 1.

Let AB be a cylindrical conductor supported horizontally upon an insulating stand S, and having hemispherical ends at A and B. Suspend from the points A, B, C, D, E, F, similar pairs of pith balls attached to wires or linen threads, and, having insulated it carefully by the stand S, touch it with the finger in order to see that it contains no free electricity. Let an electrified sphere M be now brought near it, so that A, B, M are in the same straight line, and that no spark can pass from M to B. When this has been done, it will be observed that the pith balls diverge as in the figure, the divergency being a maximum at A and B, and equal at these points, becoming less at C and D, where it is also equal, and still less at E and F, where the equality of divergence still exists. Between E and F there will be found some *neutral point* where the pith balls exhibit no divergence, and this point will shift its position according to the distance of the electrified body M. If we now suspend an unelectrified pith ball by a silk thread, and bring it near to different parts of the cylindrical conductor, we shall find that it is attracted to it in all places except the *neutral point* between E and F.

This *neutral point* is never found in the exact middle of the cylinder between E and F. Its position varies with the distance of the body M, and with the intensity of its charge. In every case, however, it is nearer to the extremity B next the sphere M, than the distant extremity A.

From these experiments we are led to the important and curious result, that an *unelectrified body may be electrified by the influence of an electrified body acting upon it at a distance.* The electricity is in this case said to be *induced*, and the phenomenon is called *electrical induction.*

If we now electrify the pith ball which was suspended by a silken thread, and bring it near to the cylinder AB, we shall find that it is *attracted* by one half of the cylinder

Phenomena and Laws.

from A, for example, to the neutral point between E and F, and *repelled* by the other half from B to the same neutral point.

From this experiment we infer that *the electricity on one half of the cylinder, from one extremity to the neutral point, is* POSITIVE, *while the electricity in the other half is* NEGATIVE.

Bring the electrified pith ball near the electrified body M, and it will be found that, if it was formerly repelled from B, it will be attracted by M, and *vice versa;* so that we conclude that *the electricity induced upon the half of the cylinder nearest the electrified body is always opposite to that of the electrified body.*

If we now measure the electricity of the body M, both before and after the preceding experiments, and make allowance for the dissipation of it through the agency of the adjacent air, we shall find that no part of its electricity has been communicated to the cylinder AB; and if, while the cylinder AB is electrified by the inductive influence of M, we either remove M to a distance, or discharge its electricity by touching it with the finger, the electricity of the cylinder AB will instantly disappear. In like manner, AB will recover its electrical state the moment that M is brought near it.

Hence it follows that *the positive and negative electricities developed in a conducting body by the presence of an electrified body are not communicated to it by that body, but have existed in a state of combination in the substance of the conductor, and have only been separated from their state of combination by the action of the electrified body.*

As the intensity of the *positive* electricity, as well as its quantity, is the same in one half of the conductor as that of the *negative* electricity is in the other half, and as there is no remaining or *free* electricity in the cylinder AB when the body M is withdrawn, it follows that the union or recombination of the two electricities has neutralized or saturated each other. But as the two united electricities have not been destroyed by their union, they exist in a new state, which is called the *natural electricity* of bodies. The electricity, therefore, which thus naturally resides in conductors, consists of equal quantities of *positive* and *negative* electricity, which neutralize each other's action, and are consequently incapable of producing any of the phenomena of *free* electricity, or of a portion of positive or negative electricity existing in a separate state.

With these explanations, we are now able to understand how the cylinder AB is electrified by the influence of the electrified body M. We have clearly proved, by direct experiment, that bodies similarly electrified repel each other, while bodies oppositely electrified attract each other; and we have shown in Section X. that this repulsion and attraction does not take place between the material particles of the bodies, but between their electricities, or the electric fluids which they respectively contain. Hence we may enunciate the law in the following manner:—*Similar electricities repel each other, and dissimilar electricities attract each other.* Now when the sphere M, which we shall suppose to be electrified *positively*, is brought near the cylinder AB, in which the electricity exists in its natural or combined state, it will repel all the *positive* electricity, and attract all the *negative* electricity, overcoming the tendency which each has to diffuse itself in virtue of the mutual repulsion of its own particles, and the tendency which the two opposite electricities have to recombine by their mutual attraction. Hence all the *negative* electricity will be *attracted* to and occupy the half FB of the cylinder, and all the *positive* electricity will be *repelled*, and occupy the remoter half EA. If M is *negatively* electrified, the opposite effects will be produced. Let the body M be now withdrawn, the repulsive and attractive forces which it exercised upon the natural electricity of AB will cease, and the two electricities, separated by its action, will recombine by their mutual attraction, as well as by the mutual repulsion of the particles of each, and the cylinder AB will be restored to its natural state of electricity.

Electrical attraction explained.

The principle of electrical induction which we have now illustrated enables us to give a satisfactory explanation of the phenomena of attraction which have been described in Section II. It was there shown that electrified bodies attracted light and unelectrified bodies that were brought near them; but it will now appear that these apparently unelectrified bodies were first electrified by induction, and, in consequence of the decomposition of their natural electricities, were attracted by the excited body. Thus, if M (Plate CCXXV., fig. 1) is an electrified body placed in a perfect vacuum, and AB a small light body suspended near M, and capable of moving towards it, then AB will be so electrified by the influence of M, that the electricity of the same name as that of M will be accumulated in the half FB of the cylinder, and the other electricity in the half EA. But the electricity of M attracts that of BF more powerfully than it repels that of EA, and consequently the light body AB will be attracted to M in consequence of the previous decomposition of its native electricity. If this decomposition cannot be effected by M, or if it takes place with difficulty, the body AB will not be attracted, or will be attracted less readily.

Plate CCXXV., fig. 1.

Biot's experiment.

M. Biot has illustrated this position by the following simple experiment. Suspend by fine silk threads two small balls of equal dimensions, one of them being made of pure gum-lac, and the other of gum-lac either gilt on its surface or covered with a thin plate of tinfoil. When these two balls are placed beside each other, and at a small distance, bring near them an electrified tube of glass or sealing-wax, and it will be seen that the gilt ball will be more strongly and easily attracted than the other. The uncoated ball of lac will not begin to be attracted till after a certain time, when the decomposition of its natural electricity has been effected; and thus its electrical state will continue after the removal of the electrified body. The first ball, though gilt, acquires also in this manner a permanent electricity, because the gum of which it is composed is impregnated with the electricity developed at its surface, and both of them are in this respect assisted by the contact of the air, which, under the influence of the electrified body, tends especially to carry off from them the one of the two electricities, which is repelled by this body, while it has less effect upon the other, whose proper repulsive force is concealed by attraction. Hence, says M. Biot,[1] we observe in general, that insulated bodies which have for some time been under the influence of an electrified body, end in having an excess of electricity of a kind opposite to its own, and the effects of which are seen when they are withdrawn from the influence of that body.

In examining the action of M upon AB, fig. 1, we supposed that no change took place in the electrical condition of M; but this is not the case, for the body AB, as soon as its natural electricity has been decomposed, begins to re-act upon M, through the agency of its separated electricities. These separated electricities not only tend by their attractive and repulsive forces to change the distribution of the free electricity which exists in M, but also to decompose its natural electricity, and thus to increase its free electricity by one of the two separated electricities. When this change has been effected upon the electrical state of M, its action upon AB will also change. It will decompose a new quantity of the natural electricity of AB, and distribute the positive and the negative electricities of which it is composed in the halves AE, BF; and these new portions will again re-act upon M, till a permanent equilibrium is effected

[1] *Traité de Physique*, tom. ii., pp. 283–4.

Phenomena and Laws.

among all the attractive and repulsive forces which are thus brought into play.

Supposing such an equilibrium to be established between the two bodies M and AB, we shall proceed to examine the phenomena which are produced by the introduction of a third body. For this purpose let AB represent the conducting cylinder, and M the electrified body, as in fig. 2. Let an insulated conducting body O, in its *natural state* of electricity, be now brought near AB, so as to touch it, and let us suppose that the electricity of M is *positive*, and consequently that the electricity in the half BE is *negative*, and that in AE *positive*. If we now remove the body O, and examine its electrical state, we shall find that it has acquired *positive* electricity, and we shall observe that the divergency of the pith balls at A has diminished, while their divergency at B has increased. If we again remove the cylinder AB from the influence of M, or remove M from it, we shall find that AB is charged with *negative* electricity. Previous to the contact of O with A, the *positive* electricity in AE repels the *negative* electricity in M, and attracts the *negative* electricity in BE. Hence it contributes by both these actions to weaken the attraction of the *positive* electricity in M for the *negative* electricity in BE, and its repulsion for the positive electricity in AE. But when, by the contact of the third conductor O with the end A of AB, we withdraw a portion of the positive electricity in AE, we at the same time increase the attraction between M and BE, and the repulsion between M and AE, by diminishing the force by which that attraction and repulsion were weakened. Hence the increased action of M will decompose an additional portion of the natural electricity of AB, drawing the *negative* part of it to EB, and repelling the *positive* part of it to AE. The electricity, therefore, which is accumulated at B or in EB is greater than that accumulated at A or in EA, because the third conductor O has taken away a part of the positive electricity in AE. Hence, when we remove AB from the influence of M, so as to allow its separated electricities to re-combine, there is an excess of negative electricity, with which of course AB will be found charged. It is therefore obvious that the divergency of the balls should be greater at B than at A, as was found to be the case from the excess of *negative* electricity which existed at B while the cylinder was under the influence of M.

Plate CCXXV., fig. 2.

In the experiment, as above described, the third conductor O was insulated, and could therefore carry off only a portion of the positive electricity in AE, corresponding to its size: but if we use a conductor which communicates with the ground, the whole of the free electricity in AE will escape; the pith balls at A will exhibit no divergency, while those at B will diverge still more than they did formerly; and this divergency will suffer no diminution by again touching the end A with the insulated conductor. If the conductor AB is now removed out of the influence of M, the divergency of the balls at B will be still further augmented. The cause of these phenomena is very obvious. When all the positive electricity in AE has escaped into the earth, it no longer counteracts the action of M upon BE, so that this action is augmented; and the consequence of this is, that M decomposes a fresh portion of the natural electricity of AB, the positive part of which passes off, by the mutual repulsion of its own particles, into the earth, while the resinous part is collected in BF, and increases the divergency of the balls at B. Hence, when AB is removed from the influence of M, the excess of *negative* electricity will be greater than previously, and the divergency of the balls at B will increase conformably with observation. The very same phenomena will be observed if the body M is charged with *negative* electricity, and may be described in the very same words by changing only the terms *positive* for *negative* and *negative* for *positive*.

The subject of electrical induction, on which Coulomb had thrown so much light, has been recently studied by M. Mohr, a German philosopher. Having insulated a cylinder AB, Plate CCXXV. fig. 1, 65 centimeters in length, he placed a positively electrified body M at the distance of 1 centimeter from the extremity B. In this case the *neutral* point was found at the distance only of 1 centimeter from B, so that the negative electricity occupied only 1 centimeter in length of the surface of the cylinder, while the *positive* electricity occupied 64 centimeters. By *increasing* the distance of M from B, or by diminishing the charge of M, the space occupied by the *negative* electricity would have been *increased*, and that occupied by the *positive* diminished, the former, however, being always inferior to the latter.

In making experiments of this kind, great care must be taken to prevent any of the electricity of the charged sphere M passing into the insulated conductor, either by the moisture of the intervening air, or the shortness of the intervening space.

If we connect AB with the earth, after removing it from the sphere M, it will be found charged with an excess of the electricity opposite to that of M.

In all these experiments on induction, the charged sphere M, the inducing body, suffers no loss of electricity from having exercised its inductive action.

CHAP. II.—ON THE ELECTRICITY PRODUCED BY HEAT, PRESSURE, AND SEPARATION OF PARTS.

In the preceding chapter we have given a general and popular view of the phenomena of electricity, and we have explained the remarkable phenomena of electrical induction. In our experiments and observations on these subjects we have made use of the electricity which is generated by the friction of tubes of glass or sticks of sealing-wax, or which is obtained from the common electrical machine. But electricity can be obtained from various other sources, and its properties are the same, from whatever source it is obtained, provided it is used in the same quantities and of the same intensity.

As there is no part of the science more interesting to the general reader than that which relates to the different modes in which electricity can be obtained from organized and unorganized bodies, we shall enter fully into this branch of the subject, and shall treat, in successive chapters, of the electricity produced by heat and pressure, by change of form and separation of parts, by animal bodies, and by the elements of our atmosphere.

SECT. I.—*On Pyro-electricity, or the Electricity produced in Minerals by Heat.*

Pyro-electricity.

In our history of the science we have already given a general view of the progress of discovery in this interesting branch of electricity. We shall now, therefore, proceed to describe the phenomena which are developed by heat in various minerals and artificial salts.

1. *On the Pyro-electricity of Tourmaline.*

Tourmaline.

The tourmaline is a very common mineral, which crystallizes in long slender prisms. Its primitive form is an obtuse rhomb, the axis of which coincides with the axis of the prism. It has also one negative axis of double refraction, which is coincident with the axis of the rhomb; and it possesses some remarkable properties in reference to the absorption of common and polarized light, which will be described in another article. This mineral acquires *vitreous* electricity by friction; and when two tourmalines are rubbed

Phenomena and Laws.

together, the one acquires *vitreous* and the other *resinous* electricity.

In order to observe the electricity which heat developes in certain minerals, we have found it convenient to use the thin internal membrane of the *Arundo Phragmites*, which was cut with a sharp instrument into the smallest pieces, or, what is still better, the thin transparent scales which cover the buds of several plants of the genus *Pinus*, and which are pushed off at the expansion of the bud in spring. These minute fragments are well dried, and the pyro-electricity of any mineral is determined by its power of lifting one or more of these light bodies after the mineral has been exposed to heat. When we wish, however, to determine the kind of electricity which is developed in any pole of a mineral, we must employ a small instrument, called an electroscope, such as that used by Haüy, which is shown in Plate CCXXV., fig. 3, where AB is a needle of silver or brass, terminated on one side by a globule B of the same metal, and on the opposite side by a small bar or narrow plate G of transparent Iceland spar, fixed to A by wax or any other means. This needle carries at its middle point D a cup of rock-crystal (garnet is preferable), by which it rests on a steel pivot at the upper end of the piece of wire D, fixed in a cylinder E of gum-lac or sealing-wax. A small weight G is made to move along the arm BD to balance the needle in a horizontal position. In order to prepare this little instrument for observation, take the lever by the end B, with the right hand, and with two of the fingers of the left hand press two of the opposite faces of the crystal G, and then place the lever upon its pivot D. Haüy calls this apparatus a *vitreous* or *positive* electroscope.

Haüy's vitreous electroscope. Plate CCXXV., fig. 3.

The *resinous* or *negative electroscope*, which is shown in Plate CCXXV. fig. 4, differs from the preceding only in having a simple needle of silver or copper AB, with two globules A, B at its extremities, and having a cup C of the same metal. In order to prepare this electroscope for use, a stick of sealing-wax is rubbed with a piece of woollen cloth, and then made to touch one of the globules of the needle, which is immediately repelled.

Haüy's resinous electroscope, fig. 4.

In order to determine the kind of electricity generated in any pole of a crystal by heat, we have only to apply it to either of these electroscopes. If it attracts the globule of the vitreous electroscope, or repels that of the resinous one, its electricity will be resinous; and if it repels the globule of the vitreous one, and attracts that of the resinous one, the electricity will be vitreous.

Haüy's general apparatus, fig. 5.

Haüy used another apparatus in his experiments with tourmaline, which he considers preferable to all others. A rectangular plate of metal *hk*, bent up at right angles at its two ends *h*, *k*, is balanced on a steel needle *ab* by a cup of agate *x*, which is confined by a circle of silver and two screws *s*, *z*. Towards the extremities of the lower surface of the plate *hk* are fixed two silver wires *pi*, *uy*, having a slightly oblique direction, and terminated by two silver globules *i*, *y*. The use of these little balls is to lower the centre of gravity of the apparatus, so that the plate *hk* may always remain supported during its revolution on the pivot. Let us now suppose that we wish to determine the two kinds of electricity which exist in the poles of a tourmaline. Take one of the Spanish crystals, which is the best for the purpose, both from their thinness and their strength, and having heated it either at the fire or at the flame of a spirit-lamp, by holding it in a pair of iron pincers with a wooden handle, place it at *mn*, as shown in fig. 5, in the two notches made on purpose in the bent-up pieces *h*, *k*; and having held near its poles in succession a stick of excited sealing-wax, that pole, *v*, will be the *vitreous* one which is attracted by the wax, and the other, *r*, the resinous one which will be repelled by it.

After measuring the intensity of the electricity in different points of the tourmaline, Haüy found that the electricity was distributed nearly in the same manner as in a cylindrical conductor electrified by induction. The *vitreous* electricity was a maximum near one extremity of the crystal, and gradually diminished towards the middle of the crystal, where it disappeared. Here the *resinous* electricity appeared very faintly, and gradually increased towards the other end of the crystal, near which it was a maximum.

If tourmaline, when rendered electrical by heat, is broken in pieces, each piece will have a vitreous and a resinous pole, whether it is broken from the vitreous or the resinous end, the extremity of the fragment always possessing the same kind of electricity as that of the pole to which it was nearest when it formed part of the crystal.

Influence of heat.

It had been early noticed that the tourmaline became electrical only at a particular temperature, and that its electricity disappeared at temperatures above and below that particular degree of heat. If we heat the tourmaline beyond this temperature, and allow it gradually to cool, it will soon arrive at that temperature (between 30° and 80° of Reaumur, 99° and 212° of Fahr. according to Æpinus) at which it exhibits its electrical properties. As the temperature falls, its electricity becomes progressively feebler, and finally disappears. Haüy, however, found that other changes take place as the cooling of the mineral increases. At a certain degree of coldness its electricity re-appeared, and gradually increased till it reached its maximum, when it again disappeared gradually. But, what was very interesting, the electricity was not the same as before; the pole which was formerly *vitreous* was now *resinous!* [1] It is extremely probable that the same changes would continue to take place both above and below the temperatures at which these two opposite states were produced. Haüy caused the foci of two burning-glasses to fall upon the poles of a tourmaline, and he observed that, after each pole had acquired its electricity, it then ceased to act, and finally exhibited an electricity of an opposite kind.

Haüy has ingeniously explained the phenomenon of each fragment of a tourmaline having two different poles, like the crystal to which it belonged, by supposing that every integrant particle of a tourmaline is itself a little tourmaline with its two poles. "Hence it follows," says he, "that in the entire tourmaline there will be a series of poles alternately vitreous and resinous; and such are the quantities of free fluid which appertain to these different poles, that in all the half of the tourmaline yet unbroken, which manifests the vitreous electricity, the vitreous poles of the integrant molecules are superior in force to the resinous poles in contact with them; while the contrary obtains in the half which manifests the resinous electricity; whence it follows that the tourmaline is in the same state (speaking generally) as if each of its halves were only solicited by quantities of vitreous or resinous fluid equal to the differences between the fluids of the neighbouring poles. Now, if the stone be cut at any place whatever, as the section can only take place between two molecules, the part detached will necessarily commence with a pole of one kind, and terminate with a pole of a contrary nature."

Experiments of Sievright and Æpinus.

Mr Sievright of Meggetland fitted up a tourmaline so as to bring the action of its two poles very near each other. It resembles the letter D with an opening in its round part, the straight line representing the tourmaline, and the two bent portions are pieces of silver wire rising out of two silver cups, one of which embraces each pole of the tourmaline. If a pith ball, or a ball of sola, is suspended between the two ends of the silver wires, it will vibrate in a beautiful manner, in virtue of their opposite actions. Æpinus, it appears, fitted up the tourmaline in a manner somewhat re-

[1] This inversion of the poles was discovered by Mr Canton.

Phenomena and Laws.

sembling that which has been described. Sir Humphry Davy has stated the curious fact, which we believe has never been verified by any subsequent observer, that "when the stone is of considerable size, flashes of light may be seen along its surface."[1]

On the Pyro-electricity of thin Plates of Tourmaline.

Pyro-electricity of thin plates of tourmaline.

The electricity exhibited by ordinary crystals of tourmaline is very feeble; and though two good tourmalines, when floated in water upon corks, will approach and recede from each other when they are excited by a suitable temperature, yet these tourmalines are not capable of lifting one another, or of adhering to an unelectrified body, by decomposing the natural electricity of the part of it with which they are brought in contact.

A method of increasing the electrical action of tourmaline, and of enabling one large piece to lift another, and even to adhere to other bodies, has been used by Sir David Brewster. He cut thin slices out of a large crystal of tourmaline so that they had parallel faces perpendicular to the axis of the original crystal, as represented in fig. 6, where VVVV is the vitreous face of the plate, corresponding to the vitreous pole of the crystal; and RRRR the resinous face; each of these faces being perpendicular to the edge VR of the prism, and consequently to the axis of the crystal. When the two faces of the plates thus formed are ground flat and well polished, one plate will readily lift another. If we place one of these plates upon a piece of flat plate glass, placed horizontally upon a table, the tourmaline will slip off the glass if the latter is slightly inclined to the horizon. But if the glass has been previously heated, the tourmaline plate will adhere to it; and by inverting the glass, the tourmaline will adhere to it even in that position, supporting its own weight by its attraction for the glass. The intensity of the electricity may be easily measured at different temperatures, by ascertaining the angle of inclination at which the weight of the tourmaline overcomes its adhesive force. The plate which exhibits this powerful action obviously consists of an infinite number of minute crystals of tourmaline, with vitreous and resinous poles; and as the point of maximum intensity is situated near the extremity of each crystal, all the vitreous poles will be situated in a plane near the vitreous surface VVVV, while all the resinous poles will be situated near the resinous surface RRRR. If a rectangular plate of the same size, like VVRR, fig. 7, is cut out of a crystal, so that its surfaces are parallel to the axis of the prism, it will adhere to the heated glass plate with much less force than in the preceding case. These plates of excited tourmaline adhere to all metallic bodies, to wax, and to all minerals that have been tried.[2]

Plate CCXXV., fig. 6.

If there was no mistake in the experiment by Sir H. Davy, described in a former paragraph, respecting the appearance of a flash of light in a mounted tourmaline, it will doubtless be best verified by mounting several plates of equal thickness, cut out of a broad tourmaline, placing them all in the same plane, and combining their effects in two wires. A powerful little pyro-electrical battery might thus be made, from which both a shock and a flash might be obtained.

Having found that the electricity of plates of tourmaline was more powerful than crystals of it, Sir David Brewster conceived the idea of examining its pyro-electricity, when its fragments were infinitely small, or when it was reduced to the finest powder or dust. The analogy of magnetic bodies led to the notion that the pyro-electricity would disappear, while the results obtained with short prisms in the form of plates strengthened the opposite opinion, that the pyro-electricity might even be increased by this process. I therefore "pounded, he says, a portion of a large opaque tourmaline in a steel mortar till it was reduced to the finest dust. I then placed the powder upon a plate of glass, from which it slipped off by inclining the glass, like all other hard powders, without exhibiting any symptoms of cohesion, either with the glass or with its own particles. When the glass was heated to the proper temperature, the powder stuck to the glass; and when stirred with any dry substance, it collected in masses, and adhered powerfully to the substances with which it was stirred. This viscidity, as it were, or disposition to form clotted masses, diminished with the heat, and at the ordinary temperature of the atmosphere it recovered its usual want of coherence."[3]

M. Becquerel made some interesting experiments on the pyro-electricity of the tourmaline. He found that when the crystal was of a certain length it became electrical both by heating and cooling; and that crystals of a greater length ceased to become electrical by heating. When the length of the crystal was eight centimeters, or three inches and one ninth of an inch long, they ceased to exhibit electricity either by heating or cooling. M. Becquerel remarks, that if this law is inversely true, that is, for very small lengths, *the atoms of the tourmaline ought to acquire a considerable electrical polarity by the smallest changes of temperature.*[4]

2. *On the Pyro-electricity of the Borate of Magnesia.*

Borate of magnesia.

The electricity developed in boracite by heat is considerably less than that of the tourmaline. In 1791 the Abbé Haüy discovered the pyro-electricity of this mineral; but he found it extremely difficult to determine the vitreous and resinous poles. He naturally expected to find two opposite poles, as in the tourmaline; but a succession of attractions and repulsions which took place very rapidly perplexed him extremely. Considering, however, that the boracite was a cubical crystal with three axes, and the tourmaline a rhombohedral one with only one axis, he conceived that the former crystal has a vitreous pole at the one end of each axis, and a resinous pole at the other end. This conjecture he verified by experiment; and the poles were found to be so placed that each alternate pole possessed the opposite electricity; the experiments, however, which are necessary to establish this result require to be made with great care, particularly in reference to the repulsive actions, which take place only within a very limited space; so that, in order to obtain the repulsion of one of the resinous poles on a body which is itself in a resinous state of electricity, we must direct this body exactly to the repulsive point, otherwise it will be attracted towards the neighbouring points, which are in their natural state, or nearly so.

It is a curious fact, in reference to the preceding results, that the boracite has been found by Sir David Brewster to possess distinct double refraction; and consequently it cannot, as he concludes, have the cube for its primitive form, or three axes of crystallization. He infers that its primitive form is a rhombohedron of ninety degrees, the form which separates the obtuse and acute rhombohedrons; and hence it is a most remarkable circumstance that its electrical poles should be arranged in the manner described by Haüy.

3. *On the Pyro-electricity of the Topaz.*

Topaz.

The pyro-electricity of the Brazilian topaz was discovered in by Mr Canton in 1760. The Abbé Haüy detected the same property in the topaz of Siberia, and found that the poles resided in the two opposite summits of the secondary form of the crystal. Haüy at first thought that the Saxon topazes did not possess pyro-electricity, although they often preserved excited electricity for more than half

[1] *Elements of Chemical Philosophy*, vol. i., p. 130.

[2] See *Edin. Phil. Journal*, 1819, vol. i., p. 205.

[3] *Edin. Journal of Science*, October 1824, No. ii., p. 213.

[4] *Id.*, 1828, No. xvi., p. 365.

Phenomena and Laws.

an hour when the weather was favourable. He afterwards found, however, that they became electrical by heat if previously insulated. Sir David Brewster found pyro-electricity in the greenish-blue topazes of Aberdeenshire.

A pyro-electric rotation of a very extraordinary kind was observed by Sir David Brewster in a specimen of topaz. It presented itself when he was studying the very interesting collection of crystals in the cavity AB. This cavity is filled with the dense fluid which is frequently found in topazes,

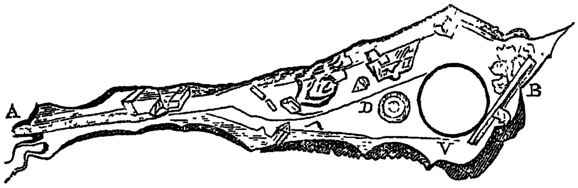


Fig. 5.

in contradistinction to the highly expansible one which often accompanies it. The circle at V represents a vacuity in the fluid, which diminishes so perceptibly by the expansion of the fluid when heated, that there is reason to believe that it would disappear by an increased degree of heat, like the vacuities in the expansible fluid. The fear, however, of bursting so rare and interesting a cavity, prevented the experiment from being made. The cavity AB contains a great number of crystals of different forms, not one of which melts with heat like some of those in other cavities, and almost all of them possess double refraction. When this cavity was first placed under the microscope there were five small crystals lying between D and the vacuity V—one a flat prism, a second a hexagonal plate, a third an amorphous crystal, and a fourth and fifth two irregular halves of a hexagon. *Upon the first application of heat one or two of these crystals leapt from their places, and darted to the opposite side of the cavity.* In a few seconds the others quitted their places one after another, *performing the most rapid and extraordinary rotations;* one crystal joined another, and at last four of them thus united revolved with such rapidity, that their respective shapes were completely effaced. They afterwards separated on the withdrawal of the heat, and took the position which their gravity assigned them. On another occasion a long flat prism performed the same rotation round its middle point; and, on showing the phenomenon to different persons, the experiment was so often repeated that the small crystals have been driven between the inclined edges of the cavity so that they cannot be extricated. A fine octahedral crystal, however, truncated in its edges and angles, was afterwards conducted into the middle at D, where it performed its rotations as indicated by the concentric circle at the right hand of D. In subsequently applying a high degree of heat the cavity burst, and scattered its microscopic contents.[1]

Haüy observed that the Siberian topazes often preserve their pyro-electricity during several hours, and sometimes from *twenty* to *twenty-four* hours.

Among some topazes which Haüy received from M. Langsdorf, there was one which exhibited resinous electricity at both of its poles, and indications of vitreous electricity in the middle of the crystal. This effect was probably owing to one or more strata of cavities containing fluids, which may have interrupted the distribution of the electricity in the same manner as a fissure.

4. *On the Pyro-electricity of Mesotype.*

Mesotype. Haüy discovered that some crystals only of this mineral were electrical by heat; but as he was not able to obtain complete crystals he detached from its support one about five and a half lines long, and found the pyramidal summit to be resinously electrified. *Mem. Instit.*, tom. i., p. 54–55. In the first edition of his Mineralogy, however (vol. iii., p. 168), he states that the pyramidal summit exhibits *vitreous* electricity by heat, and the fractured end *resinous* electricity; but in the *second* edition of his mineralogy he has omitted altogether that passage, and said nothing whatever on the subject.

The mesotype of Haüy's first edition included the Auvergne mesotype, the apophyllite, the scolezite, and the nadelstein; and therefore it is difficult to say to which of these minerals his observations are applicable.

Sir David Brewster found distinct pyro-electricity in the mesotype of Auvergne.

5. *Pyro-electricity of the Scolezite.*

Scolezite. The scolezite is a compound crystal, in which the faces of composition are parallel to the axis of the prism. Sir David Brewster found it to possess pyro-electricity, the pyramidal summit having vitreous, and the fractured end resinous electricity.

6. *Pyro-electricity of Mesolite.*

Mesolite. The mesolite, which has been separated from the scolezite both by distinct chemical and optical characters, is distinguished still further by its being composed of four simple crystals, whose faces of composition are parallel to the axis of the prism, whereas the scolezite consists of two prisms separated by a thin film or vein. Sir David Brewster likewise observed the pyro-electricity of this mineral, and found that its crystallized summit possessed vitreous electricity, and its fractured end resinous electricity, when heated.

7. *On the Pyro-electricity of the Powders of Scolezite and Mesolite when deprived of their Water of Crystallization.*

Powders of Scolezite and Mesolite. In the experiments above recited on the powder of tourmaline, the mineral had suffered no other change by trituration than that of being reduced to minute fragments. It became interesting therefore to compare the pyro-electricity of such a powder with that of the powder of a pyro-electrical mineral on which an essential chemical change had been induced. With this view Sir David Brewster reduced to powder the crystals of scolezite and mesolite, and by the application of heat drove off their water of crystallization, which is doubtless an essential ingredient in every mineral species. When the powder was exposed to a proper heat on a plate of glass, it adhered to it like the powder of tourmaline; and when stirred about by any substance whatever, it collected in masses like new-fallen snow, and adhered strongly to the body which was used to displace it. "This fact," says Sir David Brewster, "is a very instructive one, and could scarcely have been anticipated. As several minerals differ only in the quantity of their water of crystallization, the powder which was thus pyro-electrical could not be considered either as scolezite or mesolite, but as another substance not recognised in mineralogy. The pyro-electrical property, therefore, developed by the powder, cannot be regarded as a property of the minerals of which the powder formed a part, but merely as a property of some of their ingredients. In which of the ingredients, or in what combination of them, the pyro-electricity resides, may be easily determined by further experiments.

8. *Pyro-electricity of Axinite.*

Axinite. In his *Manual of the Mineralogist and the Geological Traveller*, M. Braard has stated that some crystals of this mineral become electric by heat. Haüy has confirmed this observation, but no accurate experiments on the position and electricity of its poles have been made.

[1] See *Edinburgh Transactions*, 1845, vol. xvi., part i., p. 19; or *Phil. Mag.*, Dec. 1847, vol. xxxi., p. 497.

Phenomena and Laws.

9. *Pyro-electricity of Calamine.*

Calamine. So early as 1785 M. Haüy discovered the pyro-electricity of this mineral, which being an oxide of zinc, is the more remarkable, as it is the only metallic body in which this property is very distinctly developed. Haüy found that every crystallized specimen which he tried was pyro-electrical, and that it acquired this property also by cooling. His first observations on the return of the electric action were made on the crystals of oxide of zinc from Limbourg, near Aix-la-Chapelle; and a portion of the acicular variety from the Brisgau. In the winter of 1819 he placed a crystal on a window where the temperature was 11 degrees Cent. below zero, and having left it there a few seconds he found that it acted very sensibly on a magnetic needle not insulated. He next placed it in a room whose temperature was four degrees above zero, and he observed that its polar action progressively diminished and disappeared. He then brought it within a yard of a fire, and had the satisfaction of observing its polarity return, the pole which was formerly vitreous being now resinous.

10. *Pyro-electricity of Sphene.*

Sphene. Haüy has found that some crystals of this mineral possess pyro-electricity, but he has not determined the position or nature of its poles.

11. *Pyro-electricity of Prehnite.*

Prehnite. This mineral crystallizes in right rhomboidal prisms. Haüy found it to be pyro-electrical, and that its poles are in a direction corresponding with the smaller diagonal of the crystal.

12. *Pyro-electricity of other Minerals.*

Other minerals. The property of becoming electrical by heat has been found by Sir David Brewster to exist in a great number of minerals; and he has given the following list of those in which he succeeded in detecting it:

Calcareous spar.	Yellow orpiment.
Beryl yellow.	Analcime.
Sulphate of barytes.	Amethyst.
Sulphate of strontites.	Quartz, Dauphiny.
Carbonate of lead.	Idocrase.
Diopside.	Mellite?
Fluor spar red.	Sulphur native.
Fluor spar blue.	Garnet.
Diamond.	Dichroite.

13. *Pyro-electricity of artificial Crystals.*

Artificial crystals. In examining the physical properties of artificial crystals, Sir David Brewster found that several of them, when well dried, were electrical when heated. The following is the list of those in which he detected this property.[1]

Tartrate of potash and soda.	Sulphate of magnesia.
Tartaric acid.	Prussiate of potash.
Oxalate of ammonia.	Sugar.
Oxymuriate of potash.	Acetate of lead.
Sulphate of magnesia and soda.	Carbonate of potash.
Sulphate of ammonia.	Citric acid.
Sulphate of iron.	Oxymuriate of mercury.

Oxalate of lime. Dr Faraday[2] has more recently discovered a remarkable degree of pyro-electricity in oxalate of lime. Having obtained some of this salt by precipitation, and dried it, when well washed, in a Wedgewood's basin, at a temperature of about 300° Fahr. till it was so dry as not to dim a cold plate of glass held over it, Dr Faraday remarked that, when it was stirred with a platina spatula, it became in a few moments so strongly electrical that it could not be collected together, but flew about the dish whenever it was moved from its sides into the sand-bath. This phenomenon took place whether the salt was placed in glass, porcelain or metallic basins, or stirred with glass, porcelain, or metallic rods. When the particles were well excited and shaken on the top of a gold-leaf electrometer, the leaves diverged two or three inches. The same phenomena took place when it was cooled out of the contact of air. When it was excited in a silver capsule, and left out of contact with the air, the powder continued electrical for a great length of time, proving its very bad conducting power, in which it probably surpasses all other bodies. Dr Faraday remarks, that oxalate of lime stands at the head of all other bodies yet tried, in its power of becoming positively electrical by heat.

14. *On the connection between the Pyro-electricity of Minerals and their Secondary Forms.*

It is well known that the opposite and corresponding sides of crystals are similar in the number, disposition, and figure of their faces. Haüy, however, found that pyro-electrical crystals deviate from this symmetry, so that there are certain supernumerary planes at one pole which are not seen at the other. This is true of tourmaline, boracite, topaz, and axinite, and may possibly be found to be a general fact among pyro-electrical crystals, though we do not expect that it will. In the crystals above mentioned, the vitreous electricity resides in that pole where the supernumerary planes are found, and the resinous electricity in the other.

This deviation from symmetry as existing in the tourmaline is shown in fig. 8, where A is the vitreous pole at the summit of a pyramid with *five planes*, and B the resinous pole at the summit of a pyramid with *three planes*. Plate CCXXV., fig. 8.

The deviation from symmetry in the boracite is more remarkable. The resinous pole at *s*, fig. 9, is marked with one plane, while the vitreous one has the same plane *s* with other three planes *rrr*, fig. 10. Plate CCXXV., fig. 9; fig. 10.

From the preceding facts, Haüy is of opinion that, during the formation of these crystals, the two electrical fluids have influenced, in an opposite manner, the laws by which the crystallization was regulated.

SECT. II.—*On the Influence of Heat upon the Electric Fluid in Metallic Bodies.*

The experiments which have been made on this subject we owe chiefly to M. Becquerel, of whose labours we shall endeavour to give a brief account. It had been long ago shown by M. Desaignes that metallic bodies are capable of electric excitation by heating and cooling. By raising the temperature o. one end of a plate of silver, while the other retained the temperature of the surrounding air, he succeeded in producing contractions in a frog, by making the nerve communicate with one end of the plate, and the muscle with the other end. Other philosophers had observed the influence of heat, and they believed that it increased the repulsive force of each of the two fluids. In proof of this they sealed hermetically at a lamp a tube of glass which had been previously electrified interiorly, and by raising its temperature it gave very distinct signs of electricity. M. Becquerel, however, has remarked, that the glass, becoming a better conductor when heated, allowed a portion of the fluid accumulated in the interior of the tube to pass; so that the experiment does not prove that the electrical power of the tube was increased. In order to determine if any does take place, M. Becquerel made the following experiment. Influence of heat.

Let AB, fig. 11, be a Leyden jar, on the surface of which is fixed a conductor RS. The jar is closed by a cork *gg*, through which there passes a rod *bb*, fixed at its upper end Fig. 11.

[1] *Edinburgh Journal of Science*, October 1824, p. 212.

[2] *Id.*, October 1825; and *Quarterly Journal*, No. xxxviii., p. 338.

Phenomena and Laws.

to a small glass receiver *abc*, and carrying at its opposite end a mass of metal P. When the jar has been electrified interiorly, it is placed in another vessel filled with ice, so that the conducting rod RS is without it. The cork *gg* and the metal P having been taken out, and the mass P heated and replaced as in the figure, the iron P will gradually heat the interior of the bottle without sensibly altering the temperature of its outer surface, which is surrounded with ice. If we then present the button S to an electroscope, there will be perceived an indication of free electricity, and consequently the heat has not increased the action of the electric fluid in the interior of the jar; for if it had done so, the electricity of the exterior surface would have been decomposed, and the rod RS would have communicated to the electroscope the repelled electricity.

But though heat exerts no action on the free fluid, this is far from being true with the natural fluid. When a metallic wire, which we may call mm', or a series of metallic molecules m, m', m'', &c., connected together by the force of aggregation, is connected by one of its ends with a heated body, such as a piece of red-hot glass, the moment that the heat enters it this extremity becomes positively electrical, while the negative electricity is driven to the adjacent molecules; but m' receiving the heat of m, m'' that of m, &c., the second molecule, which is heated at the expense of the first, takes from this last its positive electricity, and gives to it negative electricity, and so on for all the other molecules. Hence there will arise a series of decompositions and recompositions of the natural fluids while the elevation of temperature lasts.

M. Becquerel's next experiment was to place on the upper plate of Bohnenberger's gold-leaf electroscope (taking care to avoid the contact of metals) a platinum wire whose other end is coiled into a spiral. This outer end is brought to a red heat by a spirit-lamp, which is soon withdrawn, and the spiral is then touched with a band of wet paper. After having made the lower plate communicate with the common reservoir. the small band of paper is found to have carried away positive electricity, and negative electricity remains free on the surface of the metal. If we repeat the experiment in an inverse manner, that is, if we hold between the fingers the platinum wire by the end opposite to that of the spiral, and make this last communicate when it is red hot with a band of wet paper, we shall find that the band carries away positive electricity. This result, which takes place also with gold and silver, does not depend on the electricity which is disengaged during the combustion of the alcohol, since the experiment did not commence till the lamp was withdrawn. Nor can it be ascribed to the presence of water in the band of paper, nor to the alteration of the latter by the effect of heat, two causes which are capable of producing electricity, since the same result is obtained when we carry away the positive electricity of the metal by a tube of glass brought to the same temperature as the metal.

In order to make the experiment in this way, take a glass tube of a very small diameter, and whose length is little more than half an inch, and fix to one of its ends a platinum wire one fiftieth of an inch in diameter, soldering it with a lamp. A wire of the same metal, but of a very small diameter, is fixed at the other end of the glass tube, and the largest platina wire is then put in communication with one of the plates of the condenser, avoiding the contact of metals, and the free end of the other wire is held between the fingers. A red heat is then communicated to the end of the small tube to which this last wire is fixed. As its temperature is much higher than that of the other, which is larger and more distant from the focus of heat, and as the tube becomes at the same time a conductor of electricity, the natural electricity of each wire is decomposed. According to the disposition of the apparatus, we shall have the difference of the effects, which will be to the advantage of the small wire, whose end in contact with the tube possesses the highest temperature. In order to obtain this result, it is not necessary to use a heat so high as that of a red heat. By this process we avoid every foreign cause which is capable of modifying the result.

Iron and copper give similar results; but the electric effect produced by oxidation is in this case combined with that of difference of temperature. M. Becquerel has proved that the oxidation is not the sole cause of the electricity obtained with oxidable metals; and he concludes that heat exerts over the natural electric fluid of all metals a similar action, which probably varies in intensity in different metals, according to their nature. With bismuth, tin, and antimony, the effects are scarcely sensible.

The following is Becquerel's theory of the preceding phenomenon. It is an incontestable fact that all bodies contain between their molecules a neutral electric fluid; and M. Becquerel thinks that a rise of temperature establishes round two contiguous molecules an accumulation of opposite electricities, the quantity of which is proportional to this temperature, but whose recomposition is effected without there having been an apparent separation of the two electricities. It is therefore an electrical effect of motion. When the molecules are separated, each of them takes the excess of electricity relative to the portion of electricity which surrounds it.

The influence of heat on the natural electricity of metals may be shown by means of the lamp without flame, in the two following experiments given by Becquerel. Let AB, fig. 12, be a copper lamp filled with alcohol, *cc* a tube, and *dd* a cork through which there passes a glass tube EF, covered with a varnish of gum-lac. A cotton wick passes through this tube, one end of it going into the alcohol, while to the other end there is fitted a platina spiral *g*, which becomes incandescent throughout as soon as its temperature is sufficiently raised. By means of this construction the platina spiral communicates with the interior of the lamp only by means of the vapour of alcohol and the wick. If we now place this apparatus on the upper plate of an excellent electroscope, whose lower plate communicates with the ground, and touch the spiral with an ordinary platina wire, it is evident that we carry off the negative electricity which the spiral takes during the combustion of the alcohol, and also the negative electricity furnished by the end of the wire which has the lowest temperature. In this case the spiral will be found to have become positively electrical. If we touch the spiral with a band of wet paper, a contrary result will be obtained; the spiral will become negatively electrical, because the incandescent metal transmits positive electricity to the wet paper, which is no doubt stronger than the negative electricity acquired by the spiral during combustion.

Plate CCXXV., fig. 12.

Sect. III.—*On the Electricity produced by Pressure.*

Experiments of M. Haüy.

The electricity produced by pressure seems to have been first observed by Æpinus. The Abbé Haüy subsequently studied it in Iceland spar, which seems to be more susceptible of this species of excitation than any other mineral. If we take into one hand a rhomb of this mineral, holding it by two of its opposite edges, and at the same time lightly touch two of its parallel faces by two fingers of the other hand, and then bring it near to the small needle of the electroscope, it will exhibit *vitreous* electricity. If the two opposite planes, in place of being touched, are pressed between the fingers, a still greater degree of electricity will be developed.

M. Haüy has observed this property of becoming positively electrical by pressure in topaz, especially the variety which is colourless, euclase, arragonite, fluor-spar, and car-

Phenomena and Laws.

bonate of lead, all of them substances which are capable of being mechanically cleaved into smooth laminæ. The experiments are always most successful with pure and transparent specimens. Sulphate of lime and sulphate of barytes do not evolve electricity by pressure.

In all the minerals above named which furnish positive electricity by pressure, positive electricity is also produced by friction; and in those substances which develop resinous electricity by pressure, such as a properly shaped piece of elastic bitumen, resinous electricity is also produced by friction. Hence it has been inferred, that in pressing minerals friction is produced, and that the preceding phenomena are only those of excitation by friction.

Experiments of M. Libes.

M. Libes, however, has stated a fact which appears to be hostile to this explanation of the phenomena. He took a metallic disc insulated by a glass handle, and having pressed it on the surface of varnished silk, either when single or several times folded, the *disc* acquired *resinous* and the *silk vitreous* electricity, and the quantity of electricity increased with the pressure. In order to ascertain if friction was a remote cause of these effects, he set the disc lightly down upon the silk, and rubbing it backwards and forwards so as to produce the effects of friction, the *disc became vitreously and the silk resinously electrified,* a result the very opposite to that which was produced by pressure.

Experiments of M. Becquerel.

This curious subject has been recently examined with much attention and success by M. Becquerel. Having constructed an apparatus for compressing two bodies with a given quantity of pressure, and also an electrical balance of Coulomb, whose platinum torsion wire is sufficiently fine to compare very small electric forces, M. Becquerel sought to determine the phenomena which took place when two bodies were placed under the action of a given pressure and then quickly separated. He found that the excess of electricity acquired by each body was proportional to the pressure as long as it was not great enough to disorganize the body; but if the two bodies are exposed to a certain pressure, and if this pressure is reduced to one half without changing the contact, the effect of the pressure lost subsists during a time which depends on the degree of conducting power, so that if we immediately withdraw the bodies from compression, each of them will carry off an excess of the opposite electricity greater than that due to the remaining pressure. In place, however, of separating the bodies when the pressure has been diminished, let the pressure taken away be restored, and let this mode of action be several times repeated, the following results will be obtained:

Let a very thin disc of cork be pressed against a plate of Iceland spar with a weight of four kilogrammes; without changing the contact, let this pressure be reduced to one half, and after a minute let the bodies be separated. The tension or intensity of the electricity of each disc is represented by 170. When the separation took place during the whole pressure of four kilogrammes, the intensity would have been 250; and during a pressure of two kilogrammes it would have been 125, or one half. Hence it appears, that in the first case the effect produced by the pressure which was lost still subsisted in part, for it would only have been 125 for two kilogrammes, in place of 170, as given by experiment.

In place of separating the bodies when the pressure has been reduced from four to two kilogrammes, let the pressure of two kilogrammes which was removed be restored, and let us repeat several times the alternate action of simple and double pressures; it will then be found that the disc of each never possesses a greater electrical intensity than 250 relative to the strongest pressure. From these results M. Becquerel draws the following conclusions: first, that the electricity developed by pressure is proportional to the pressure; and, second, that when the molecules have been compressed, the effect of the pressure lost will subsist for some time, even though the contact has not ceased to subsist. This is not the case with conducting bodies, seeing that the two electricities disengaged instantly recombine whenever the pressure ceases.

The following are some of the numerical results obtained by M. Becquerel:

Cork pressed against	Pressures.	Intensity of Electricity.
Iceland spar	1	1·5
	2	3·4
	3	5 6
	4	6
Polished crystals of sulphate of barytes	1	1·05
	2	2·1
	3	3·1
	4	4·2
	6	6·3
Polished quartz	4	3·9
Sulphate of lime	4	1 9

When two insulated discs, one of cork and the other of caoutchouc, are pressed against each other, the cork after pressure is negatively electrical, and the caoutchouc positively electrical. When the cork is pressed against the skin of an orange, the cork is positive and the skin negative.

When cork is pressed against Iceland spar, sulphate of lime, fluor spar, sulphate of barytes, the cork is negative and the minerals positive; but when cork is pressed against kyanite, retinasphaltum, pit-coal, amber, zinc, silver, &c., the cork is positive, and the minerals or metals negative.

When insulated cork is pressed against any part of the animal body free from moisture, the cork receives an excess of negative electricity. The hair and down of animals produce nearly as much electricity by pressure as Iceland spar, but of the opposite kind. Cork pressed lightly against inspissated oil of turpentine is negatively electrified.

When two discs of the same substances, such as skin or amadou, are pressed against each other, the one becomes negative and the other positive.

The electricity thus developed by pressure is lasting. Haüy found it to continue eleven days with Iceland spar. Sulphate of barytes of Royat parts with it instantly unless well insulated; but a well insulated crystal retains it half an hour. The duration of the electricity seems to be inversely as the conducting power. Becquerel supposes the internal surface of the body to be, like the Leyden jar, charged with the opposite electricity; so that dissipation is prevented by the action of the two electricities.

In these phenomena the electricity never appears till the bodies are separated.

When the temperature of any body is raised, it has the greater tendency to acquire negative electricity by friction. In like manner, by heating Iceland spar, it may be made to give *negative* electricity by pressure against cork. If we cut a piece of well-dried cork into two pieces by a very sharp knife, and press the cut surfaces against each other, no electricity is developed; but if one of the pieces is heated slightly near the flame of a candle, and the pressure applied, each surface will, when separated, exhibit opposite electricities. The same is true of two pieces of Iceland spar.

Sect. IV.—*On the Electricity produced by Cleavage and Separation of Parts.*

Electricity by separation of parts.

It has been long known that electricity is produced during the violent disruption of a body, or by tearing it asunder, or by separating a laminated body, or by breaking a body across, or by crushing it, or even by cutting it into portions.

Phenomena and Laws.

Mr Bennet observed that when an unannealed glass tear, or Prince Rupert's drop, was put upon a book, it electrified the book negatively. Mr Wilson noticed that if a piece of wood, when dry and warm, is rent asunder, one of the separated surfaces becomes vitreously and the other resinously electrified. When a stick of sealing-wax is broken across, one of the surfaces of fracture is vitreously and the other resinously electrified.

Flash from Rupert's drops.

The electricity developed by the bursting of a Prince Rupert's or unannealed glass drop was found by Sir David Brewster to be accompanied with a flash of light. "These drops," says he, "have three different cleavages, one like the lines of a melon diverging from the apex of the drop, another concentric with the surface of the drop, and another oblique to the axis. Having laid one of these drops upon a table in a dark room, and covered it with a plate of thick glass to prevent any of the fragments from reaching the eye, the drop was burst by breaking off a part of its tail, and the whole of it appeared luminous, so that at the instant of the fracture a quantity of faint light, of the same shape and size of the drop itself, was distinctly visible. The drop which gave this singular result was made of flint glass, and was the largest that he had ever seen. Every other flint glass drop produced a distinct electrical light; but in none of them except the large one could he see the luminous shape of the drop. The same light appeared when they were burst under water. The small glass drops made of bottle-glass never exhibited any light at the moment of bursting; but it was almost always visible, in small sparks, in bottle-glass drops of a larger size." The same author observed also a bright electric light when the water-proof cloth manufactured by Charles Mackintosh, Esq., was separated by tearing it into its two component pieces, which are united by a thin film of caoutchouc. He found also that the same light was produced by tearing quickly cotton and other cloths, and by separating the films of mica. The same effects are produced by breaking barley-sugar or sugar-candy.

When the plates of mica, or the laminæ of sulphate of lime, are quickly separated, each of the two plates, when separated, carry off an excess of the opposite electricities, the one being vitreously and the other resinously electrified. If these two plates are again placed together in the position which they occupied previous to their separation, and a slight pressure used to make them adhere, M. Becquerel found that the same phenomena took place as at the instant of their first separation, that is, each plate took the same kind of electricity. This property continued only a few moments, perhaps till the molecules had taken their ordinary state of equilibrium, which is aided by increasing their temperature. The effects above described he found to be more distinct in proportion as the crystal was more heated previous to the cleavage.

Cleavage.

The electrical phenomena produced by cleavage, and by tearing asunder and crushing bodies, differ in degree only from those produced by pressure, as in every case of a separation of parts there must be an approximation of the molecules in one direction. If we press, for example, a piece of caoutchouc in one direction, or draw it out in an opposite direction till it breaks, the effect of both these mechanical actions is an approximation of the molecules in the same direction. Hence the electrical phenomena are nearly the same. The light produced by the collision of hard bodies, or by the separation of the parts of bodies, is no doubt produced by the rapid recombination of the two electricities when developed at the points of pressure.

Cleavage of topazes.

A very curious phenomenon was observed by Sir David Brewster during his numerous experiments on the cleavage of topazes, in which there were cavities containing very highly expansible fluids. His practice was to make the cleavage plane pass through a fluid cavity, and thus to open the cavity and allow its contents to be seen and examined. When this was done, the most expansible of the two fluids flowed from the cavity upon the polished and electrified face of cleavage, and continued to expand and contract itself alternately, now collecting itself into a drop, and then expanding itself into a flat disc. These motions continued till the fluid evaporated; and the effect was no doubt owing to the electricity produced by evaporation, as well as to that produced by cleavage.[1]

Wood shavings.

The experiments of Mr Wilson on the electricity of wood shavings belong, to a certain extent, to the present section. Having had occasion to work very dry wood that had lain for several hours over a very large fire, he observed the shavings adhering to the tools and to everything that they came in contact with. When the dry wood was scraped with a piece of window glass, the shavings were always vitreously electrified; but when it was chipped with a knife, the electricity of the chips was vitreous when the wood was hot and the knife not very sharp, but resinous when the wood was perfectly cold. The electricity of the knife was always opposite to that of the chips. The surface of the shaved or chipped wood was seldom electrified, but when it was, the electricity was very feeble, and of the same kind as the weakest of the other two. The wood used in these experiments was beach and cherry tree.

Sect. V.—*On the Electricity of Sifted Powders.*

Sifted powders.

As it has not been determined whether the electricity produced by the falling of sifted powders arises from friction, pressure, or separation of parts, we have thought it best to describe them in a separate section.

Bennet's experiments.

In 1786 Mr Bennet observed that when powdered chalk was blown from a pair of bellows upon the cap of his gold-leaf electrometer, *vitreous* electricity was produced when the cap was *six* inches from the pipe of the bellows, and *resinous* electricity when the distance of the pipe was *three feet*. The vitreous electricity first produced was changed to resinous by breaking the stream of air in the bellows-pipe with a bunch of wire, silk, or feathers, or by removing the pipe so as to make air issue in a wide stream.

When the plate which receives the powders at a distance of *three* inches was moistened or oiled, Mr Bennet found that the electricity was opposite to that produced when the plate was dry.

When powdered chalk fell from one plate to another placed upon the electrometer, resinous electricity was produced; and Mr Bennet obtained the same result when he used red ochre, yellow rosin, coal ashes, black lead, powdered quicklime, powdered sulphur, flowers of sulphur, sand, rust of iron, or iron filings.

When powdered chalk was placed on a metal plate upon the cap of the electrometer, and blown away with the mouth or bellows, it produced permanent vitreous electricity; and the same result is obtained if the chalk is merely blown over the plate, or if a chalk is drawn over a brush placed on the plate.

When chalk, or other powders, was sifted upon the cap of the electrometer, *resinous* electricity was produced; but when the instrument was placed in a dusty road, and the dust excited by a stick fell upon the cap, *vitreous* electricity was developed.

Experiments of Mr Singer.

The most accurate experiments on the electricity of powders were made by Mr Singer. The following results were obtained by sifting the powders on the cap of a delicate electrometer, through sieves of hair, flannel, or muslin, the sieve being cleaned after every experiment.

[1] See *Edinburgh Transactions*, 1823, vol. x., p. 27.

Phenomena and Laws.

Experiments of Mr Singer.

The following bodies produced *negative* electricity:—

The metals.	Acetate of copper.
The earths.	Sulphate of copper.
Oxides.	Sulphate of soda.
Acids.	Phosphate of soda.
Starch.	Carbonate of soda.
Sulphur.	Carbonate of ammonia.
Silex.	Carbonate of potash.
Alumine.	

The following bodies produced *positive* electricity:—

Wheat flour.	Wood charcoal.
Oatmeal.	Sulphate of potash.
Lycopodium.	Nitrate of potash.
Quassia.	Acetate of lead.
Powdered cardamum.	Oxide of tin.

Mr Singer obtained the following results by bringing an insulated copper plate repeatedly in contact with extensive surfaces of powders spread upon a dry sheet of paper, the copper plate being brought in contact with the condenser after every repetition of the touching, until a sufficient charge was communicated. Very distinct effects were produced with the alkalies by contact with a copper or silver plate, an experiment which had failed in the hands of Sir H. Davy. The pure alkali being broken into small pieces, was exposed in an open phial for a quarter of an hour to a moderate heat not sufficient to fuse the alkali. It was then reduced quickly to a powder in a dry and warm mortar, and distributed instantly over a dry sheet of card paper, which for some time continued to attract moisture from the alkali as rapidly as the alkali absorbed it from the air. The whole operation was performed as rapidly as possible. The following tables contain the substances that gave positive and negative electricity, the copper plate being always electrified oppositely to the powders.

Electricity Positive.

Lime.	Pure potash.
Barytes.	Common pearl ashes.
Strontites.	Carbonate of potash.
Magnesia.	Carbonate of soda.
Pure soda.	Tartaric acid.

Electricity Negative.

Benzoic acid.	Alumine.
Boracic acid.	Carbonate of ammonia.
Oxalic acid.	Sulphur.
Citric acid.	Rosin.
Silex.	

From the preceding experiments, which were several times repeated with uniform results, Mr Singer infers that they are unfavourable to the idea of natural electric energy; and he considers the result with sulphur and resin, viz. that the electricity is similar to that produced by their friction, as almost establishing the opinion that the contact of dissimilar bodies is in general the primary source of electrical excitation.

CHAP. III.—ON THE ELECTRICITY PRODUCED BY CHANGE OF FORM.

It has been long ago observed that electricity is developed when bodies change their form, or pass from one state into another. This important fact is exhibited when melted bodies pass from the fluid into the solid state, when fluids are converted into vapour, and when bodies are decomposed by combustion. The phenomena exhibited in these cases of change of form are very interesting, and will be described in the following sections.

SECT. I.—*On the Electricity developed during the Melting and Cooling of Resinous Bodies.*

Electricity of melted bodies.

In our history of electricity we have already given a general account of the experiments by which Mr Stephen Gray discovered a method of developing electricity by the fusion and cooling of resinous bodies. In his nineteenth experiment he formed a large cone of stone sulphur of thirty ounces avoirdupois, by melting the sulphur in a tall glass. The cone began to attract bodies two hours after it was taken out of the glass, and the glass itself exhibited a feeble attractive power. When the sulphur was lifted out of the glass on the following day, its attractive force was very strong, and that of the glass imperceptible. In making these experiments Mr Gray had occasion to place the cone of sulphur on its base between the two windows of his chamber, and to invert the glass over it. Whenever the glass was removed from the cone of sulphur, it exhibited electrical attraction as strongly as the cone, and they both preserved the property for several weeks. The glass, however, at last attracted at a less distance than the sulphur, that is, its attractive force diminished most quickly.

Experiment of Wilcke.

These interesting inquires were resumed by Mr Wilcke of Rostoch, who gave the name of *spontaneous* to the electricity developed by cooled resins. He found that the sulphur acquired a strong electricity whether the glass in which it was fused was insulated or not; but it was always stronger when the vessels were not placed on electrics, and strongest when the glass vessel had a metallic coating. The electricity of the glass was always *positive*, and the sulphur *negative.* The electricity of the sulphur did not appear till it began to cool and contract, and it was a *maximum* at its point of greatest contraction. At this time the electricity of the glass was a *minimum,* having previously reached its *maximum* at the time when the sulphur was shaken out of it. Melted *sealing-wax* becomes *negatively* electrical when poured into *glass*, and *positively* electrical when poured into sulphur. Sealing-wax poured into a vessel of baked wood showed negative, and the wood positive electricity. When sulphur was poured into wood it was negative, but it acquired no electricity whatever when poured into sulphur or rough glass.

Of Æpinus.

Æpinus pursued this subject by melting the sulphur in metallic dishes. The sulphur and the dish showed no electrical signs when they were cooled, but the moment they were separated the electricity of each was very strong, that of the dish being always negative, and that of the sulphur positive. The electricity invariably disappeared when the sulphur was replaced in its dish, and reappeared upon their separation.

If the electricity was abstracted either from the sulphur or from the dish when they were separated, they both exhibited, when re-united, the electricity which had not been taken away, and which always existed *on the surface* of the sulphur.

Electricity of melted chocolate.

Mr Sanders, a maker of chocolate, having observed that the chocolate exhibited electricity during its cooling, communicated the fact to Mr Henley, who having previously repeated the experiments of Mr Gray, resumed the subject. From several experiments made by Mr Sanders under his direction, he found that by heating the chocolate over and over again, the electrical property gradually disappeared; and that it could at any time be restored by the addition of a small quantity of olive oil.

Experiments of Van Marum.

The most elaborate series of experiments on this subject were made by MM. Van Marum and Van Troostwyck. The substances which they employed were sulphur, sealing-wax, gum-lac softened with rosin, rosin, pitch, and wax. These substances were all poured when in a fluid state on the surface of mercury, and all of them, except the sulphur, were electrical after their removal from the metallic surface. These soft solids were next melted in insulated vessels of baked clay, and also in linen and gauze insulated by silk cords; but though Volta's condenser was employed, no proof could be obtained that they had lost any portion of their natural quantity of electricity.

The electricity owing to friction.

In order to verify the suspicion that friction was the source

Phenomena and Laws.

of the electricity generated in the melting and cooling of soft solids, they poured them upon copper, tin, lead, glass, and porcelain, and they invariably found *that they acquired the same kind of electricity as if they had been rubbed by the body on which they were poured.* In confirmation of this opinion they found that the lower surface of each plate was much more strongly electrified than the upper one, and no difference of effect was perceived when the plates were even one inch and a half thick. To obtain still more complete evidence of this conclusion, they melted gum-lac and rosin, and having suspended plates of copper by silk cords, they caused the plates to come in contact with the melted gum, without producing any friction. After the gum was cooled, and the plates again raised, not a trace of electricity could be discovered.

From these results their authors infer that the electricity exhibited in this class of phenomena is not produced either by the separation of the fused substance from the electric on which it is melted, or by the fusion or subsequent cooling of the body, but that it is generated by the friction which the particles of the electric bodies undergo when they disperse themselves over the surfaces of the dishes into which they are poured. The electricity thus produced is masked or counterbalanced by the opposite electricity acquired by the dish, and therefore does not appear till the one is separated from the other.

Electricity of congelation and sublimation.

The electricity produced during the congelation of glacial sulphuric acid and other substances has probably a similar origin; and it is likely that the electrical effects which are observed when calomel fixes itself by sublimation to the upper part of a glass vessel, may belong to the same class of facts. This branch of the subject, however, has been but very imperfectly studied, and will form a fine topic of research for some young and active philosopher.

SECT. II.—*On the Electricity developed during Evaporation and the Extrication of Gases.*

Electricity of evaporation.

The development of electricity during the transition of bodies from the solid or fluid state into the state of vapours or gases, was first investigated by MM. Lavoisier and Laplace, with the assistance of M. Volta. Two kinds of apparatus were used in these experiments. In both of them the bodies to be vaporized were insulated by varnished supports of glass; and in those cases where the electricity was quickly disengaged, a common electroscope communicating with the body was used to indicate it, whereas, when the effect was likely to take place place continuously, Volta's condenser was employed.

Experiments of Lavoisier, Laplace, and Volta.

Electricity of chemical action;

When hydrogen gas was rapidly disengaged from iron filings by the action of sulphuric acid, the condenser of Volta afforded a strong spark, and the electricity was negative.

When carbonic acid gas was evolved from powdered chalk, no sensible spark was educed, but the electricity generated was negative.

When nitrous acid diluted with two parts of water was poured upon iron filings placed in six separate vessels, so as to generate nitrous gas, a distinct negative electricity was obtained without a spark.

of combustion;

During the combustion of charcoal in three insulated chafing dishes strong negative electricity was generated; and a spark could easily have been obtained, by increasing the quantity of charcoal.

of evaporation.

Having arranged three insulated furnaces of hammered iron, and made them communicate with the electroscope, water was thrown upon them when heated. In the first experiment the electricity generated was *negative*, and in the other two *positive;* a discrepancy which they ascribed to the cooling which accompanied the evaporation, the positive electricity produced by cooling being supposed to counterbalance the negative effect occasioned by evaporation.

Phenomena and Laws.

Bennet's experiments.

Mr Bennet, before whom Volta had repeated his experiments in England, published in the *Phil. Trans.* for 1787 the following interesting facts on the same subject. Having placed a metallic cup with a red-hot coal in it upon the cap of his gold-leaf electrometer, he threw a spoonful of water into the cup. The cup was electrified *negatively*, while the ascending column of vapour exhibited *positive* electricity. When water is poured through an insulated cullender, containing hot coals, the *descending* drops of water are *negatively*, and the *ascending* vapour *positively* electrified; and Mr Bennet regards this as a good illustration of the electricities of fogs and rain. A more simple and certain method of making these experiments consists, according to Mr Bennet, in heating the small end of a long tobacco pipe, and pouring water into the head. The water, being allowed to run through the heated end, is suddenly expanded into steam, and, when projected upon the cap of the electrometer, exhibits signs of electricity. If the pipe, when fixed in a cleft stick, is fixed on one electrometer, while the steam is received upon the cap of another, the two opposite electricities will be simultaneously exhibited. The vapour of alcohol and ether exhibits the same phenomena as that of water, but sulphuric acid and oil generate only smoke, and exhibit no electrical indications.

Experiments of Saussure.

M. Saussure devoted much attention to this interesting branch of electricity. He confirmed the general results obtained by Volta, Lavoisier, and Laplace, and proved that negative electricity was constantly produced by the evaporation of water. He then determined the degree and kind of electricity produced by evaporation when it was carried on in vessels of different metals, and kept at different temperatures. The apparatus which he employed consisted of a well-baked vessel of clay, four inches in diameter and fifteen lines thick, which was insulated upon a clean and dry goblet of glass. Upon this clay vessel he placed a crucible, or any other dish powerfully heated; and this crucible was made to communicate with the electrometer by means of a wire. Fifty-four grains of distilled water were then thrown upon the crucible, and, by means of a time-piece and an electrometer, he observed the duration of the evaporation, and the intensity and character of the electricity.

In his first series of experiments the crucible was of iron; the number of projections of the water varied from 1 to 21, the time of the projection from 0″ to 17′, the duration of the evaporation from $2\frac{1}{2}''$ to 118″, and the degree of electricity from 1 to 18 tenths of a line. In *ten* of these experiments the electricity was *positive*, and in *six negative.* In four of the negative experiments the strongest electricity was 7, 13, 17, and 18 tenths of a line, and in four of the positive experiments the strongest was 3, 3, 5, and 8 tenths; thus showing, as might have been thought, that the weak positive electricity was produced by some secondary cause.

But in repeating the same series of experiments with the same iron crucible, he found very different results. The projections of water varied from 1 to 23, their time from 0′ to 14′ 10″, and the duration of the evaporation from $2\frac{1}{2}''$ to 120″. The electricity was now *always* positive, and its intensity varied from 0 to 30 tenths of a line.

When the experiment was repeated with a *copper crucible* $3\frac{1}{4}$ inches wide at top, 2 inches wide at bottom, 3 inches high, and weighing 57 ounces, the electricity was always *positive*, and its intensity varied from 0 to 33 tenths of a line, the maximum effect taking place when the duration of evaporation was 165″, a mean between the shortest and longest times. In another experiment with the same *copper* crucible, made under the very same circumstances, the electricity was negative at the end of the first projection, but afterwards became positive, and continued so till the experiment was complete.

In the next experiment the crucible was of *pure silver*, $2\frac{3}{4}$ inches wide at top, $1\frac{1}{2}$ at bottom, $12\frac{1}{2}$ inches high, $1\frac{1}{2}$

Phenomena and Laws.

line thick, and weighing 16 ounces. At the first trial, when the evaporation was very slow, the electricity, which was always very feeble, was *thrice negative*, and thrice 0. In a second trial it was also negative at first, but it became *positive* afterwards, and then vanished. In a third trial the electricity was stronger and negative. The balls of the electrometer now diverged $3\frac{1}{2}$ lines. It then became *positive*, when the balls diverged $\frac{7}{10}$ths of a line; and at the third projection, when it was still positive, the separation of the balls was so great as *six* lines.

Saussure's next experiment was made with a cup of white *porcelain*, surrounded with sand in a clay crucible. The electricity was *negative*, and the evaporation remarkably rapid. Its intensity varied from 0 to 8 lines. The same results were obtained with different porcelain crucibles.

When *alcohol* and *ether* were substituted for water, and the silver crucible used, the electricity was *negative*. With the former the greatest intensity was 1 line, and with the latter 4·2 lines.

From these experiments Saussure infers, with great hesitation, that the electricity is positive with those bodies which are capable of decomposing water, or of being themselves decomposed by their contact with water; and that it is negative with those which are not decomposed. He ascribed the result with silver to its being adulterated with copper or other oxidable metals. The negative electricity of burning charcoal he supposes to arise from the readiness with which it loses its heat in contact with water.

Saussure was unable to procure electricity either from combustion or by suddenly exploding heaps of gunpowder; and all his attempts failed to develop electricity, *without ebullition*, by evaporation, from large surfaces of wet linen or white iron.

Experiments of Cavallo.

M. Cavallo followed Saussure in this inquiry, though he does not seem to have been acquainted with the labours of the Swiss philosopher. He found that evaporation from iron produced negative electricity when the iron was free from rust, but positive when it was very rusty. He found also that white and clear flint glass produced *positive*, while bottle glass evolved *negative* electricity. From these various researches it is not easy to deduce anything like a general principle. The subject indeed requires to be resumed, and great attention paid to the chemical changes which take place during the progress of the experiments.

SECT. III.—*On the Electricity developed in Flame and Combustion.*

Electricity of flame.

We have already seen in the preceding section, that MM. Lavoisier and Laplace obtained distinct indications of electricity by the combustion of charcoal, and Volta informs us that he never failed to obtain it. Saussure, on the contrary, as has been mentioned, never could develop electricity either by combustion or the explosion of gunpowder; and Sir Humphry Davy equally failed to procure it by the combustion of iron or of charcoal in air or in pure oxygen.

Experiments of Erman.

The electrical relations of flame have been subsequently examined by M. Erman of Berlin and Professor Brande. M. Erman concluded, from some experiments, that the insulated flames of *wax, oil, alcohol*, and *hydrogen gas* conduct *only positive* electricity, while the flame of *phosphorus* conducts only *negative* electricity. It was noticed by Mr Cuthbertson that when the flame of a common candle was placed halfway between two equal balls, the one positively and the other negatively electrified, the flame was attracted to the *negative* ball, which consequently became very warm, while the positive ball continued comparatively cold.

In pursuing this idea, Mr Brande placed the flames of various bodies between two insulated brass balls, one of which was insulated positively and the other negatively, and obtained the following results.

Experiments of Brande.

Flames, &c., attracted to the Negative Ball.

Olefiant gas.
Sulphuretted hydrogen, slightly.
Arseniated hydrogen.
Flame of hydrogen, weakly.
Sulphuret of carbon.
Potassium in combustion, and its fumes.
Flame of gum benzoin.
Smoke of benzoin.
Charcoal emitted by camphor in combustion.

Resinous bodies in combustion exhibit the same phenomena as charcoal.

Flames attracted to the Positive Ball.

Sulphurous acid vapour.
A *small* flame of phosphuretted hydrogen, slightly.[1]
Fumes of white arsenic, slightly.
Large flame of carbonic oxide.
Vapour of burnt sulphur.[2]
Flame of phosphorus.
Vapour of phosphorus.
Stream of muriatic acid.
Stream of nitrous gas.
Vapour of benzoic acid.

In order to explain these phenomena, Mr Brande supposes, that since some bodies are naturally negative and others positive, the positive ones will be attracted by the negative ball, and the negative ones by the positive ball.

This conjecture was not confirmed by future observation, and did not lead philosophers to any certain conclusions. The subject, however, was resumed by M. Pouillet, who arrived at a general result, which explains in a satisfactory manner the errors and contradictions of preceding observers.

Experiments of M. Pouillet.

The first point which occupied his attention was the combustion of charcoal; and in his earliest experiments he found with surprise that he could sometimes obtain from it positive and at other times negative electricity, while at other times he could not obtain the slightest electrical indications. In explaining these discrepancies, he supposed that one of the electricities was taken by the charcoal, and the other by the oxygen or carbonic acid; and in order to determine the truth of this supposition he made the following arrangement.

Combustion of charcoal.

Having taken a cylinder of charcoal, he placed it vertically six or eight centimeters below a plate of brass which rests upon one of the discs of the condenser. The charcoal having a communication with the ground, was lighted at its upper end without the fire reaching the lateral surface, and there arose a column of carbonic acid, which struck the plate of brass, and in a few seconds charged the condenser. The electricity which the condenser received from the carbonic acid was *always positive*, whereas Lavoisier, Laplace, and Volta made the electricity *negative*. When the charcoal was held nearly horizontally, so that the carbonic acid which was generated could rise only by ascending along the base of the charcoal, which was now vertical, *no sensible effect was obtained;* and when the lateral as well as the upper surface of the charcoal, placed vertically, was lighted, an uncertain result was obtained.

In order to determine the electricity of the charcoal itself, M. Pouillet placed the base of the cylinder upon the disc of the condenser; and after lighting the upper end of it, and keeping up the fire by a gentle blast of air, the condenser was charged, and showed that the electricity taken by the charcoal was negative. When the charcoal burned on all its surface, or when it touched the condenser only in a few points, no electrical effects were observed. In the

[1] When the flame was *large* it was equally attracted by both balls.
[2] The direction of the flame could not be determined.

Phenomena and Laws.

last of these cases a small quantity of electricity only can pass by a small number of points, and in the first case the positive electricity of the ascending carbonic acid was recombined with the negative electricity. In order to produce intense and rapid electrical effects, several cylinders of charcoal of the same height should be placed on their ends, and near each other, upon a sufficiently large plate of brass; and when all the cylinders are made to burn at their upper ends, and their united columns of carbonic acid received by another brass plate communicating with the condenser, and raised a few inches or even a foot above it, a strong charge of *positive* electricity will in a few seconds be communicated to the brass plate. When the electricity of the charcoal is required, we have only to unite the condenser to the brass plate upon which the burning cylinders are placed, and in a few seconds the condenser will be abundantly charged with *negative* electricity.

Experiments of Pouillet.

When the combustion is maintained by a current of oxygen, the electricity is not only much more intense, but is much more quickly developed; and the gold leaves of the condenser separate to their maximum divergency in an instant. The first point, however, to be attended to in every form of the experiment, is to burn only the upper horizontal surface, so that the carbonic acid forms and ascends in a moment, and without touching any other body till it deposits its electricity on the brass plate. So essential is this condition, that if we burn even a deep cavity on the circumference of a vertical cylinder of charcoal, and do this even with a jet of oxygen, the electrical indications are sometimes positive and sometimes negative, just as the electricity of the gas or the charcoal predominates.

M. Pouillet next entered upon the more arduous investigation of determining whether or not electricity is produced by change of condition or chemical affinity. Volta had supposed that carbon, in becoming gaseous, absorbed the positive, and left to the remaining solid parts the *negative* electricity which we find in them. M. Pouillet, on the contrary, supposed that if electricity is disengaged from two elements which combine, positive electricity would be given out by the one and negative by the other; and that when these elements separate, each of them required to take up the fluid which they had lost.

Combustion of hydrogen.

By forming combinations unaccompanied by changes of condition, M. Pouillet resolved this question. He first tried that of oxygen and hydrogen. The flame of hydrogen, like charcoal, gave electricity, sometimes strong and sometimes feeble, sometimes *positive* and sometimes negative; and it was some time before he discovered the cause of these discrepancies. That the gases are not very good conductors of electricity, he found by the following very curious experiment. Having set a very small spirit-lamp upon a common electroscope, and about five or six feet above it a feebly charged body, such as a stick of electrified rosin or a plate of glass, he observed that the gold leaves diverged greatly, though the same charged body could produce no divergence if held even so near as an inch to the electroscope without flame. This apparatus enabled our author to discover the smallest trace of electricity. If we turn the plate of an electrifying machine, the air of the room is electrified; and the flame which ascends in that air is charged at the moment with electricity of the same name. A pile in action electrifies the air in the same manner, as the flame of the electroscope proves. A charcoal fire, or even a lighted candle, develops carbonic acid electrified positively, which is shown also by the electroscope. The atmospheric air, in short, is always electrified: and if it enters a room by any opening, it will preserve itself in an electrified state so long as to affect the results of experiments on small quantities of electricity.

These causes of error being excluded, M. Pouillet repeated his experiments on the combustion of hydrogen. The gas was emitted from a glass tube, and the flame, which was vertical, was about three inches long and four or five lines broad. The brass plate was now set aside, and the electricity conducted to the condenser by a platina wire, whose end is coiled into a spiral. The spire is vertical, and the circumvolutions are sometimes so large as to surround the flame without touching it, and sometimes so small as to be completely enveloped in the interior of the flame. When we approach this flame from the interior outline of the spire, and keep it ten millimeters distant, we obtain indications of positive electricity. As the distance of the flame diminishes, the electricity becomes more and more intense; but when the flame touches the spire, the electricity becomes weak, and its nature uncertain. The same thing is observed when the flame passes to the interior of the spire, and in the direction of its own axis. Hence there exists round the apparent flame of the hydrogen a sort of atmosphere, more than ten millimeters in thickness, charged with positive electricity. Positive electricity being thus developed in the combustion of hydrogen, Pouillet tried to discover the negative electricity which must have been set free. He placed a small spiral in the centre of the flame, and when it was enveloped on all sides, negative electricity was collected by the condenser. If we plunge the spire half way into the bright part of the flame, no electricity is manifested. Hence it follows that the inside and outside of the flame are in opposite electrical states, the former being negative and the latter positive, and that there is an intermediate layer of the flame where the electricity disappears. On these facts M. Pouillet thus reasons. In the thickness of the exterior atmosphere of the flame, when the positive electricity appears, the combination of oxygen and hydrogen is not effected, for the hydrogen cannot arrive there. The electricity is therefore communicated, and it must come from the oxygen which predominates on the outside, and which envelopes in some measure all the jet of hydrogen. This combined oxygen must therefore disengage positive electricity, which communicates itself to the neighbouring strata of air sufficiently heated to conduct it. In like manner the hydrogen predominates in the interior of the flame, and the negative electricity must be disengaged from the hydrogen which burns, and which it communicates to the excess of uncombined hydrogen. If this view is correct, it is probable that, at a certain distance above the flame, the two opposite electricities ought no longer to appear, as they must have combined; and this is proved to be the case by the fruitless attempt to collect electricity at a distance sufficiently great above the vertical flame. At the distance, however, of a few inches, other phenomena appear. The two electrical fluids appear there in the same quantity, but they are not recombined; for if we present a soldered plate of zinc and copper, the zinc will attract the positive and the copper the negative electricity.

Electricity of flame.

When the hydrogen issues from a metallic in place of a glass tube, and a communication is made with the condenser and not with the ground, the metal tube, which touches the hydrogen without touching the flame, always takes the negative electricity; and, on the contrary, if the tube communicates only with the ground, it loses in this manner the negative electricity which it had before taken to the condenser, and the product of the combustion preserves an excess of positive electricity.

In pursuing this inquiry in a similar manner, M. Pouillet found that the flames of alcohol, ether, wax, the oils, fatty substances, and several vegetable bodies, present exactly the same phenomenon as the flame of hydrogen. He observed, however, that the particles of charcoal which float in all these flames, and which, according to Sir H. Davy, give them the lustre with which they burn, render them also more fitted to manifest negative electricity. From these results M. Pouillet has deduced the general conclu-

Phenomena and Laws.

sion, *that in combustion the molecules of oxygen which combine disengage positive electricity, which may be communicated to the neighbouring molecules not yet combined; and that the combustible body, on the contrary, disengages negative electricity, which can, in like manner, be communicated to all the neighbouring combustible parts.*

Experiments of M. Becquerel.

The experiments of M. Pouillet were repeated by M. Becquerel in 1827, on the flames of hydrogen gas or alcohol; but he commenced them with some reserve, for, as they were made by means of platina wires plunged in the flame, he supposed that the phenomena were not only owing to the electricity disengaged during combustion, but also to some property which the metals acquired at a certain temperature. The following is the general fact, without entering into any of the details of his experiments: A platinum wire communicates by one end, through the intermedium of a band of wet paper, with one of the plates of a condenser, the other end being plunged in one of the envelopes of a flame produced by the combustion of alcohol, contained in a vessel of copper, which the observer holds in his hand. The end of the wire may even be placed without the flame, provided it is so near it as to become red hot. The wire soon takes a considerable excess of negative electricity, which ought not to be ascribed entirely to that which the alcohol carries off during combustion. In order to prove this, let us resume the last experiment but one. As soon as the end of the platinum wire attains a red heat, let us withdraw the lamp, and touch this end of the wire with a band of wet paper, or rather with the end of a tube of hot glass; the effect is the same as when the wire touched the flame, or was at a small distance from it. It is very probable that the disengagement of the electricity is due, in this last case, in part to the difference of temperature between the two ends of the wire, and that the flame has carried off the positive electricity of the wire, or the band of wet paper, as the hot glass tube had done. This opinion is confirmed by the circumstance that the effect is the same whether we bring the wire to a red heat in the interior or in the exterior of the flame, neither of which possesses the same kind of electricity. Notwithstanding this result, M. Becquerel still admits, that during the combustion of alcohol and hydrogen, the exterior envelope of the flame is charged with positive electricity.

M. Becquerel has endeavoured to explain the curious fact discovered by M. Erman, and already referred to. Having placed upon an electroscope a lamp without flame, whose platinum wire was kept at a red heat by the burning vapour of the alcohol, he held above the spiral the negative pole of a dry pile, and the two gold leaves instantly diverged. He next held the positive pole above the spiral, but there was now no divergence of the leaves. Hence the platinum wire afforded a passage only to the negative electricity. The contrary effect took place when the electricity passed from an incandescent wire to another which was not so; and hence M. Erman found that the incandescent wire was reciprocally a conductor and insulator of each fluid.

In order to show that this conclusion is incorrect, M. Becquerel presented successively to a red-hot platinum wire the two poles of a dry pile, and it conducted equally well both kinds of electricity. Besides, as he remarks, it appears, from our knowledge of the electrical effects produced in gaseous combustion, and by increase of temperature, that part of the air which surrounds the red-hot wire of the lamp without flame ought to be in a positive state of electricity, and the wire which is in the middle of the alcoholic vapour in a negative state. Moreover, it is evident, from what has been already stated, that the part of the wire which is red hot ought easily to yield positive electricity to contiguous bodies. This being admitted, when we present to this wire the negative pole of a dry pile, there are two reasons why the negative electricity should neutralize both the positive electricity of the surrounding air, and that of the red-hot wire which tends to escape from it. The negative electricity of the wire then becoming free, manifests its action upon the electroscope. In repeating the experiment in an inverse manner, that is, by causing each of the two electricities to escape successively by the red-hot wire, as this last tends to be negative, it neutralizes the positive electricity which arises, and sets free that of the surrounding air and of the red-hot end of the wire. It is not therefore necessary to have recourse to a reciprocity of insulating and conducting action in the red-hot wire in order to explain the phenomenon, for the fact admits of an easy explanation on the properties above explained.

Sect. IV.—*On the Electricity of the Solar Rays.*

Electricity of the solar rays.

Our readers are no doubt aware that Dr Morrichini and others succeeded in magnetizing needles by the action of the blue rays in the solar spectrum. Other philosophers have failed, even in good climates, in obtaining decided indications of magnetism, so that accurate researches are still wanting to remove this opprobrium from our experimental physics. The very same observations are applicable to the development of electricity by the influence of solar light; but still it is necessary, in a work like this, that we should give some account of the experiments from which this electrical action has been inferred.

Experiments of Barlocci;

In a memoir on the influence of solar light in the production of electric and magnetic phenomena, Professor Saverio Barlocci of Rome relates the following experiments: Having formed the prismatic spectrum by the solar rays, he caused the red rays and the violet rays to fall upon two discs of blackened copper, each of which was attached to a copper wire. Two copper nuts sliding upon a vertical glass rod, and to which the two wires were fixed, allowed the discs to be brought near each other or separated at pleasure. A prepared frog was then suspended by the body to the upper wire, and the legs were placed upon the lower one. The red rays being made to fall on one disc, and the violet on the other, the extreme parts of the two wires were brought into contact, and distinct signs of contraction were observed in the frog.

of Matteucci.

M. Matteucci has more recently investigated the same subject. Having exposed to the sun a delicate condensing electrometer of gold leaf, he soon perceived the leaves diverge and open themselves on that side of the glass which was directly exposed to the solar action, as if they had been attracted by it. Hence he was led to suspect that glass thus exposed was electrified; and in order to ascertain this, he placed some plates of it in the sun, and having in a few minutes touched them in different places with the ball electrometer, a perceptible divergence took place. This divergence was much more apparent when he touched the plates even lightly with a flat surface, as the effects of the friction did not afford a doubtful result.

Having inferred from these results that the solar rays had the power of developing electricity in glass, M. Matteucci endeavoured to ascertain whether this was owing to the existence of electricity in the rays themselves, or to the increased temperature of the glass. He therefore heated a plate of glass repeatedly, and having tried it with the electrometer, he never could discover in it any signs of electrical action. M. Matteucci likewise observed that the glass plate exposed to the rays of the sun never became electric if placed beneath another glass plate, or if the face of the sun was obscured by a cloud.

Experiments of Dr Faraday.

Dr Faraday likewise made experiments on the solar spectrum, in the same manner as M. Barlocci, with the exception that he used a very delicate galvanometer in place of a frog; but, to use his own words, "no electricity could be obtained by means of an English sun."

Phenomena and Laws.

M. Delarive has still more recently (*Bibl. Univers.* July 1833, p. 326) stated that, after taking every precaution to avoid the action of extraneous causes, he could not discover in the solar rays the slightest trace of electricity.

Sect. V.—*On the Electricity produced by Vegetables.*

Electricity of vegetation.

Mr Read seems to be the only author who, previous to the researches of M. Pouillet, had made any distinct statement respecting the electricity of vegetable bodies. He had concluded, from several experiments, that vegetable putrefaction is always electrified negatively, while the surrounding atmosphere is electrified positively. It is to M. Pouillet, however, that we owe all our knowledge on this subject, and in the present section we shall communicate to our readers a general abstract of his researches.

Researches of M. Pouillet.

That the various parts of plants act upon atmospheric air is well known. At the expense of the oxygen they sometimes form a large quantity of carbonic acid gas, which disengages itself insensibly; and sometimes they exhale pure oxygen, proceeding from some combination which goes on in the interior of the plant.

As carbonic acid gas is electrified vitreously at the moment of its formation, from charcoal in combustion, M. Pouillet conceived that a considerable quantity of electricity ought to be produced during the exhalation of this acid from growing plants. This idea was soon confirmed by experiment, and M. Pouillet was led to the important conclusion that vegetation is an abundant source of electricity, and is therefore a powerful cause in the generation of the electricity of the atmosphere.

He took twelve capsules of glass, about nine inches in diameter, and coated them externally, but only to a distance of one or two inches towards the edge, with a film of gum-lac varnish. They were then arranged in two rows at the side of each other, either on a table of very dry wood, or on a table which was itself varnished with gum-lac. When they were filled with vegetable mould, they were made to communicate with each other by metallic wires, which went from the interior of the one to the interior of the other, passing over the edges of the capsules. In this manner all the insides of the twelve capsules, and the mould which they held, formed only one conducting body. If electricity is communicated to such a system, it will be distributed over the twelve capsules, and will remain there, as it cannot pass into the ground, nor even into the exterior surfaces of the capsules, on account of the film of gum-lac round their edges. The upper plate of a condenser is now put in communication with one of the capsules by means of a brass wire, and its lower plate with the ground by the same means; and these communications are so made that they may be kept up even for several days. The grain of which we wish to study the effects is then sown in the earth in the capsules, and from this moment the laboratory must be closely shut, and neither fire nor light, nor any electrical body, admitted.

This experiment was made during the dry north and east winds of the month of March. During the first two days the surface of the mould was dried up, and the grains swelled; the germ projected about a line out of its envelope, without, however, appearing above the thin stratum of earth which covered the grain; and the condenser, after several trials, gave no signs of electricity. On the third day the germs had come out of the mould, and began to raise their points towards the window, which had no shutters. Upon now trying the condenser, M. Pouillet saw a divergence in the gold leaves, and he found the electricity to be negative in the capsules, and positive in the gases which were disengaged. Hence M. Pouillet infers that the rapid action which the rising germ exercises on the oxygen of the air disengages electricity.

The apparatus was then put into its usual state, and after the lapse of some hours the action of the germ again charged it with electricity. Upon visiting the apparatus next morning, M. Pouillet found that it gave a very strong electric charge, and the electricity was of the same kind as before. During the next eight days the vegetation continued active, and at all times of observation, both during the day and night, the condenser exhibited more or less electricity, according to the time that had elapsed. After twelve hours the divergence of the gold leaves was more than an inch, and the electricity of the earth in the capsules was always *negative*. Damp weather followed, and it was then impossible to collect the least quantity of electricity.

M. Pouillet's next experiment was to make two vegetations of corn, two of cresses, one of gillyflower, and one of lucerne; but he was obliged to maintain in his laboratory an artificial dryness, by spreading in a very large apartment several bushels of quicklime broken into very small fragments, and he also distributed in porcelain saucers several kilogrammes of muriate of lime, and placed them near the capsules. The condenser now exhibited a more intense electricity than before, and in each operation the development of the vegetable action, and that of the accompanying electrical phenomena, were observed during ten or twelve days. So rapid was the development of electricity, that after the first three or four days of vegetation, if the condenser was put into the natural state after one observation, and it was then replaced for experiment only during *one second*, it was found to be charged with electricity. "But," as M. Pouillet observes, "it is evident that, during one second, the weight of oxygen which combines and disengages during a languid vegetation, of only three or four square feet, is a weight so feeble, and a fraction of a milligramme so imperceptible, that the electricity which it disengages is not sensible to the condenser. One is apt to fear, after this, that the electricity has another source, and that it can only be developed by some foreign cause; but upon reflection we see that the earth of the capsules is so dry that it becomes an imperfect conductor, that the electricity is retained, and that it is it which charges the condenser. To be certain of this, it is sufficient to place successively in contact with the condenser, one, two, three, or a greater number of capsules, and we shall see the charge increase in proportion as the number increases; in short, it is sufficient to place them in communication with the ground for a long time, when they will no longer give a charge to the condenser, and it will be many hours after that before they communicate a sensible electricity. It is without doubt this imperfect conductibility of the dried earth which has rendered it impossible for me to observe until now any electrical charges during the periods of day or night, although I took every precaution to observe it, presuming that if the disengagement of carbonic acid produce resinous electricity in the ground, the disengagement of oxygen ought, on the contrary, to produce vitreous electricity.

"It is perhaps the same cause which has given birth to another phenomenon, which I have not yet studied sufficiently to give an exact account of it. It happened twice that the electric signs had ceased during two or three days, and that they were then presented in opposite directions, that is to say, the capsules had exhibited vitreous electricity, and had continued to exhibit it, with a very weak intensity, during the rest of the vegetation."

Sect. V.—*On the Electricity of Living Animals.*

Electricity of living animals.

When we consider the structure of organized bodies endued with life and motion, we should naturally expect, from the phenomena described in the preceding section, that electricity would be developed in the chemical pro-

Phenomena and Laws.

cesses and changes which are incessantly taking place. During the processes of digestion and assimilation, for example, in which both solid and fluid bodies are changing their form, and in the process of respiration, in which the atmospheric air is decomposed, electricity cannot fail to be developed in greater or less intensity.

Another source of electricity in animal bodies is no doubt the friction between the clothing and the skin; and the electricity thus generated will be more or less intense, according to the state of the atmosphere, the nature of the clothes, and the constitution and habits of the individual.

But, independent of the electrical phenomena which arise from these causes, we find in certain fishes a regular system of electrical organs, by which they either defend themselves from the attacks of their enemies, or seize the prey which nature has provided for their use. The curious phenomena which have been observed relative to these subjects will be described under separate heads.

ART. I. *On the Electricity of the Human Body.*

Electricity of the human body.

Long before electricity had become a science, electrical phenomena had been distinctly observed. Cardan relates that sparks were emitted from the hair of a Carmelite monk whenever it was stroked backwards; and Faber mentions a young woman from whose hair sparks of fire always fell when it was combed. Cassandra Buri, a Veronese lady, often terrified her maid-servants by brilliant sparks, and a crackling noise, which were emitted when her body was rubbed, or even touched slightly, by a linen cloth. Antonio Ciampi, a bookseller at Pisa, emitted sparks from his back and arms with a crackling noise, whenever he pulled off a narrow shirt and a piece of cloth which he wore upon his breast.

Gesner relates that in Germany, where heated stoves prevailed, it was exceedingly common to observe crackling flames issue from the shirts of persons who had been previously warming themselves at a stove.

The experiments of Mr Seymour on the electricity of silk stockings that had been worn, which we have already detailed, correspond with the preceding facts; and there are few individuals who have not observed similar electrical phenomena in changing different parts of their dress.

Experiments of Saussure;

That the electrical effects exhibited in the human body are, generally speaking, produced by the friction of the clothes against the skin, has been proved by the experiments of Saussure, Landriani, the Abbé Bertholon, and M. Volta. M. Saussure examined the electricity of his own body by means of Volta's electrometer and a condenser, and he never could discover any electricity in it when he was perfectly naked, when his clothes were cold, or when he was in a state of perspiration. In other states of his body and dress the electricity which did manifest itself was sometimes positive and at other times negative, without any apparent cause for these variations. When he bent his body forwards and raised himself suddenly, the balls of the electrometer diverged to a considerable distance, and then collapsed; but if he drew away his hand when the balls were thus divergent, they continued in this state of divergency, and exhibited positive electricity. Saussure observed also that the motion produced by respiration is of itself sufficient to produce a small quantity of electricity; for when he remained on the insulating stool in a state of the most perfect repose that a living being could observe, distinct indications of electricity were manifested when he laid his hand for some time on one of Volta's condensers.

of Hemmer.

The most complete series of experiments on the electricity of the human body were made by M. J. J. Hemmer of Manheim. He insulated himself upon a board supported by glass feet, and then touched for about half a minute a condenser The condenser was then applied to Saussure's improved electrometer, and, by means of a glass tube excited by woollen cloth, he examined the nature of the electricity. The following are the results of experiments which he made upon himself on the 21st of February 1786, and which he has repeated upon persons in every state of body and mind, and under every variety of dress and temperature.

1. The electricity of the human body is common to all men. It was found in thirty persons of all ages and sexes; but it varied in strength in different individuals, and was positive in some and negative in others.

2. The intensity and character of the electricity often varies in the same person. In 2422 experiments M. Hemmer found it 1252 times positive, 771 times negative, and 399 times imperceptible. Out of 94 experiments made upon his maid-servant, it was 17 times positive, 33 times negative, and 44 times imperceptible.

3. The electricity of the body is naturally positive; for when it is subject to no violent exertion this is always its character. Out of 356 experiments made upon himself when sitting at rest, and when the natural heat of his body was not disturbed, his electricity was 322 times positive, 14 times negative, and 10 times imperceptible.

4. The natural positive electricity of the body is changed into negative by cold, or is greatly diminished. Out of 62 experiments made upon himself when he came from a temperature of 32° of Fahrenheit, his electricity was 38 times negative, 15 times positive, and 7 times imperceptible.

5. The natural positive electricity of the body is changed into negative by lassitude. Out of 16 times that he walked backwards and forwards in his apartment, or was otherwise employed, he found the electricity only *once* weakly positive, 10 times negative, and 5 times imperceptible. In 32 experiments made when he was standing at rest, the electricity was 2 times weakly positive and 30 times imperceptible.

6. The natural positive electricity of the body is changed into negative by sudden, speedy, and violent motion.

It is obvious from these experiments, that the human body possesses no electrical organs over which the will exercises any control, and that its electricity depends on the chemical and physical changes which are taking place either in its interior or upon its surface.

It has been supposed that the remarkable phenomena of spontaneous combustion in the human body are somehow or other connected with its electrical state; but we possess no accurate data by which the truth of this opinion can be tried.

Researches of M. Matteucci.

Some very interesting discoveries have been recently made respecting the electricity of animals. It has been proved by M. Matteucci and M. Dubois Remond, that there are electrical currents in the frog and in all other animals, whether cold or warm blooded. According to Matteucci, the current is more feeble in proportion to the rank which the animal occupies in the scale of animals. We have witnessed the fine experiments which he performed at York in 1844, by severing the lower halves of the thighs of a certain number of living frogs, and inserting the knee of the one into the central muscles of the second, and so on. A voltaic pile was thus formed of six or eight elements, which was capable of deflecting the needle of a galvanometer, or producing convulsions in an electroscopic frog. The direction of the voltaic current was from the interior to the exterior of the muscle. M. Matteucci also showed that there was a specific voltaic current in the frog, which is directed from the feet to the head, and is detected only in that animal.

Experiments of M. Dubois Remond.

The existence of electrical currents in the human body has been proved by M. Dubois Remond by means of an extremely sensitive galvanoscope. This instrument consisted of a coil of wire 16,752 feet or $3\frac{1}{3}$ miles in length, which made 24,160 turns on the frame upon which it was

Phenomena and Laws.

wound. Its diameter was only 0·0055 of an inch. Two plates of homogeneous platina, fixed one to each end of the galvanoscope, were immersed in two vessels containing salt water. When the two corresponding fingers of each hand are plunged into these vessels, the needle of the galvanoscope deviates a little from its place; but as it does not follow any law, M. Dubois Remond ascribes it to something heterogeneous in the skin of the finger, for when there is an abrasion of the skin or a slight wound in one of the fingers, the deviation is greater than usual. When the needle has returned to its place of rest at zero, the operator, dipping his finger into the vessel, forcibly stiffens or contracts all the muscles of one of his arms, and immediately the needle begins to move through a space of 30°, indicating an *inverse* current of electricity, or one which moves from the hand to the shoulder. The greatest effect is generally produced by the strongest persons, but sometimes no effect is produced by particular individuals.

This beautiful instrument has been improved and rendered more sensitive by Mr Rutter of Brighton, who has described it in his work on *Human Electricity*. Upon

Fig. 6.

a circular stand is fixed a pillar, on the top of which is a moveable bracket with a collar and adjusting screws. An oval-shaped compact coil of insulated copper wire is suspended from the bracket by a fibre of raw silk. The ends of this wire are soldered to small binding screws at each extremity of the coil, by which contact is made with cups containing mercury. The coil or helix moves with scarcely any friction, as its terminals consist of fine silver wire, which dips into mercury. One of M. Logeman of Haerlem's horse-shoe magnets, constructed by the process of M. Elias of Haerlem, is supported horizontally with its poles as near as possible to the sides of the helix without touching them. Wires proceed from the cups of mercury and beneath the stand, and terminate in plates of platina. A brass index with an engraved dial plate is fixed on a plate at the top of the helix. On a separate bench or table are placed two basins containing about 3 quarts of pure spring or distilled water.

In using the apparatus, the platina plates are placed in these basins, and when the index points at 0° the operator places his hands in the basins so as to be well covered with water, and not to touch the plates of platina. After the deviations of the needle noticed by M. Remond have subsided, clench one hand, firmly contracting the muscles of that hand and arm to the shoulder, keeping those of the left hand and arm relaxed. The index will move 4° or 6°. When the other hand is clenched similarly, the index will move in the opposite direction to 4° or 6° on the other side of 0°. By continuing this process the deviation of the needle may amount to 14° or 16°. Mr Rutter has found that children of both sexes can deflect the needle with as much force as adults.

By forcibly extending the fingers of the hand in place of clenching it, and at the same time contracting the muscles of the hand and arm, Mr Rutter has found that the needle is deflected in a direction opposite to that when the hand is clenched. The force, however, is not so great as when the hands are clenched. In order to increase the sensibility of his galvanoscope he occasionally uses an electro-magnet.[1]

Art. 2. *On the Electricity of the Raia Torpedo.*

Electricity of the torpedo.

The remarkable property of giving an electrical shock possessed by this fish was known in the time of Aristotle and Pliny, and has been distinctly described by Appian. Redi, Reaumur, Kæmpfer, and Bancroft, successively described the phenomena which it exhibited; and Lorenzini, so early as 1678, published good engravings of the electrical organs of the torpedo.

Experiments of Walsh.

The first person, however, who made accurate experiments on the torpedo was Mr Walsh. He confirmed the remarkable observation of Kæmpfer, that the shock could be evaded if the person who touched the animal held in his breath at the time. Mr Walsh made two series of experiments on this fish, one when it was placed in the air, and the other in the water. In the first series he placed a living torpedo upon a table covered with a wet napkin, round which stood five persons who were insulated. Having suspended from the ceiling by strings two brass wires, each thirteen feet long, one of them was made to communicate by one extremity with the wet napkin, while its other extremity was plunged in a basin of water placed upon a second table, on which other four basins of water stood. The first of the five insulated persons plunged a finger of one hand in the basin in which the above-mentioned wire was placed, and a finger of the other hand into the second basin. The second person put a finger of one hand in this second basin, and a finger of the other in a third basin, and so on till the five persons formed a communication with each other by the water in the basins. The end of the second wire was plunged in the last basin, and Mr Walsh having taken the other end of this wire in his hand, touched the back of the torpedo, when all the five persons experienced a shock which differed only in force from that of the Leyden jar. The shock seldom extended beyond the touching finger, and out of 200 only one reached above the elbow. When the torpedo was insulated, it gave forty or fifty shocks to insulated persons, without any diminution of its force. Mr Walsh found that the shock was communicable through iron wires and other conductors, but not through air, glass, and other electrics; and he was never able either to produce a shock, or move the pith balls of an electrometer. In the series of experiments in water, Mr Walsh held a large and powerful torpedo in both hands by its electric organs, and after plunging it about a foot under water, he raised it suddenly to the same height in air. The instant the lower surface of the fish touched the water in descending, he received a violent shock, and the instant the same surface quitted the water in ascending, he experienced a still more violent shock. A writhing of the fish accompanied both these shocks, particularly the last. The intensity of the shock under water was scarcely one-fourth of that at the surface, and not much more than one-fourth of those given in the air. The number of shocks in a minute was about twenty, generally two and always one when he was wholly in the air, and sometimes two when he was below water. When the finger of one hand touched

[1] See Mr Rutter's *Human Electricity*, chap. vii., Lond. 1854.

Phenomena and Laws.

the upper part, and the thumb of the same hand the lower part, of a single organ, the shock was twice as great as when it passed through the arms, and Mr Walsh concluded that the two sides of the fish are in opposite electrical states.

Experiments of Ingenhousz;

Dr Ingenhousz, who repeated and confirmed these experiments, says that the sensation of the shocks is the same as if a great number of very small electrical bottles were discharged very quickly through the hand. M. Spallanzani found the shocks strongest when the fish was laid upon a plate of glass. When the animal was dying the shocks were not given at intervals, but resembled a continual battery of small shocks. The battery continued seven minutes, and in this time he experienced 316 shocks. Spallanzani also found that the fœtus gave perceptible shocks like the full-grown fish.

of Humboldt and Gay Lussac.

In the year 1805, MM. Humboldt and Gay Lussac examined the properties of the torpedo at Naples, but they do not seem to have added much to the observations made by Mr Walsh. They found that a person accustomed to electric shocks could with some difficulty support the shock of a vigorous torpedo fourteen inches long; that before each shock there is a convulsive movement of the pectoral fins; that the animal must be irritated previous to the shock; that the shock may be felt when a single finger is applied to a single surface of the electric organ; that an insulated person will not receive a shock if he touches the fish with a key or any other conducting body; and that the least injury done to the brain of the fish prevents its electrical action.

Electrical organs.

At the request of Mr Walsh, Dr Hunter, the celebrated anatomist, examined the electrical organs of a torpedo about eighteen inches long, twelve broad, and two thick. These organs are placed on each side of the cranium and gills, reaching from thence to the semicircular cartilages of each great fin, and extending in length from the anterior extremity of the animal to the transverse cartilage which divides the thorax from the abdomen. Within these limits the organs occupy all the space between the skin of the upper and outer surfaces. This description will be understood from fig. 1 of Plate CCXXVI., which represents a female torpedo, the skin B having been flayed from the under surface of the fish, to show the electric organs A. The nostrils, in the form of a crescent, are shown at *c*, and the mouth, having a crescent form, opposite to the nostrils, at *d*. The mouth is furnished with several rows of small hooked teeth. The bronchial apertures are shown at E, five being on each side; F is the place of the heart, *gggg* the place of the anterior transverse cartilages, *hh* the exterior margin of the great lateral fin, *i* its inner margin on the confines of the electrical organ, *l* the abdomen, *mmm* the place of the posterior transverse cartilage, which is single, united with the spine, and sustains the smaller lateral fins *nnnn* on each side; O is the anus, and P the fin of the tail.

Plate CCXXVI., fig. 1.

Each organ is about five inches long, and about three inches broad at the anterior end, and half an inch at the posterior extremity. Each organ consists wholly of perpendicular columns reaching from the upper to the under surface of the body, and varying in their lengths according to the thickness of the parts of the body where they are placed. The longest column is about one and a half inch, the shortest about one-fourth of an inch, and their diameter about two-tenths of an inch. The figures of the columns are irregular hexagons or pentagons, and sometimes have the appearance of being quadrangular or cylindrical. The number of columns in the fish examined by Dr Hunter was 470 in each organ; but in a very large fish four and a half feet long, and weighing seventy-three pounds, the number was 1182 in each organ. The number of partitions in a column one inch long was 150. The nerves inserted into each electric organ arise by three very large trunks from the lateral and posterior part of the brain; and when they have entered the organs they ramify in every direction between the columns, and send in small branches on each partition, where they are lost. Dr Hunter remarks that there is no part of any animal with which he is acquainted, however strong and constant its natural action, which has so great a proportion of nerves; and he hence concludes that, if it be probable that these nerves are not necessary for the purposes of sensation or action, they are subservient to the formation, collection, or management of the electric fluid.

M. Geoffroy de St Hilaire has more recently examined the torpedo. He analysed the fluid in the cells of the hexagonal columns, and found it to consist of albumen and gelatine; and, what is very curious, he discovered organs analogous to those of the torpedo in other species of the same genus Raia, which do not possess any electrical power.

Observations and experiments of Mr Todd.

Some useful observations were made upon the torpedo of the Cape of Good Hope in 1812 by Mr John T. Todd. The torpedos of this locality are never more than eight, nor less than five inches in length, and never more than five, nor less than three and a half inches in breadth. The columns of their electrical organs were larger and less numerous in proportion than those described by Hunter, and they appeared to be of a cylindrical form. The shocks of these torpedos were never sensible above the shoulder, and seldom above the elbow joint. The electrical discharge was generally accompanied by an evident muscular action, as shown by an apparent swelling of the superior surface of the electrical organs. From a great variety of experiments, which we have not room to enumerate, Mr Todd drew the following conclusions:—

1. That the electrical discharge is a vital action dependent on the life of the animal.

2. That the action of the electrical organ is entirely voluntary.

3. That frequent action of them is injurious to its life, and, if continued, deprives the animal of it.

4. That when the nerves and the organs are cut, the torpedo loses the power of giving a shock, though it appears more vivacious, and lives longer, than those in which this change has not been produced, and in which the electrical power is exerted.

5. That the possession of one organ only is sufficient to produce the shock.

6. That the perfect state of all the nerves of the electrical organs is not necessary to the production of the shock.

7. That (as was shown by Dr Hunter) a more intimate relation exists between the nervous system and electrical organs of the torpedo, both as to structure and functions, than between the same and any organs of any animal with which we are acquainted.

In 1816 Mr Todd made another series of experiments at La Rochelle, principally with the view of determining whether the torpedo possessed any voluntary power over the electrical organs, either in exciting or interrupting their action, except through the nerves of these organs. Shocks were given by the torpedo even when one half of each electrical organ was removed; and also when an incision was made extending round the circumference of both organs, so as to leave no attachment between these organs and the animal except the nerves. When the large lateral cartilages were removed, and a large portion of the surfaces of the electrical organs denuded, two distinct shocks were received; but the fish being much injured, soon died. During these experiments, Mr Todd observed how powerfully the action of the electrical organs was excited by the cutting of the scalpel; and on one occasion, when he pressed on the electrical organ with his left hand, and held the scalpel wet in the other while cutting the electrical organ,

Phenomena and Laws.

he received a distinct shock in the right hand through the scalpel. He observed also that all the nerves of the electrical organs arise from the medulla oblongata, notwithstanding the long course which three of them are obliged to follow.

Mr Todd informs us that the torpedo called *la tremble*, which occurs on the coast between the Loire and the Garonne, is eaten by the poorer inhabitants, who carefully avoid the electrical organs, which are supposed to possess some disagreeable properties.

Observations and experiments of Sir H. Davy;

In 1814 and 1815, when Sir H. Davy was on the shores of the Mediterranean, he was desirous of ascertaining whether or not the electricity of the torpedo possessed the chemical and magnetic powers of that agent. In both these trials he could neither decompose water, nor influence a highly delicate magnetic electrometer; and he seems disposed to infer that there is a stronger analogy between the common and animal electricity than between common and voltaic electricity, and that it is probable that animal electricity will be found to be of a distinctive and peculiar kind.

This eminent chemist intended to pursue these inquiries, but his ill health prevented him; and in his latest illness he requested his brother, Dr John Davy, to carry on the investigation. Dr Davy accordingly pursued the inquiry at Malta, and succeeded in obtaining several important results. He placed a needle perfectly free from magnetism within a fine copper spiral wire one and a half inch long and one-tenth of an inch in diameter, containing about 180 convolutions, and weighing about four and a half grains. By the electricity of a torpedo about six inches long, he succeeded in communicating distinct magnetism to this needle; and he repeated the experiment with the same success with fishes of different sizes. Dr Davy likewise succeeded in throwing into violent motion the needle of a magnetic multiplier. With every fish he tried he obtained decisive results, and he met with no instance of a fish which had the power of magnetizing a needle in the spiral wire failing to move the needle in the multiplier, though he met with more than one example of a fish whose electricity was equal to the latter effect and not to the former. Dr Davy, however, failed in obtaining any igniting power, or the faintest spark, by means of the torpedo. He also found that air was not impermeable to the electricity of the torpedo; but he never could exhibit any influence on the electrometer, or any indications of attraction and repulsion in air. Dr Davy's experiments on the chemical agency of this species of electricity were highly satisfactory. He decomposed strong solutions of common salt, nitrate of silver, and superacetate of lead, and he inferred that the *under* surface of the organ corresponds to the zinc, and the upper surface to the copper extremity of the voltaic battery. In the deviation of the needle in the multiplier produced by the torpedo, the action of its under surface corresponded with the zinc plate, and that of the upper surface with the action of the copper plate. In like manner, the extremity of a needle that received polarity from a torpedo when placed in a spiral wire, had *southern* polarity when it was nearest the *under* surface of the fish, and the other extremity of course *northern*. In one experiment Dr Davy connected the spiral with the multiplier, and having charged the former with eight needles, a single discharge from an active fish moved the needle in the multiplier powerfully, and converted all the needles into magnets. each of them as strong if one only had been used.

of Dr John Davy.

Chemical and magnetical effects.

Substance of its organs.

Dr Davy's next object was to ascertain "the exact nature of the substance of the electrical organs, or the peculiar structure of which they are composed." The electrical organs when wet weighed only 302 grains; and when completely dried by sixteen hours exposure to the boiling heat of water, they weighed only twenty-two grains. They appeared to him to consist of 7·28 of matter not evaporable at 212°, and of 92·72 water. When the electrical organs are immersed in boiling water, they suddenly contract in all their dimensions, and the columns, from pentagonal, which they generally are, become circular. The electricity of a small voltaic trough, the shock of which was just perceptible, distinctly affected the voluntary muscles of the live torpedo, but did not in the least affect the electrical organs. Their substances appeared to be neither sensitive nor contractile by the application of other stimulants; and hence he infers that these organs "are not muscular, but columns formed of tendinous and nervous fibres, distended by a thin gelatinous fluid." Dr Davy never could observe satisfactorily in the fresh fish the horizonal partitions which Dr Hunter had counted. After describing more fully and accurately than Dr Hunter the distribution of the three great trunks of the nervous system, Dr Davy describes the mucous system, which forms a conspicuous part of the anatomical structure of the fish. It consists of several clusters and chains of glands, distributed chiefly around the electrical organs, at different depths beneath the cutis, and of strong transparent vessels of various lengths and sizes opening externally in the skin for the purpose of pouring out the thick mucus secreted by the glands, and destined for lubricating the surface. This system, which was not noticed by Dr Hunter, was described, but imperfectly, by Lorenzini. Dr Davy thinks that this system may not only be aided by, but also aid the secretion of the mucus. In comparing the phenomena of the torpedo with those of other kinds of electricity, Dr Davy notices the following points of difference:—"Compared with voltaic electricity, its effect on the multiplier is feeble; its power of decomposing water and metallic solutions is inconsiderable; but its power of giving a shock is great, and so also is its power of magnetizing iron. Compared with common electricity, it has a power of affecting the multiplier, which, under ordinary circumstances, common electricity does not exhibit; its chemical effects are more distinct; its power of magnetizing iron and giving a shock appears very similar; its power of passing through air is infinitely less as is also (if it possess it at all) its power of producing heat and light."

Experiments of Dr Davy;

of Cavendish.

These differences have been explained in different ways by different authors. Mr Cavendish endeavoured to account for them on the principles of common electricity. Mr Nicholson did the same with much ingenuity. Volta at first supposed that the superposition of the different cells in the columns, formed of substances some of which excite electricity by contact, while others transmit it, corresponds to that of the metallic and moist conductors of which the pile is composed; but he afterwards showed to Sir H. Davy another form of the pile, which he thought fulfilled the conditions of the organs of the torpedo; a pile of which the fluid substance was a very imperfect conductor, such as honey, or a strong saccharine extract, which required a certain time to be charged, and which, though it did not decompose water, communicated nevertheless weak shocks when charged. MM. Humboldt and Gay Lussac were more inclined to compare the action of the torpedo to a chain of small Leyden phials, like Cavendish, than to the voltaic pile. In order to explain why no spark is given by the torpedo, Mr Cavendish proved by experiment that the distance through which the spark flies is inversely (or rather in a greater proportion) as the square root of the number of jars; and hence the torpedo may contain sufficient electricity to give a shock, without being able to make it pass through such a space of air as is requisite for the production of the spark. He accounted also for the absence of every appearance of attraction and repulsion, from the known fact that the shock of a battery so weakly electrified as to be incapable of passing through a chain, which is the case with the electricity of the torpedo, is not capable of producing

Phenomena and Laws.

any divergency in the pith balls of an electrometer. Mr Cavendish corroborated these views by constructing an artificial torpedo of thick leather, connected with glass tubes and wires, and covered with a piece of sheep-skin leather, which was an exact imitation of the real torpedo. The battery was composed of forty-nine jars of very thin glass, and contained about seventy-six feet of coated surface.

Humboldt has enumerated the following species of the torpedo which are electrical:—Torpedo narke, *Risso;* Torpedo unimaculata; Torpedo marmorata; Torpedo Galvanii.

It is very difficult to preserve the torpedo for experiments. Dr Davy could not keep them alive for twelve or fifteen days; and M. Matteucci could not preserve one out of 116 above three days, though the greatest attention was paid to them.

Art. 3.—*On the Electricity of the Gymnotus electricus.*

Electricity of the gymnotus.

The electrical eel of Surinam, or *Gymnotus electricus*, possesses electrical organs different from those of the torpedo, and exhibits different electrical properties. Its common size is about *three* feet in length; though Dr Bancroft was told that some have been seen in the Surinam river upwards of twenty feet long, and whose shock proved immediately fatal.

Richer was the first person who made known in Europe the electrical properties of this fish; and experiments have been since made upon it by various naturalists. It is from the observations, however, of Dr Williamson of Philadelphia, Dr Garden of Charlestown, and Mr Walsh, that our knowledge of its properties is derived; and these may be summed up in the following manner:—

1. When the gymnotus is touched by the hand, a shock is felt in the fingers, and often as far up as the wrist and elbow; and when it is touched with an iron rod twelve inches long, the shock is felt in the finger and thumb.

2. If the eel is provoked by one person, the hand of another person held in the water will experience a small shock.

3. When the eel was touched and provoked with one hand, and the other held in the water at a small distance, a shock passed through both arms; and the same effect was produced when the hand held a wet stick in the water; and when the same experiment was made by eight or ten persons who joined hands, a shock was also experienced.

4. When the first of eight persons pinched the tail, while the last touched the head, they all experienced a severe shock.

5. The shock of the eel was found to pass through those substances which are conductors, and to be stopped by those which are non-conductors, of common electricity.

6. An insulated person electrified, exhibited no marks of electricity; and pith balls refused to diverge either when suspended over the eel's back, or touched by an insulated person when he received the shock.

7. Dr Williamson succeeded in making the electricity of the eel pass through a small space of air, and exhibit the electric spark when the fish was in the open air; but the spark is not visible when the fish is placed in water.

In the preceding experiments the gymnotus was in a large vessel, supported by pieces of dry timber about three feet above the floor. A small hole having been bored in the vessel, a person who held his finger in the stream of water which flowed from it experienced a shock when the eel was irritated.

Dr Williamson threw a cat fish into the same vessel with the gymnotus, and in a short time it gave the cat fish a shock, and caused it to turn up its belly and remain motionless.

Observations of Fahlberg.

Experiments on the gymnotus have more recently been made by M. Fahlberg of Stockholm, and by MM. Humboldt and Bonpland. The Swedish philosopher succeeded in obtaining an electric spark from the eel when placed in the air, by interrupting the conducting chain by two gold leaves pasted upon glass, and a line distant from each other; but he never could discover any phenomenon of attraction or repulsion, though he employed very delicate electrometers, and caused very strong shocks to pass through them.

Of Humboldt and Bonpland.

While MM. Humboldt and Bonpland were in South America, where the little streams, and even the basins of stagnant water, are filled with electrical eels, they enjoyed the finest opportunities of studying the phenomena of their electrical action. Having imprudently placed both his feet on a fresh gymnotus, Humboldt experienced a more dreadful shock than he ever received from a Leyden phial, and which left a violent pain in his knees, and in almost every joint, during the rest of the day. When both he and M. Bonpland held a fish, the one by the head or by the middle of the body, and the other by the tail, and, standing on the ground, did not join hands, one of them received shocks which the other did not feel; and hence they concluded that the eel could direct its strokes where it chose, or towards the point where it was most strongly irritated, sometimes discharging them from the whole surface of its body, and sometimes from one point only.

The gymnoti that had been rendered extremely tame during their voyage from Surinam to Stockholm were made to fast a long time, and when fishes were put into the tub they killed them at a distance, the electrical stroke passing through a very thick stratum of water. A fresh-caught gymnotus was placed by Humboldt beside little tortoises and frogs, which, ignorant of their danger, placed themselves upon its back. The frogs did not receive the shock till they touched the body of the eel. When they recovered they leapt out of the tub. Humboldt remarks that this gymnotus was not yet sufficiently tamed to attack and devour frogs.

Upon cutting a very vigorous fish through the middle of the body, Humboldt observed that the fore part alone gave shocks. The shocks, however, are equally strong in whatever part of the body the fish is touched, though it is most disposed to dart them forth when the pectoral fins, the electrical organ, the lips, the eyes, or the gills are pinched. Humboldt remarks that no person has ever perceived a spark issue from the body of the fish itself. He irritated it for a long time during the night, at Calabozo, in perfect darkness, without observing any luminous appearance.

Method of fishing the gymnoti with horses.

The method of fishing the electrical eels by horses, as described by Humboldt, is too interesting to be omitted in a popular article. The Indians having brought about thirty wild horses, forced them to enter a pool of muddy water surrounded with fir trees. "The extraordinary noise caused by the horses' hoofs makes the fish issue from the mud, and excites them to combat. These yellowish and livid eels, resembling large aquatic serpents, swim on the surface of the water, and crowd under the bellies of the horses and mules. A contest between animals of so different an organization furnishes a very striking spectacle. The Indians, provided with harpoons and long slender reeds, surround the pool closely, and some climb upon the trees, the branches of which extend horizontally over the surface of the water. By their wild cries, and the length of their reeds, they prevent the horses from running away, and reaching the banks of the pool. The eels, stunned by the noise, defend themselves by the repeated discharge of their electric batteries. During a long time they seem to prove victorious. Several horses sink beneath the violence of the invisible strokes which they receive from all sides in organs the most essential to life, and, stunned by the force and frequency of the shocks, disappear under the water. Others, panting, with with mane erect, and haggard eyes expressing anguish, raise

Phenomena and Laws.

themselves, and endeavour to flee from the storm by which they are overtaken. They are driven back by the Indians into the middle of the water; but a small number succeed in eluding the active vigilance of the fishermen. These regain the shore, stumbling at every step, and stretch themselves on the sand exhausted with fatigue, and their limbs benumbed by the electric shock of the gymnoti.

"In less than five minutes two horses were drowned. The eel being five feet long, and pressing itself against the belly of the horses, makes a discharge along the whole extent of its electric organ. It attacks at once the heart, the intestines, and the *plexus cœliacus* of the abdominal nerves. It is natural that the effect felt by the horses should be more powerful than that produced upon man by the touch of the same fish at only one of its extremities. The horses are probably not killed, but only stunned. They are drowned from the impossibility of rising amid the prolonged struggle between the other horses and the eels.

"We had little doubt that the fishing would terminate by killing successively all the animals engaged; but by degrees the impetuosity of this unequal combat diminished, and the wearied gymnoti dispersed. They require a long rest and abundant nourishment to repair what they have lost of galvanic force. The mules and horses appear less frightened: their manes are no longer bristled, and their eyes express less dread. The gymnoti approach timidly the edge of the marsh, where they are taken by means of small harpoons fastened to long cords. When the cords are very dry the Indians feel no shock in raising the fish into the air. In a few minutes we obtained five large eels, the greater part of which were but slightly wounded. Some were taken by the same means towards the evening."

The gymnotus is the largest of the electrical fishes. A fish of three feet ten inches long, obtained by Humboldt, weighed twelve pounds. The transverse diameter of the body was three inches five lines. The gymnoti of the *Cano de Bera* are of a fine olive-green colour. The under part of the head is yellow mingled with red. Two rows of small yellow spots are placed symmetrically along the back, from the head to the end of the tail. Every spot contains an excretory aperture, which keeps the skin of the animal covered with a mucous matter, which, as Volta has proved, conducts electricity twenty or thirty times better than pure water.[1]

Electrical organs of the gymnotus. Plate CCXXVI., fig. 2.

Dr Hunter examined, with his usual skill, the electrical organs of this fish; and in fig. 2 we have copied his engraving of it, in which the skin is removed to show the structure. In this figure A represents the lower surface of the head; C, the cavity of the belly; B, the anus; E, the back, where the skin remains; GG, the fin along the lower edge of the fish; EE, the lateral muscles of this fin, removed and laid back with the skin to expose the small organs; L, part of the muscle left in its place; FF, the large electrical organ; HHH, the small electrical organs; *mmm*, the substance which separates the two organs; and *n*, the place where this substance is removed. These organs occupy nearly one-half of the part of the flesh in which they are placed, and form more than one-third of the whole fish. There are two pairs of electrical organs of different sizes, and placed on different sides; the large one F occupies the whole of the lower and lateral part of the fish, constituting the thickness of its fore part, and extending from the abdomen to near one end of the tail, where it terminates nearly in a point. The two organs are separated at the upper part by the muscles of the back, at the lower part by the middle partition, and by the air bag at the middle part. The lesser organ stretches along the lower edge of the fish, and nearly as far as the other, terminating almost insensibly near the end of the tail. The two small organs are separated from each other by the middle muscle, and by the bones in which the fins are articulated. The large organ may be seen by merely removing the skin, which adheres to it by a loose cellular membrane; but in order to see the small organ, the long row of small muscles which move the fin must be removed. The electrical organs consist of two parts, viz. flat partitions of septa, and thin plates or membranes intersecting them transversely. The septa are thin parallel membranes stretching in the direction of the fish's length, and as broad as the semidiameter of the animal's body. The septa vary in length, some of them being as long as the whole body. In a fish two feet four inches long, the distance of the septa was nearly half an inch; and in the broadest part of the organ, which was one and a quarter inch, there were thirty-four septa. In the small organ the septa have a somewhat serpentine direction. They are only the fiftieth of an inch distant, and there are fourteen septa in the breadth of the organ, which is half an inch. The very thin plates which intersect the septa have their breadth equal to the distance between any two septa. There is a regular series of these plates from one end of any two septa to the other end, 240 of them occupying a single inch.

Dr Faraday's experiments.

A number of interesting results were obtained in 1838 with a gymnotus by Dr Faraday. The fish was caught in March 1838. It was brought to the Adelaide Gallery on the 15th of August, but did not feed from the time of its capture up to the 19th of October, when it killed and eat four small fish. It subsequently ate one gudgeon, carp, or perch daily. Dr Faraday obtained from the electricity of this gymnotus the electric spark, chemical decomposition, and the evolution of heat. It deflected the needle of a galvanometer, and he made magnets with it. He failed, however, in producing the attraction of gold leaves. The shock of the gymnotus was most powerful when one hand was placed on the body near the head, and the other near the tail. It resembled "that of a large Leyden battery, charged to a low degree, or that of a good voltaic battery of perhaps one hundred or more pairs of plates, of which the circuit is completed for a moment only." Dr Faraday concluded from his experiments that "a single medium discharge of the fish is at least equal to the electricity of a Leyden battery of fifteen jars, containing 3500 square inches of glass, coated on both sides and charged to its highest degree;" and, great as this force is, he frequently experienced it to give two and even three shocks with scarcely a sensible interval of time between them. When the fish wills the shock, the *anterior* parts are *positive*, and the *posterior* parts *negative*.

The following results were obtained by Dr Faraday, and will be understood from the annexed diagram, where AB is the tub containing the animal, supported upon dry wooden logs. It was 46 inches in diameter, with a depth of water in it of $3\frac{1}{2}$ inches. The numbers show the places where the hands were put; those across the fish implying that the hands touched it: the letters A,B,C are three different experimenters, A being the person who excited the fish to action.

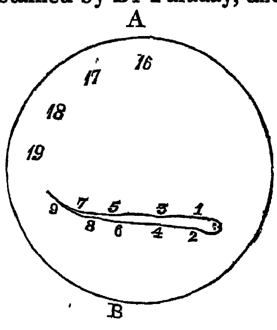


Fig. 7.

When one hand was in the water a weak shock was felt only in it, whatever part of the fish it touched, and only in the part immersed. When both hands were in the water at the same parts of the fish, a weak shock was felt only in the parts immersed.

When both hands were at 1, 3, or 4, 6, or 3, 6, strong

[1] Humboldt notices it as remarkable that no electrical fish is covered with scales.

Phenomena and Laws.

shocks extended up the arms and even to the breast. The shock was strongest at 1, 8, and perceptible at 8, 9.

When B's hands were at 10, 11, four inches from the fish, whilst A excited it with a glass rod, B received a powerful shock. When A was at 4, 6, B at 10, 11, C at 16, 17, and D at 18, 19, they all received shocks at the same time, A and B strongly, and C and D feebly.

When B had both hands at 10, 11, or at 14, 15, whilst A had but one hand at 1, or 3, or 6, the former got a strong shock, and the latter a weak one.

When A's hands were at 3, 5, B's at 14, 15, and C's at 16, 17, A's shock was the most powerful, B's the next, and C's the feeblest.

When A excited the fish with his hands at 8, 9, whilst B was at 10, 11, B had a stronger shock than A.

When A excited the fish with one hand at 3, B with both hands at 10, 11 (or along), and C had the hands at 12, 13 (or across), A felt a pricking shock in the immersed hand only, B a strong shock up the arms, and C but a slight effect in the immersed parts.

Dr Faraday concludes from all the experiments he has made that "all the water and all the conducting matter around the fish, through which a discharge circuit can in any way be completed, is filled at the moment with circulating electric power. "This state," he adds, "might be easily represented generally in a diagram by drawing the lines of inductive action upon it. In the case of a gymnotus surrounded equally in all directions by water, these would resemble generally in disposition the magnetic curves of a magnet having the same straight or curved shape as the animal, that is, provided he in such cases employed, as may be expected, his four electric organs at once." [1]

Experiments of Matteucci.

The subject of electric fishes has been more recently studied by M. Matteucci of Pisa. The following are some of the results which he has obtained:—

1. When any part of the body of an electric fish is irritated, the irritation is transmitted by the nerves to the fourth lobe of the brain, and then only the electric discharge takes place.

2. An electric discharge is obtained by irritating a very small part of a prism of the electric organ of the torpedo.

3. The electric organ of the fish is a nervous fibril in contact with a small cell filled with albumen; and as this cell gives an electric shock when subjected to nervous action, the two opposite electricities must be separated to be instantaneously reunited.

4. Each prism of these electric organs is a pile of elementary organs upon each of which a nervous filament is spread normally to the axis of the pile, analogous to a cylinder of cast-iron inclosed in a helix of metallic wire, and traversed by the electric current.

5. The sum of the electric currents given by the different slices of the organ of a torpedo is approximately equal to the current given by the entire organ. In the gymnotus the strongest discharge is that which is obtained by including the entire length of the animal within the circuit.

6. The electric shock increases with the vital action of the torpedo. The shock is increased by raising a little the temperature of the water, and diminished by hindering respiration or circulation. It is diminished also after a number of shocks. It is increased by rest, and it becomes more powerful than usual when the fish is excited by nux vomica.[2]

Art. 4. *On the Electricity of the Silurus electricus.*

Silurus electricus, fig. 3.

The *Silurus electricus*, of which we have given a drawing in fig. 3, is a fish about twenty inches long, which is found in the Senegal, the Niger, and the Nile. It is eaten by the Egyptians, who dress its flesh, and salt its skin as an aphrodisiac medicine. The shock of this fish is distinctly felt when it is laid on one hand, and touched by an iron rod six feet long held in the other. Its electrical organs, according to M. Geoffroy, are much less complicated than those of other electrical fishes. They lie immediately below the skin, and stretch all round the body of the animal. Their substance is a reticulated mass, the meshes of which are clearly visible, and these cells are filled, like those of other electrical fishes, with an albuminous gelatinous matter. The nerves distributed over the electric organs proceed from the brain, and the two nerves of the eighth pair have a direction and nature peculiar to this species.

Art. 5. *On the Electricity of the Tetraodon electricus.*

Tetraodon electricus.

In the cavities of the coral rocks in Johanna, one of the Canary islands, Lieutenant Paterson discovered the *Tetraodon electricus*, which he found to possess the properties of other electrical fishes. It has a long projecting mouth, and is seven inches long and two and a half broad. The colour of its back is brown, of its belly sea-green, of its sides yellow, of its fins and tail sandy-green. Its body is covered with red, green, and bright white spots. It has large eyes, and its iris is red, tinged with yellow on its outer edges. It is found also in the American seas.

Lieutenant Paterson found this fish in water whose temperature was 56° or 60° Fahrenheit; and having caught two of them in a linen bag, he had no sooner taken one of them in his hand than he received so severe a shock that he was obliged to let it go. He carried the two fishes to the camp, and though one of them died, and the other was in a state of great debility, he was able to obtain the evidence of the surgeon and the adjutant in favour of his discovery. The former having held it between his hands, received a distinct electrical shock, and the latter received a shock by merely touching the fish on its back with his finger.

Art. 6. *On the Electricity of the Trichiurus electricus.*

Trichiurus electricus.

This fish, which we believe is the *Trichiurus indicus* of Shaw, inhabits the Indian seas, and has been found to possess the power of giving an electrical shock. It has a pointed snout, and belongs to the family Tænioides, of the order Acanthopterygii.

Other electrical fishes.

Other electrical fishes have been met with, but the descriptions given of them do not enable us to determine whether or not they are the same as those which we have described in this section. Mr Maxwell, in his observations on Congo and Loango, mentions his having found at sea an electrical fish, which made the sailor who took it exclaim "that the devil was in the fish." When examining it attentively, Mr Maxwell found that his astonishment arose from his having received an electrical shock. Before each shock the skin on his back and sides became very tense. It was like a cod, and weighed *thirty pounds.* He gave it to the natives to eat, and they praised it much. No electrical fish of such a size has, so far as we know, been found, and it is highly probable that it is a new species.

Sect. VI.—*On the Electricity of the Atmosphere.*

Electricity of the atmosphere.

There is perhaps no branch of electricity so highly interesting as that which treats of the electricity of the atmosphere, whether we consider it in reference to ourselves, as beings exposed to its tranquil as well as to its disturbed influence, or in reference to the grandeur and beauty of the phenomena which it exhibits.

[1] Faraday's *Experimental Researches, &c.*, vol. ii., p. 8, &c.

[2] See *Phil. Trans.*, 1847, p. 239, 241.

Phenomena and Laws.

The methods which have been adopted for examining the electricity of the atmosphere consist in elevating long vertical rods, the summits of which collect the electricity, or in extending insulated wires in a horizontal direction, or in sending up kites into the higher regions.

Experiments of Le Monnier and others;

M. le Monnier, the Abbé Mazeas, Mr Kinnersley, Beccaria, Saussure, Ronayne, Cavallo, Read, Crosse, Ronalds, Schubler, &c., have made numerous experiments on the electricity of the atmosphere in its ordinary state. Le Monnier discovered that there was always more or less electricity in the atmosphere; that there was a regular diurnal period in which the electricity increased from sunrise, when it was scarcely perceptible, till three or four o'clock in the afternoon, when it reached its maximum; and that it again diminished till the fall of the dew, when it again increased, and subsequently diminished, till midnight, when it became insensible.

of Beccaria;

M. Beccaria found that the electricity of the air was always perceptible in a clear sky and calm weather. In rainy weather, without lightning, it always appeared a short time before the rain fell, and during its actual fall, but disappeared soon after the rain had ceased.

of Saussure;

Saussure made many important observations on this subject. He found that the electricity of the air was very strong at nine o'clock in the morning; that it gradually diminished till six o'clock P.M., when the first minimum took place; that it afterwards increased to eight o'clock P.M., when the second maximum took place. It then diminished again with some irregularities till six A.M., when it reached its second minimum. It then increased again till eleven o'clock in the evening, when it again became a maximum. The electricity of the atmosphere has therefore a daily period, like the sea, increasing and decreasing twice in twenty-four hours. It, generally speaking, reaches its maximum intensity a few hours after sunrise and sunset, and descends again to its minimum before the rising and setting of that luminary. Saussure also observed that the electricity of the air is strongest during fogs, unless when they change into rain. Saussure likewise found that the electricity of clear weather is always positive; and the opinion of Volta is therefore highly probable, that the electricity of the atmosphere is essentially *positive*, and that the negative electricity which appears in rain, snow, and storms, is derived from more elevated clouds, which are electrified negatively by the discharge of a portion of their electricity into the earth or other clouds, in the same manner as an electrometer acquires negative electricity when it is touched at the instant that the air is electrified positively.

of Crosse;

These results were confirmed by subsequent observers, whose observations we have not room more particularly to notice; but we shall make no apology for giving some account of the more recent and valuable observations of Mr Crosse and Mr Ronalds. Mr Crosse's experiments were made with an insulated copper wire, extending originally a mile and a quarter in length, and supported upon two masts from 100 to 110 feet high. The wire was one-sixteenth of an inch thick. It was subsequently shortened to 1800 feet in consequence of its being exposed to depredations. From the observations made with this apparatus, which was in use eighteen months, Mr Crosse deduced the following conclusions.

1. The electricity of the atmosphere in its ordinary state is invariably *positive*. It is always most copious during the night. It increases at sunrise, diminishes towards noon, increases again towards sunset, and again diminishes to its nocturnal minimum.

2. The electrical state of the wire is disturbed by fogs, rain, hail, snow, and sleet. It becomes negative when they first come on. It frequently changes to positive, increasing gradually in strength, and then decreasing, a change from positive to negative occurring every three or four minutes.

3. The approach of a charged cloud at first sometimes produces positive and sometimes negative electricity. Its intensity increases and then diminishes and vanishes, being succeeded by the opposite electricity, which increases to a higher maximum, and then diminishes and disappears, and is again followed by the electricity which first appeared. In general the electricity increases at every repetition, till sparks issue in a copious stream from the conductor to the receiving ball, sometimes with interruptions, and again returning with fresh energy. When this happens, a powerful stream of air issues from the wire and the connecting apparatus. An explosive stream of electricity rushes from the one ball to the other at every flash of lightning, and a brilliant light is thrown upon surrounding objects. When the lightning increases, it is wise to let it pass into the ground.

4. The wire is almost as strongly electrified during a driving fog and a smart rain as during a thunder storm, and the electricity passes into opposite states in a similar manner.

5. A very feeble degree of positive electricity occurs in cloudy weather. When rain falls it changes to negative, and again becomes positive when the shower is over.

The following table contains a list of the different states of the air in which its electricity appears, those at the top of the list being those in which it is most powerful.

1. Regular thunder clouds.
2. Driving fog with small rain.
3. A fall of snow, or a brisk hail storm.
4. A smart shower in a hot day.
5. A smart shower in a cold day.
6. Hot weather after some wet days.
7. Wet weather after some dry days.
8. Clear frosty weather.
9. Clear warm summer weather.
10. A sky obscured by clouds.
11. Mackerel or mottled sky.
12. Sultry weather with light hazy clouds.
13. A cold damp night.
14. Weather during north-east winds, with a sensation of dryness and cold not shown by the thermometer.

Experiments of Ronalds,

By means of an electrical apparatus, founded on a new method of electrical insulation, Mr Ronalds made some interesting observations on Vesuvius at the time of moderate eruptions, and another series at Palermo during the prevalence of a sirocco. The rod of the electrometer was placed perpendicularly on the highest pinnacle of Mount Vesuvius, on the north side of the great crater, and about five hundred yards distant from it, a ravine being interposed. The following were the results:

1. The electricity was *always* positive.

on Vesuvius;

2. The intensity of it increased as the sun rose, unless when it was affected by the explosions of the volcano. Very frequent variations took place in the intensity, sometimes accompanying changes of the wind, sometimes following explosions from the crater, sometimes attending the approach of vapour from an aqueous fumerole, when the intensity of the electricity was always increased, and sometimes occurring without any apparent cause.

3. The black fumes from the old crater diminished the intensity more frequently than the white fumes, and very rarely increased it. Mr Ronalds supposes that the black fumes may be in a negative state; and that the white fumes, consisting principally of aqueous vapour, sulphuric and muriatic acids, and sulphur, may, when these vapours are condensed, and when the sulphur sublimes in the air, be brought into a positive state; and that these two states of the two fumes may sometimes act separately on the electrometer, or sometimes wholly and sometimes partially neutralize each other, either by induction or position, or by a discharge from the one to the other.

at Palermo.

The observations of Mr Ronalds on the electricity of the atmosphere during a dry sirocco were made on the roof of

Phenomena and Laws.

Page's hotel, in Palermo. The electricity was always *positive*, the straw electrometer of Volta varying from five to twenty-one degrees. The electrical phenomena were diametrically opposite to those of the ordinary state of the atmosphere in serene weather, as the electric tension increases almost progressively from sunrise till the hottest part of the day, viz. about three o'clock P.M., when it gradually declined until sunset.

In the arctic regions in 1819–20, there were no sensible indications of electricity "in the summer months, when the clouds become more dense and frequent, and even when a slight shower of rain falls."

Observations of Schubler.

A series of most interesting observations have been made by Professor Schubler of Tubingen, on the electricity accompanying the condensation of aqueous vapours in the atmosphere, as affected by the direction of the winds. They were carried on during thirty months, between January 1805 and August 1811. The *first* series was made at Ellvanguen, during sixteen months, from January 1805 to April 1806; and the *second* at Stuttgard, during fourteen months, from June 1810 to August 1811. Ellvanguen is situated 1331 feet above the sea, in 48° 57′ 25″ of N. Lat., and Stuttgard at 847 feet, in N. Lat. 48° 46′ 32″. Professor Schubler observed no fewer than four hundred and twelve atmospherical precipitations. He used the straw electrometer of Volta, and a simple condenser; and in storms he never pushed his observations beyond the 600th degree of the instrument.

The following table contains the results of these observations.

Direction of the Winds corresponding to the Observations.	Number of observed Precipitations, classed according to the Nature of their Electricity.		Ratio of the Number of Positive and Negative Precipitations.	Mean Intensity of each of the two Electricities.		Mean Intensity of the Electricity, without considering its Nature.	Total Number of Precipitations observed.
	Positive.	Negative.		Positive.	Negative.		
North	12	11	100 : 91	131	99	116	23
North-east	11	12	100 : 109	105	132	120	23
East	3	5	100 : 166	15	13	13	8
South-east	4	7	100 : 175	19	10	13	11
South	5	13	100 : 260	26	23	24	18
South-west	28	65	100 : 232	66	33	44	93
West	73	106	100 : 145	75	39	53	179
North-west	25	32	100 : 128	31	46	40	57
The three north winds, N.W.—N.—N.E.	48	55	100 : 114	74	75	75	103
The three south winds, S.E.—S.—S.W.	37	85	100 : 230	57	26	39	122
The three west winds, S.W.—W.—N.W.	126	203	100 : 161	57	38	48	329
The three east winds, N.E.—E.—S.E.	18	24	100 : 133	71	72	72	42
All the winds	161	251	100 : 155	69	43	53	412

From these observations Professor Schubler draws the following conclusions:—

1. The ratio of the *positive* to the *negative* precipitations follows a regular variation, setting out from the north or south wind, and proceeding either by the *east* or *west* winds.

2. By a *north* wind, the positive precipitations are a little more frequent than the negative ones; by a *south* wind, the *negative* precipitations are more than *double* the *positive* ones.

3. The negative precipitations, by the three south winds, viz. south-east, south, and south-west, are double those by the three *north* winds, viz. north-west, north, and north-east, the ratio being 114 to 230.

4. The *east* and *west* winds hold a mean in this respect. The *former*, however, approach more to those of the *north*, and the *latter* to those of the *south*, the electricity being oftener *negative* by the three *west* winds than by the three *east* winds in the ratio of 161 to 133.

5. The electricity of all the observed precipitations is oftener negative than positive in the ratio of 155 to 100.

6. The mean intensity of the *positive* electricity is, on the contrary, more considerable than that of the *negative* in the ratio of 69 to 43.[1]

7. The intensity of the electricity, abstraction being made of its nature, is the *strongest* by the three north winds, particularly the north-east and north.

8. The electricity is at an average the weakest by the three south winds. Its intensity is by these three winds in the ratio of 39 to 75 weaker than by the three *north* winds.

9. By the three east winds the electricity is in the ratio of 72 to 48 stronger than by the three west winds.

10. The mean intensity of the electricity of all the precipitations, whether positive or negative, observed *in all directions of the winds*, is almost the same as that of the electricity of the precipitations observed *during the west winds alone*.

11. During the *north* and *east* winds the opposite electricities appear most distinctly, and almost with equal intensities. The *west* winds, and particularly the *south*, exhibit, on the contrary, a more feeble electricity, but a greater number of negative precipitations.

12. The *greatest* number of electrical precipitations takes place during *west* winds, and the *least* during *east* winds. The mean direction of the wind during the whole of the precipitations is 86°·9, making use of the formula of Lambert, in which the south is marked by 0°, the west by 90°, the north by 180°, and the east by 270°. The number 86°·9 corresponds with the WEST, with four degrees of declination to the south-west.

With respect to the cause of the phenomena now described, Professor Schubler is of opinion, that at the moment of the precipitation of the vapours in our atmosphere, *positive* electricity is at first developed, and the *negative* appears to arise most frequently from the influence of the former. The precipitations which first take place during storms, or passing rains and snows, are commonly *positive*, and are soon followed with *negative* ones of nearly equal in-

[1] Considering the quantity of the two electricities as made up of their intensity and the number of times that either of them is observed, the ratio of the quantities of positive and negative electricity observed will be 690 or 666, nearly that of equality.

Phenomena and Laws.

tensity. This alternation often happens several times, during which the drops of rain, hailstones, sleet, and snow, continually vary in their size, density, and continuity. At last the electricity, growing weaker and weaker, ends by remaining negative; and sometimes after the storm a rain falls with negative electricity.

Observations of Schubler.

It is, however, not uncommon to see regular and continuous rains *negative* from their commencement, and during whole days. This fact, together with the feeble intensity of this kind of electricity, seems to favour the opinion that it is often owing to the partial evaporation experienced by the drops of rain during their fall.[1] In confirmation of this he adduces the fact of the negative electricity of the fine aqueous dust at the foot of cascades, which is sometimes so strong in large waterfalls as to make the electrometer diverge more than 100 degrees.

This explanation, Professor Schubler alleges, agrees also with the great frequency of *negative* rains in *south* winds, and of *positive* ones in *north* winds. A current of warmer air, and consequently more light and more elevated, in the first case ought to facilitate the evaporation of drops of rain during their fall; whilst, by the colder north wind, and consequently more heavy and nearer the surface of the earth, the clouds have in general a lower position, and the evaporation of the drops of rain is less easy, and almost nothing.

From these observations it also follows that we must not infer the negative state of the cloud from the negative electricity of the rain which falls from it; for it may happen that rain coming from clouds slightly positive may become negative by the partial evaporation of the falling drops.

M. Schubler also remarks, that the great intensity of the electricity, and the distinct manner in which the two electrical principles alternately predominate during *north* and *east* winds, seem to arise chiefly from the dryness of the air during their continuance; to which we must add the situation of the clouds brought by these winds near the surface of the earth, the electricity of which may then naturally exert a more sensible influence upon our instruments.

Observations of Gay Lussac and Biot.

The positive electricity of the atmosphere was found by Saussure to increase in intensity in proportion to the height at which it was collected. When MM. Gay Lussac and Biot ascended in a balloon, they collected atmospheric electricity from the clouds below them, by suspending a wire about 160 feet long from the balloon, and stretching it with a ball of metal. The electricity collected at the upper end of this thread was very perceptible in their electroscope; and when it was examined with a stick of sealing-wax it was found to be *resinous* or *negative*, although the weather was perfectly serene. This result, though apparently inconsistent with the observations of Saussure and others, has been shown by M. Biot to be perfectly reconcilable with them.

Plate CCXXVI., fig. 4.

In fig. 4, Plate CCXXVI., let WW′ be the wire, let us call A the stratum of atmosphere through which the wire passes, B the stratum above this, and C the stratum below it; and let us suppose, what is true, that the atmosphere has positive electricity, which increases with the height. The *positive* electricity in the superior stratum A will attract the *negative* electricity of the wire WW′ with a force equal to $+ P$, and will repel the positive electricity of WW′ with a force equal to $+ N$. The positive electricity in the lower stratum C will do the very same, but in an opposite direction, and with an inferior degree of force, viz. $+ p$ and $+ n$, since the electricity increases with the altitude. Hence it follows that the negative electricity of the wire will be attracted towards its upper end by an excess of force equal to $P - p$, and the positive electricity will be repelled to its lower end with an excess of force $N - n$. To MM. Gay Lussac and Biot, therefore, who observed the electricity of the wire at its upper end, the electricity should be *negative;* and to M. Saussure and others, who observed it at its lower end, it should be *positive.*

Experiment of Hermann.

Upon the same principle, M. Biot explains a very interesting experiment made by M. Hermann. A very sensible electroscope with gold leaves is fixed at a certain height in the atmosphere when the weather is clear, and it there gives no perceptible indications of electricity. A metallic wire, or any other conductor, placed horizontally at the end of an insulating rod, is then placed and kept a short time in a stratum of air a few feet only above the electroscope. It is afterwards quickly brought down so as to touch the electroscope, and the gold leaves diverge with *vitreous* or *positive* electricity; but if, on the contrary, the insulated wire is placed and kept a short time in a stratum of air below the electroscope, and is then quickly raised and made to touch the electroscope, the leaves will diverge with negative electricity.

explained by Biot.

In order to explain these opposite results, we must consider that the insulated conductor is charged at each time with the degree of electricity which belongs to the stratum in which it is placed. When it is carried rapidly, therefore, so that its state is not quite destroyed by the contact of the molecules of air among which it is placed, it will communicate this state to the electroscope. If it comes from *above*, it will carry to it an excess of *positive* electricity; if it comes from *below*, it will carry to it a defect of the same electricity, or an excess of *negative* electricity. "In general," says M. Biot, "let $+ E$ be the quantity of free vitreous electricity which the insulated conductor ought to possess, in order to be in a state of electrical equilibrium in the stratum of air where the electroscope is placed, so that whilst it has $+ E$, the molecules of air of this stratum neither give nor take anything from it. Let it now be carried to a superior stratum, where it takes $E + \delta E$, δE indicating the small excess of vitreous electricity which it has there taken. If we then bring it back quickly into the stratum of the electroscope, it will have $+ \delta E$ too much, and it will communicate this excess to all bodies that touch it. It will communicate it also to the electroscope if it touches it promptly, and, until the latter has lost by the contact of the air this excess which it has imparted, its leaves will diverge vitreously. On the contrary, when the insulated conductor returns from the lower region, it has $E - \delta E$ of vitreous electricity. If we make it touch the electroscope, the latter will partake of its state. Then the quantity of vitreous electricity which it will possess can no longer be in equilibrium with the influence of the mass of the surrounding air, and its natural fluid will be decomposed. But the excess of vitreous fluid which will result from this cannot cause the gold leaves to diverge, because its repulsive force will be wholly employed in compensating that of the exterior electricity E. The repulsive force, then, of the resinous electricity will alone be exerted, because nothing compensates it; and the gold leaves will diverge in virtue of this electricity, until it has been carried away and neutralized by the immediate and successive contact of the molecules of air. Experiments of this kind present the unique case of an indefinite medium, which is air, of which all the molecules are individually charged with an excess of electricity of the same kind, adhering to their surface; so that the entire mass of the medium is found penetrated with it in a proportion which varies with the altitude. Consequently the different particles of this medium can only be at rest from the mutual compensation of their repulsive

[1] M. Delarive is of opinion, not only that the evaporation thus occasioned must be very feeble, considering that the air is charged and almost always saturated with humidity; but that if it did take place, it could not generate electricity, as M. Pouillet has shown that the conversion of pure water into vapour produces no electricity. He is disposed to seek for the cause of the negative electricity of rain either in the mechanical action of the air on the falling drops, or in the sudden change of temperature which they experience.

Phenomena and Laws.

forces combined with their gravity; and the same condition is also applicable to conducting bodies which are immersed in it. Thus, for all these bodies the electrical equilibrium cannot take place when their natural electricities are completely neutralized, but only when they possess an excess of either electricity which corresponds to the stratum where they are found, an excess which is vitreous in the atmosphere when it is pure. If they possess a greater excess of this same electricity, they will act only in virtue of this excess upon each other, and upon all the molecules of the surrounding air. They ought, therefore, to repel one another mutually. If, on the contrary, the excess of electricity which they possess is less than that which they would naturally take in the stratum where we place them, the mass of the medium will act upon each of them in virtue of this difference, and their natural electricities will be decomposed as far as is necessary to supply what they want of the electricity of the medium. In virtue of this addition they will repel the medium as much as the medium repels them, and will experience no more action from it. But they will act upon each other with the excess of opposite electricity which they have acquired; and if the medium is an indefinite fluid composed of particles susceptible of electrifying itself by contact, this excess will gradually dissipate in space. Many curious experiments would be necessary to establish the laws of electrical equilibrium, under circumstances sufficiently different from those which we have been generally accustomed to consider."

Electricity of clouds. Observations of Canton;

The electricity of clouds was noticed by some of the earliest writers on the electricity of the atmosphere. Canton observed that certain clouds were charged with positive and others with negative electricity; and he noticed that the electricity indicated by his apparatus often changed five or six times in half an hour. This fact was confirmed, as we have seen, by the observations of Mr Crosse. These irregularities, however, remained unexplained till Mr Luke Howard distinctly proved that the electricity at the circumference of a nimbus is *negative*, while that of the centre is *positive;* and he suggested it as an interesting subject of inquiry to ascertain if the *negative* electricity was *descending* and the *positive ascending*. Mr J. Foggo undertook this inquiry, and in 1823 he erected a conductor armed with a smoking match, and erected from a south window. On the 12th of March 1824 there was a brisk wind from the north-west, with frequent showers all around. About three P.M. large dense clouds, which discharged heavy showers of hail, passed over the zenith. Between the showers the electricity was always positive, and the leaves of the electrometer showed their maximum divergency. So powerful indeed was the electrical state of the air, that by rubbing the outside of the glass of a detached electrometer with soft leather, the leaves opened more than forty degrees. During the showers, or when the clouds were over head, though no precipitation took place, the electricity was invariably positive, and so strong that sparks could at any time be drawn by the finger from the conducting wire. Mr Foggo likewise ascertained that by taking hold of the wire he could at pleasure intercept the electric fluid from reaching the instrument, so that the charge must have been received from the atmosphere or cloud. When the edge or the circumference of the cloud was nearly over the conductor, the electricity became negative, and appeared to be fully as strong as when it was positive. Mr Foggo, however, now found that it could not be intercepted as formerly by taking hold of the wire, or by touching it with a pointed steel rod. Hence he concluded that the electricity was not proceeding from the cloud as before, but was given off by the earth to the cloud. When the steel point was presented to the instrument, the divergence was so much increased as to endanger the gold leaf, and sparks were heard to pass rapidly between the point and the electrometer, while sharp pricks were experienced when the finger was brought near the brass cap.

of Luke Howard;

of Mr Foggo.

Observations of M. Quetelet

The subject of the electricity of clouds has been lately studied by M. Quetelet,[1] who has obtained some very interesting results. According to his observations, very great mistakes have been committed in the classification of showers of rain into positive and negative. During the same shower we may have positive or negative electricity according to the time when we make the observation. When the rain is falling, the electricity is very powerful; but if we collect it when there is an inversion of the sign, it may be nothing or next to nothing. When the air is clear, the upper strata are positively electrified in reference to the lower, the intensity increasing upwards. In order to understand what takes place when a storm cloud passes above any place, let

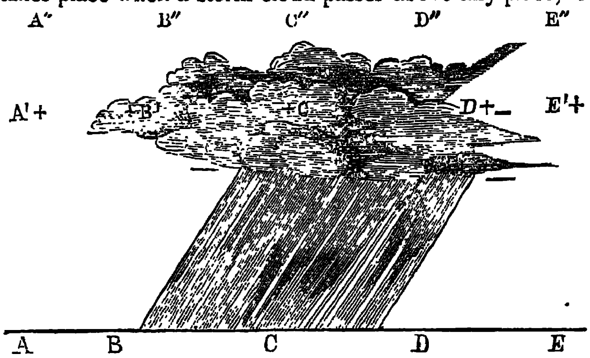


Fig. 8.

ABCDE be the ground in a neutral state, and A′B′C′D′E′ a stratum of the atmosphere positively electrified when no cloud is there; and A″ B″ C″ D″ E″ the stratum above it, also electrified positively, but in a much higher degree. If a cloud B′C′D′ arrives surcharged with positive electricity, its charge will be unequally distributed; it will be strongest in the upper part, and the cloud will be enveloped with strata of air which are relatively negative, and the more so as the electricity of the cloud is more powerful. To an observer placed at A, the electroscope above the ground will give signs of *positive* electricity. These indications will grow feebler as the cloud approaches; then the electricity disappears and becomes *negative*, which will continue even during the commencement of its passage. The electricity will then gradually diminish, then disappear, and resume its positive state when the rain commences. It will return to its first value, after having passed through the same phases, when the cloud is sufficiently distant to have no influence. The sphere of activity of a cloud is sometimes so great as to extend to several leagues. It is not uncommon to observe clouds in the horizon indicating their presence by signs of negative electricity.

M. Quetelet explains more minutely what takes place when the cloud is positively surcharged, and the rain falls. The descending shower will carry to the earth the electricity of the cloud, and with more abundance as the rain is heavy. While only a few drops have fallen, they tend only to paralyze in part the effects of the negative atmosphere which encircles the cloud, and which acts on the electrometer, which, if now observed, might lead us to believe that the rain is negative. The change of the signs of the electricity is to a certain extent gradual. In a heavy shower it is almost always instantaneous, and the passage through *zero* cannot be observed. In this state of matters all the observers below the cloud, and where it rains most strongly, ought to find the electricity positive. On the margin of the region where they are placed, the electrometer will mark *zero*, and then it will indicate negative electricity more or

[1] *Sur le Climat de la Belgique.*

Phenomena and Laws.

less powerful. The annexed figure will show by the signs + 0 − the indications of the electrometer at the surface of

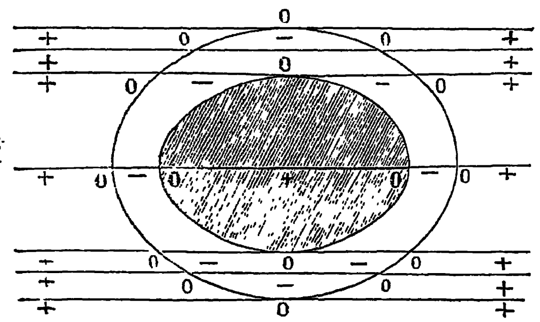


Fig. 9.

the earth on the passage of the storm cloud, or more or less in its vicinity. When the cloud is very low, so as to touch the ground, the electrometer will indicate the same electricity as that of the cloud—a fact shown in fogs, which always have an intense positive electricity; but when the cloud touches the ground it ought to lose rapidly its electricity.

When very high positive clouds give only a few drops of water, the negative atmosphere which surrounds them cannot extend its action to the earth, especially if its electricity is feeble.

When the cloud encounters mountains, it moves towards them more quickly in proportion to the negative electricity of their summits, and adheres to them like moderate conductors, abandoning successively its electricity. M. Quetelet informs us that M. Palmieri[1] has obtained similar results, with this difference, that he seems to go too far in denying the existence of clouds charged with negative electricity, and limiting the period during which positive electricity is observed to the time during which the rain falls. M. Quetelet has frequently observed the rain falling when the electrometer indicated negative electricity

Identity of electricity and lightning.

Such are the general electrical phenomena of the atmosphere during its ordinary changes; but they appear with new splendour, and at once rouse the interest of the philosopher and the dread of the vulgar, when they are exhibited in the terrific grandeur of thunder and lightning. We have already seen that various writers had pointed out the identity of lightning and the electric spark; and though Franklin has obtained the special honour of having been the first who brought down fire from heaven,

Arripuit fulmen cœlo, sceptrumque tyrannis,

yet he was no more the first who snatched the thunderbolt from heaven, than he was the first who wrested the sceptre from kings.

Observations of Franklin;

When Franklin called the attention of philosophers to the various points of resemblance between lightning and the electric spark, he conceived the idea of collecting the electricity of the atmosphere by means of pointed conductors, and of thus preserving buildings from its explosions.

of Dalibard;

One of the first philosophers who endeavoured to verify these views was M. Dalibard, who, at the instigation of Buffon, erected an atmospherical conductor at Marly le Ville, about six leagues from Paris. An iron rod, forty feet long, an inch in diameter, and pointed at its upper end, was erected in a garden upon three large poles, and insulated by silken strings, and a stool with glass feet. In M. Dalibard's absence a thunder-storm appeared on the 10th May 1752, between two and three P.M., and M. Coiffier, who had the charge of the apparatus, drew sparks with a crackling noise from the lower end of it. Having called M. Raulet, the curate of the parish, this gentleman continued for some time, and in the presence of many of his parishioners, to draw large sparks of bluish fire from the conductor. A few days afterwards, on the 18th May, M. Delors drew similar sparks from a rod ninety-nine feet high, erected in Paris. The strongest of them were drawn at the distance of nine lines, and the conductor afforded sparks even when the cloud had moved at least two leagues from above the place of observation. On the 19th day Buffon obtained, at Montbar, similar evidence of the identity of electricity and lightning.

of M. Romas.

In our history of electricity we have already given an account of the observations made with the apparatus by which Franklin, in the month of June 1752, obtained sparks of electricity from the atmosphere during a thunder-storm. Attempts were everywhere made to repeat this remarkable observation; and the most successful of these was that of M. Romas, who, according to a decision of the Academy of Sciences, had invented the electrical kite more than a year before it was employed by Dr Franklin.

His electrical kite.

The kite constructed by M. Romas was seven feet five inches high, three feet in its greatest width, and with a surface of eighteen square feet. The string was a cord wrapped round with copper wire. On the 7th June 1753 this kite was elevated to the height of 550 feet, by means of a string 700 feet long, and inclined 45° nearly. A silk cord three feet and a half long was fixed to its extremity, and suspended a large stone to govern the motion of the kite. A tube of white iron, about a foot long and an inch in diameter, was placed near the junction of the string and the silk cord, as a conductor, from which the sparks were to be drawn. From this conductor the spectators drew sparks with their fingers, keys, canes, and swords; and M. Romas having presented his knuckle, received a shock which struck him in the elbows, shoulders, breast, knees, and ankles. Seven or eight persons joined hands, and the shock struck the feet even of the fifth person. The storm now increased, and black clouds gathered in the zenith. At the distance of six inches sparks two inches long were obtained by a discharging rod. The electricity continuing to increase, flashes of fire about a foot long, three inches wide, and three lines in diameter, were frequently received, and the noise of them was audible at the distance of 500 feet. At this time he felt the sensation of a spider's web on his face when he was five feet from the string. The kite was now 650 feet high, and the wind blowing strong from the east, when M. Romas saw on the ground, about three feet from the white-iron tube, three straws dancing up and down below it. One straw was twelve, another five, and the third four inches long. The electricity having increased still more, the longest straw was attracted by the tube, accompanied with three loud sounds, which some compared to the crack of a postilion's whip, and others to that of a large pot of earthenware dashed in pieces on a pavement. This crash was heard even in the centre of the town, and the accompanying flash had the form of a spindle eight inches long and four or five lines in diameter. The long straw followed the string of the kite, and was seen moving with great rapidity even at the distance of ninety or a hundred yards, now attracted and now repelled by the string, each attraction being attended with long plates of fire and constant explosions. A phosphoric smell was distinctly felt. A permanent cylinder of light, about three or four inches in diameter, surrounded the string.

M. Romas again raised his kite on the 16th August, and though the storm was not severe, yet in an hour he obtained thirty beams of fire, nine at ten feet long, and about an inch thick, each accompanied by a noise like that of a pistol. When the glass of his discharging-rod was two feet long, he was able to conduct beams of fire six or seven feet long as easily as he had done those of seven or eight

[1] *Elettricita Atmosferica, continuazione degli studi meteorologici fatti sul real Osservatorio Vesuviano*, 4to, 1854.

Phenomena and Laws.

inches, without feeling the slightest shock. On this occasion the string of the kite was above a thousand feet long, and the metallic wire which was coiled round it was continuous throughout.

Cause of the rolling of thunder

It is obvious, from the preceding facts, that the well-known phenomenon of thunder and lightning is entirely an electrical one, the lightning being the electric spark, and the thunder the sound which accompanies it prolonged by successive echoes from among the clouds. That the clouds are capable of reflecting sound was determined by direct observation on the sound of cannon, made by Messrs Arago, Matthieu, and Prony. They observed that in a perfectly serene sky the explosions of their guns were always single and sharp, whereas when the sky was overcast, or when a cloud came in sight and covered any considerable portion of the horizon, the sound of the gun was attended by a long-continued roll like thunder; and sometimes a double sound was heard from a single shot. Sir John Herschel, however, has pointed out another cause for the rolling of thunder, as well as for its sudden and capricious bursts and variations of intensity. "To understand this cause," says he, "we must premise that, *cæteris paribus*, the estimated intensity of a sound will be proportional to the quantity of it (if we may so express ourselves) which reaches the ear in a given time. Two blows, equally loud, at precisely the same distance from the ear, will sound as one of double the intensity; an hundred struck in an instant of time will sound as one blow a hundred times more intense than if they followed in such slow succession that the ear could appreciate them singly."

Now let us conceive two equal flashes of lightning, each four miles long. both beginning at points equidistant from the auditor, but the one running out in a straight line directly away from him, the other describing an arc of a circle having him in its centre. Since the velocity of electricity is incomparably greater than that of sound, the thunder may be regarded as *originating* at one and the same instant in every point of the course of either flash. But it will reach the ear under very different circumstances in the two cases. In that of the circular flash, the sound from every point will arrive at the same instant, and affect the ear as a single explosion of stunning loudness. In that of the rectilinear flash, on the other hand, the sound from the nearest point will arrive sooner than from those at a greater distance; and those from different points will arrive in succession, occupying altogether a time equal to that required by sound to run over four miles, or about twenty seconds. Thus the same *amount* of sound is in the latter case distributed uniformly over twenty seconds of time, which in the former arrives at a single burst; of course it will have the effect of a long roar, diminishing in intensity as it comes from a greater and greater distance. If the flash be inclined in direction, the sound will reach the ear *more compactly* (i. e. in shorter time from its commencement), and proportionally more intense. If (as is almost always the case) the flash be zigzag, and composed of broken rectilinear and curvilinear portions, some concave, some convex to the ear; and if, especially, the principal trunk separates into many branches, each breaking its own way through the air, and each becoming a separate source of thunder, all the varieties of that awful sound are easily accounted for.

Distance of thunder.

The distance of the point in the atmosphere where the lightning is generated, may be readily computed by multiplying 1090 by the number of seconds which elapse between the flash and the first stroke of thunder. The product will give in feet the distance required.

The general phenomenon of thunder and lightning occurs during the passage of electricity between two clouds oppositely electrified, or one of which has an inferior charge of the same kind of electricity; but it appears in its most appalling form when the accumulated electricity of the clouds descends to the earth, shivering the strongest oak in its passage, rending the thickest walls, setting fire to houses, or stacks, or forests, and instantly destroying animal life, when the frail tenement of man or of beast happens to obstruct its path, or afford to it a more easy transit. Sometimes, however, the thunderbolt passes from the earth to the clouds, and in this case it is called the *ascending thunderbolt*. The Marquis Maffei was the first who observed this curious phenomenon. He distinctly saw during a storm the lightning issue from the ground with a loud noise. The Abbe Lioni and M. Seguier of Nismes saw the lightning rise in the form of a flame six feet high, followed by a loud noise.

Ascending thunderbolt.

One of the most interesting cases of the ascending bolt has been recorded by John Williams, Esq. It took place upon the hills above the village of Great Malvern, on the 1st of July 1826. A party had taken refuge from the storm in a circular building roofed with sheet iron, and one of the ladies on entering the hut expressed her alarm lest the lightning should be attracted by the iron roof. They had scarcely entered their retreat, and were about to partake of some refreshment, when a violent storm of thunder and lightning came on from the west. About forty-five minutes past two, a gentleman who stood at the eastern entrance saw a ball of fire which seemed to him moving on the surface of the ground. It instantly entered the hut, forcing him several paces forwards from the doorway. On his recovering from the shock, he found his sisters on the floor of the hut, fainting, as he imagined, from terror. Two of the ladies had died instantly; another lady, and the rest of the party, were much injured. The explosion which followed the flash of lightning was said by the inhabitants of the village to have been terrific. Mr Williams, who immediately examined the hut, found a large crack in the west side of the building, which passed upwards from near the ground to the frame of a small window, above which the iron roof was a little indented. Mr Williams conceived it to be quite clear, from the place of the fragments of stone and other appearances, that the clouds were negatively electrified during this storm.

Electrical phenomena on mountains; on Mount Breven;

Various electrical phenomena of a very interesting kind have been observed by travellers when ascending lofty mountains. In 1767, MM. Saussure, Pictet, and Jallabert, when on the top of Mount Breven, received small electric shocks at their finger ends by stretching out their arms, and a whistling noise even accompanied them. The gold button on M. Saussure's hat yielded distinct sparks. In 1814, a party of Englishmen experienced similar effects on Mount Ætna during a storm of thunder and lightning accompanied by a heavy fall of snow. One of the party felt his hair moving, and upon raising his hand to his head a buzzing sound issued from his fingers. The rest of the party experienced the same sensations, and by moving their hands and fingers they produced a variety of musical sounds, audible at the distance of forty feet. On the 27th of June 1825, Dr Hooker and a party of botanists witnessed effects like those described, during a fall of snow on Ben-Nevis when there was no thunder-storm. The snow fell very heavily for nearly two hours. Soon after it began, a hissing sound was heard everywhere around them, and continued about an hour and a half. It seemed to proceed from every point in the vicinity; and on arriving at the cairn on the summit of the mountain, they could almost determine the stones from which the electricity issued. The hair of several of the party exhibited, when touched, the usual electrical phenomena.

on Mount Ætna; on Ben-Nevis.

In India.

A very remarkable phenomenon of the same kind was observed by General Pollock, when in the command of a division of our Indian army and stationed at a fort about forty miles from the Khyber Pass, where the soil is an extended plain of sand. About the end of April 1842, when

Phenomena and Laws.

there was not a cloud in the sky, the air was so charged with electricity that the musket, with a fixed bayonet, of a European soldier on duty became so electrical as to emit a succession of sparks from the barrel when any conducting body touched it. General Pollock drew from it with his knuckle several powerful sparks. The barrel of the musket was insulated by the stock, which was made of wood from the Sipoo tree.[1]

On the transport of ponderable substances by lightning.

Before quitting the subject of lightning we must submit to our readers a brief account of the remarkable observations made by M. Fusinieri on the ponderable substances transported by lightning, and which it deposits in a permanent state on the bodies which obstruct its passage. When we consider the magnitude of the scale on which the great electrical machine of our atmosphere enables us to study its effects, it appears strange that so little attention has been paid to those interesting phenomena which accompany the electric stroke. M. Fusinieri is the only person who has made this an object of special investigation; and the results to which he has been led possess, as might have been expected, a very peculiar interest. The following are the general results which he obtained: Lightning contains, like the common electric spark, matter in a state of extreme division, and in a state of ignition and combustion. In the matter deposited by lightning on houses and on trees which have been struck by it, he has found *iron*, *sulphur*, and *carbon*. Lightning divides and subdivides itself indefinitely into sparks, which end in being not much larger than those of ordinary machines; and each of these sparks contains ponderable substances in the state of extreme division already mentioned. The lightning deposits the substances with which it is charged while it passes through them, and while it breaks hard bodies; and it deposits them on the surface by which it enters the body, as well as on that by which it escapes, and also on the surfaces of fracture. When the resistance to its passage is not great, it leaves no perceptible deposit; and the quantity of matter deposited increases, and is proportional to the difficulty with which the lightning traverses the body. At the same time that lightning deposits the matter which it contains, it takes up new matter from the combustible bodies, such as iron, charcoal, &c., through which it passes. The deposited matter tends always to expand itself in thin films on the surface which receives it, and it does this most readily on surfaces that are smooth and free from all asperities.

Experiments of Fusinieri.

In examining the traces left by lightning when it fell at Vicenza in 1829, and at Padua in 1831, M. Fusinieri made the following observations: It deposited, on the surface of a wall by which it entered the house, a thin layer of pulverulent matter, of a brown colour at its centre, and yellowish and much less deep at its margin. When this matter was collected and carefully examined, it proved to be *iron* in different degrees of oxidation. Upon some stones which the lightning had detached from the wall there was found a stratum the fiftieth of an inch thick, and of a brownish colour, which seemed to have undergone a species of fusion. This stratum was *sulphuret of iron*, which gradually changed into a sulphate of the same metal. M. Fusinieri indeed had previously found small crystals of sulphuret of iron upon an iron rod which the lightning had struck, and also upon a stone to which it had passed from the iron. The position of these crystals indicated that they had been formed in the middle of the passage of the lightning; a fact which he considered as proving that the electric matter could transport sulphur across metal itself. When the lightning escaped from the wall, it deposited upon the wood a dust composed of small aggregated grains, which had all the qualities of ferruginous matter. In pursuing the passage of the lightning, it was found to have divided itself into a great number of sparks more or less voluminous upon the windows, formed of pieces of rectangular glass united in a leaden frame. The traces left on the glass and on the lead were very slight, and there were only a few marks on the glass very near its contact with the lead. The traces on the lead were small cavities, round which there had been a fusion of the metal. Some of these cavities passed through the whole thickness of the lead, and their diameters varied with the size of the sparks that had produced them. In general, each cavity of any size was surrounded with several smaller cavities, which seemed to prove that each discharge was accompanied by smaller electric sparks disseminated around it. Besides these cavities, the lightning had spread on the surface of the metal a stratum of pulverulent matter, which adhered so strongly to the lead that none of it could be detached without removing at the same time a portion of the metal. Each large cavity was the centre of one of these strata, which appeared to be composed of globules of lead in the central part, and ferruginous dust on the margin. The glass, though an insulating body, was, as we have mentioned, marked also by the lightning. The origin of the thin strata formed on its surface was at those points where it had been in contact with the lead; but they extended much beyond this, and were composed at first of a powdery matter, sometimes blackish and sometimes whitish; and beyond this they terminated in continuous and diaphanous laminæ, which reflected the colours of thin plates. The central and pulverulent portion was lead; the exterior portion, and the thinnest, appeared to be iron more or less oxidated. On one occasion one of these thin plates was formed of an extremely thin stratum of metallic iron not oxidated. M. Fusinieri had formerly succeeded in diffusing metals in thin plates upon mercury by the common electric spark; and he considers the fact, that the same phenomenon takes place on glass as on mercury, as demonstrating that the effect is not owing to a molecular attraction of the surfaces, but solely by the property of expansion which is possessed in a state of fusion by those substances which are transported by the lightning. This property belongs in an especial manner to combustible bodies, particularly to metals, though these last do not all enjoy it in the same degree. Iron, for example, is more expansible than lead, as is demonstrated by the thin films which are deposited by electrical discharges.

M. Fusinieri next proceeds to describe the traces of iron, &c., which lightning deposits upon trees. By means of chemical re-agents and the magnetic needle he had previously determined that traces of iron had been left by lightning on two poplars and a pear-tree which it had struck; and he also found traces of sulphur at the extremity of the roots of a poplar tree, at which the lightning had escaped. These observations were confirmed subsequently by many others. A poplar having been struck at Casale, near Vicenza, on the 14th May 1829, M. Fusinieri found that the part of the trunk deprived of its bark was covered with small black spots, which he regarded as produced by the sparks already mentioned which had been disseminated by the electric current at the instant its bark was carried away. The bark itself must have been reduced into extremely small parts, and immediately consumed, for not a vestige of it could be found. It would appear also that the lightning had carried away a part of the wood which it decomposed, such as the carbon, while the rest was volatilized. Traces of sulphur were found at the foot of the tree; and the lightning having insinuated itself between the bark and alburnum of the roots, there was felt, by removing the former, a strong odour of sulphuretted hydrogen, similar to, though more powerful than, that which the traces of sulphur had left upon the ground. The roots torn asunder by the lightning were impregnated with a

[1] Sir W. Snow Harris's *Rudimentary Electricity*, p. 177, 3d edit., Lond. 1853.

Phenomena and Laws.

moist and brownish matter, which was extraneous, but which had penetrated into their organic tissue with the lightning which conveyed it. This matter exhaled the same fetid odour as the surrounding earth, especially that portion of the earth which, from being in contact with the roots, was impregnated with the same brownish matter. In penetrating farther into the earth, it was found traversed by serpentine furrows, covered with a cinereous matter, the odour of which was the same as that which was exhaled by the other traces of lightning. The serpentine form of these furrows clearly indicated the tendency of the lightning to disseminate itself. All these substances and deposits were carefully collected and examined by M. Fusinieri.

In a pear-tree which had been struck with lightning in 1827, M. Fusinieri discovered very remarkable effects. Though its trunk, three feet in diameter, was torn into four parts throughout its whole length, no foreign matter nor odour could be perceived either in its roots or in the earth. At the places where the branches joined the trunk, *the substance of the pear-tree* was altered to the depth of several lines. It had acquired an acid taste and a reddish colour. It exhaled while burning a penetrating and peculiar odour, and it continued to burn without flame till it was completely consumed. The matter of the lightning had therefore penetrated the tissue of the wood, and there presented traces of iron.

M. Fusinieri has collected and detailed many interesting observations respecting the substances deposited by lightning upon the various parts of houses which have been struck by it; but we regret that our limits will not permit us to pursue any farther this most important subject.

These and many other facts seem to prove that iron exists in the air and in clouds; and it is well known that the same metal mixed with manganese, nitrous salts, and organic substances, is found in rain water. M. Fusinieri is of opinion that the iron has been drawn from the earth, and chiefly from mountains, where the mines are most frequent, and where storms commonly begin to form.[1] The colouring matter of snow and rain, and the existence of meteoric stones, prove the existence in our atmosphere of dry and ferruginous vapours, the molecules of which are more or less rarefied or condensed according to the causes which may generate them. The fact that meteoric stones fall during the prevalence of storms and other electric phenomena, and especially the fact that hailstones have sometimes a nucleus of small pieces of sulphuret of iron, appear to M. Fusinieri to afford the true origin of these remarkable bodies. It has been already proved also, that electricity does transport matter; and when we consider, as Ampere has shown, that magnetic currents surround our globe, that matter in an extreme state of subdivision spontaneously expands itself, that radiating heat, like electricity, transports ponderable substances, we may obtain a very simple explanation of the origin of meteoric stones. As the temperature of the surface of the globe is not high enough to detach from it the material bodies which exist in the atmosphere, M. Fusinieri concludes that we ought to attribute this action to other causes, which are yet to be discovered, rather than deny a fact so completely demonstrated.

Effects produced by lightning.

The effects produced by lightning may be divided into mechanical, physical, and chemical. The mechanical effects of lightning are very powerful. Trees have not only been cleft and crushed to pieces, and their branches thrown to a great distance, but in some storms the sap of the tree has been drawn into steam and the dried trunk of the tree split up, as it were, into bundles of fibres like lucifer matches. When spires and elevated buildings are struck, large masses of stone are displaced or thrown down; and when houses have been injured, the articles of furniture are displaced, and even fastenings torn from the walls. M. Pouillet mentions a case, without giving the authority, where a brick wall several toises long was torn up from its foundation and carried in one piece to the distance of several toises. Effects so powerful as these are produced, as Pouillet has shown, by the sudden and simultaneous decomposition of the natural fluids of the body, which is seized with such violence that the arrangement ordinarily produced by the laws of equilibrium has not time to be effected, and the bodies are thus impelled by forces incomparably greater than those which could be resisted by the air.

Mechanical effects.

Physical effects.

The physical effects of lightning are generally limited to the production of such a degree of heat as is sufficient to set fire to the roofs of houses where there is straw or dry wood, and to the fusion of metallic bodies, such as bell wires. In some cases traces of carbonization have been found on trees struck by lightning. Effects still more powerful were observed by Dr Withering on the 3d September 1789. A man with a staff in his hand was killed when standing beneath an oak struck with lightning. The electric fluid which passed along the staff excavated a hole five inches deep and two and a half in diameter. The hole itself contained some roots of burnt grass, but upon subsequently turning up the ground it was found to be blackened to the depth of ten inches, and two inches below this the quartzy earth presented distinct traces of fusion. Among the specimens presented to the Royal Society by Dr Withering were a siliceous stone, one of the angles of which was completely fused, and a lump of sand agglutinated by the heat, in a hollow of which the siliceous matter had run, when melted, along the cavity, and formed a globular portion at the bottom.

Fulminary tubes.

By the same powerful agency are produced what are called *fulminary tubes*, which have been found in beds of sand in Cumberland, Silesia, Eastern Prussia, and near Bahia in Brazil. These tubes are in general about two inches in diameter externally, over two-tenths in their interior diameter, and about ten or twelve yards long. They are produced by the passage of the electric fluid through the sand, the particles of which are melted and agglutinated by its heat. Dr Fiegler, who has described many of these tubes from different localities, has observed that at a certain depth below these plains of sand there are little portions of water, and he ascribes the tubes as produced by the passage of the electric fluid from the surface of the ground to these portions of fluid where it is neutralized. M. Hachette conceived the idea of imitating these tubes by using a strong electrical battery; and he and M. Savart and M. Beudant having placed a quantity of pounded glass in a hole made in a brick, and having caused the electrical discharge of the battery to pass through the pounded glass, they succeeded in forming tubes exactly similar to those formed by atmospherical electricity. One of those which they made was an inch long, its external diameter varying from one-sixteenth to one-eighth of an inch, and its internal diameter being the fiftieth of an inch. In another experiment, where a little chloride of sodium was mixed with the pounded glass, the length of the tube was an inch and a fifth, and of uniform diameter. Its mean external diameter was one fifth of an inch, and its internal diameter one twentieth of an inch. When they used powder of felspar or pounded quartz, they could not succeed in making the tubes.

Produced artificially.

The repeated discharges of lightning against the summits of lofty mountains have partially fused the hard rocks of which they are composed. Saussure has observed these effects on the summit of Mont Blanc composed of schistose

[1] The returning stroke of lightning, when it passes from mountains or places containing iron and other metals, must necessarily carry along with it these substances in a state of extreme subdivision. See p. 584.

Phenomena and Laws.

amphibole, Ramond on the Pic du Midi formed of micaceous schists, and on the highest point of the volcano of Toluco MM. Humboldt and Bonpland observed more than two square inches of the rock vitrified, and in several places cavities in the interior of which there was a vitreous crust.

Vitreous mass from a hay-stack

One of the most remarkable effects of lightning which we have seen was produced in a hay-stack which was struck with lightning in the parish of Dun, near Montrose. The stack was perforated as with a red-hot bolt from top to bottom, and at the end of the perforation, where the electric fluid entered the ground, there was found a vitreous mass about the size of an infant's hand formed by the silex which exists in the hay. This specimen was in our possession for some years, and was presented to a public museum.

Disaster at Chateauneuf in 1819.

In order to give some idea of the tremendous agency of lightning, we shall give an abridged account of the disaster which befell the village of Chateauneuf-les-Moustiers, in the department of the Lower Alps, on the 11th July 1819, as communicated to the Academy of Sciences by M. Trancolye. About half-past two o'clock on Sunday, the curate of Moustiers accompanied a procession to church to instal a new rector. The weather was fine, with only a few large clouds in the sky. While a young man was chanting the epistle there was heard three claps of thunder with hardly any interval. The missal was carried away from the hands of the young man, and dashed in pieces. He himself felt as if his body was grasped tightly by the flame, which seized him by the neck. By an involuntary movement this young man, who had at first cried loudly, shut his mouth, and being thrown down was rolled upon the persons in the church, who were all thrown on the ground, and forced out at the door. Upon coming to himself again he returned to the curate, whom he found suffocated and insensible. He raised him up, put out the fire on his surplice, and restored him to life by means of vinegar about two hours after he had been stunned. The electric fluid had struck the upper part of the gold lace of his robe, ran down his arm, carried off one of his shoes to the very end of the church, broke his metallic buckle, and broke the chair on which he sat. His arms were all scarred with the lightning, and the wound did not heal for two months. A child was driven some paces from its mother's arms. Every person had their limbs paralysed. All the women were hideously dishevelled. The church was filled with a black and thick smoke, and objects were visible only by the flames of dresses set on fire by the lightning. Three persons were killed, and eighty-two wounded. The officiating priest was not struck, probably from his wearing a silk gown. All the dogs were killed on the spot where they lay. A person at a distance from the village saw three masses of fire descend upon it. The lightning first struck the cross of the spire, which was thrown to the distance of eighteen yards. An excavation of nearly two feet was made in the church, and continued under the pavement of the street, and another went beneath a stable in which five sheep and a horse were found dead.

Hail.

Among the phenomena of atmospherical electricity, one of the most interesting is the production of hailstones, particularly those of an enormous size. The connection between the formation of hail and an atmosphere highly charged with electricity has been long ago recognised; but our almost total ignorance of the subject may be inferred from the character of the hypotheses which have been framed to account for the production of hail.

Volta's theory.

Volta supposes that a small globule of snow becomes a hailstone, gradually increasing in size by being kept in a state of reciprocating motion between two clouds charged with opposite kinds of electricity, until the gravity of the constantly increasing mass overpowers the electrical force, or till the electricity of the clouds is spent by their mutual re-action.

Matteucci's theory.

M. Matteucci has justly objected to this strange hypothesis, that it is difficult to conceive how a hailstone nearly two pounds in weight could be formed by such a process. He denies that the clouds possess an electric force sufficient to produce such an effect; and, admitting that such a force does exist, he maintains that the electricity would be directly discharged from the one to the other. M. Matteucci conceives that the hailstones are produced instantaneously, and that they fall completely formed. He considers that there can be only two epochs in their formation, viz. the production of the snowy nucleus; and, secondly, that of the icy crust which covers it. When a cloud has its temperature greatly reduced, it is easy to conceive its surface covered with small flocks of snow; and if an electrical discharge should in this case pass through it, it would give rise to hail, by obliging the cooled vesicles to condense round each snowy nucleus. It is this shock, he observes, which is necessary to destroy the inertia of the particles, which ought to unite to each other, as seen in the experiment of the congelation of water with the cryophorus of Wollaston. M. Matteucci was led to these views by studying the hailstorm which took place at Tussi on the 24th July 1832. About six o'clock A.M., after a brilliant sun, the whitish and scattered clouds were seen suddenly to unite and to form a thick mass scarcely detached from the horizon, and which covered the country with a thick darkness, that continued uninterrupted by the effects of strong electrical discharges. An impetuous north-west wind soon rose, and was followed by copious rain mixed with hail. This storm, which lasted about fifteen minutes, was followed by a lucid interval, after which there fell a thick snow, which ceased and began again several times. "I do not wish," says M. Matteucci, "to cite any facts which might appear fabulous; but it appears certain that a hailstone was found which weighed *fourteen pounds*, and that another in falling upon a house forced its way through the roof; that trees from three to six centimeters in diameter were destroyed; that oxen were wounded, and that several walls were overthrown or rent by the force of the hail. I state as certain, the fact that hailstones collected a few instants after their fall still weighed a pound and a half. M. Pouillet assures us that he can himself certify that hailstones have fallen half a pound in weight. I can certify that they have fallen three times that weight."

Paragreles.

In consequence of the demonstrated connection between hailstones and a certain electrical state of our atmosphere, M. Lapostolle, professor of physics at Amiens, proposed to protect vineyards and other cultivated grounds from the destructive effects of hail, by erecting wooden poles twenty-five feet high, for the purpose of carrying off the atmospherical electricity. The use of these hailrods has extended itself over France, Switzerland, Germany, and Italy; and it is not easy to resist the evidence that has been collected of their efficacy, notwithstanding the opposition that they have met with from many scientific individuals. Each pole is supposed to protect a circle of a hundred or a hundred and thirty feet, in the centre of which they are placed. Rods of metal being too expensive, they are made of wood, in a way which will be described in a subsequent part of this article. Each rod does not cost more than a few shillings, and the practice is to take them up after having put them under cover with the other rural implements, and replace them at the vernal equinox.

Water-spouts.

Another phenomenon, which is either formed by atmospherical electricity or connected with it, is the water-spout, a meteor of rare occurrence, and often most destructive in its effects. That distinct electrical phenomena are developed during the continuance of certain water-spouts cannot be doubted; but the electricity has in these cases been supposed to be a secondary phenomenon, produced by the motion of the air. This view of the subject has received some support from the researches of M. le Comte Xavier de Maistre, who has succeeded in imitating the principal phe-

Phenomena and Laws.

nomena of water-spouts, and even the co-existing ascending and descending currents, by the mechanical circular motion of a liquid; and it is to this mechanism of the water-spout that the electrical phenomena are ascribed. The lower parts of the atmosphere, and those above the clouds are brought to the same point by the two interior and opposite currents of the spout, and strata of air charged with vapour, and often with different electricities, are thus brought into union, and produce the electrical phenomena in question.

Sheet or summer lightning.

The well-known phenomenon called *sheet or summer lightning* has recently been examined by M. Matteucci of Bologna. This ingenious author considers it to be proved that there is an accumulation of one of the two electricities at the surface of the earth; and he ascribes this electricity either to evaporation or to the analogous causes which M. Pouillet has substituted for it, or to chemical actions which are constantly going on in the interior of the earth. In order that this electricity may not escape and pass immediately into the mass of the globe, as soon as it is developed, it is necessary that the ground in which it is accumulated may not be a conductor, either from its own nature, or in consequence of the evaporation which dries it. It is also chiefly in high and insulated places rather than in the plains, above rocks rather than above forests, in summer rather than in winter, in the middle of the day rather than in the night, that these stormy clouds show themselves, whose formation cannot be well accounted for but by the influence of the electricity which the ground retains. To what other cause, he asks, can we attribute those clouds which are sometimes suddenly formed on the flanks of mountains, and afterwards rise into the air, without any variation of temperature, any change of barometrical pressure, or any other apparent modification in the state of the atmosphere? In applying these principles to the explanation of summer lightning, he considers the electricity of the earth's surface to be detained there by the desiccation of the ground, which renders it an insulator. At the moment of sunset, and during the night, the vapours which are thus condensed by cooling near the ground form a conducting stratum which serves to re-establish by degrees the electrical equilibrium between the atmosphere and the earth, which are charged with opposite electricities. It is chiefly in the plains, he conceives, that we ought to observe sheet lightning; and it ought to last a much longer time, because on elevated and insulated places the flow of electricity accumulated during the day will be much more rapid, on account of their form and position in the middle of an atmosphere more rare, more cold, and consequently more highly charged with vapours. These electrical discharges between the ground and the atmosphere may, according to our author, take place with much force, and produce even violent effects, especially if the ground and the atmosphere are too much dried; and he supposes that some earthquakes, and particularly those which take place after great droughts, may be owing to this cause. This supposition explains, in a satisfactory manner, the process employed by the ancients, and often with success, to protect from earthquakes those places which are subject to them, and which are particularly those where the nature of the ground renders the accumulation of electricity easy, and its escape difficult. This process consisted in sinking into the ground, even to a considerable depth, long bars of iron, which, according to the explanation given above, ought to facilitate the establishment of the electric equilibrium, by establishing a metallic communication between the interior of the ground and the surface, which, by its insulating faculty, retains its electricity.

Matteucci's theory of sheet lightning.

Aurora borealis.

Among the atmospheric meteors generated by electricity the aurora borealis holds a distinguished place. The phenomena which it exhibits have already been fully described under another article (the Aurora Borealis), but it belongs to our present subject to treat briefly of its electrical origin. The crackling and hissing noise of electricity passing from one place to another has been distinctly heard in this country by Mr Nairne and M. Cavallo, and we can ourselves bear testimony to the same fact. In the north of Europe the sound accompanying the northern lights is an universally admitted fact, and proves beyond a doubt that, in certain auroræ at least, the atmosphere is highly charged with electricity. Mr Trevelyan learned when he was in Faroe that the peculiar smell which accompanies electrical discharges was distinctly felt during a brilliant aurora; and in the year 1821 Sir David Brewster had the good fortune to observe, at Belleville, in Inverness-shire, an aurora, the phenomena of which were actually combined with those of a thunder-storm. This case is so remarkable, and so instructive, that we shall give the description of it in his own words: "On the evening of the 29th August, about half-past nine o'clock P.M., when there was not a breath of wind, and when the thermometer stood at 63°, the noise of very distant thunder was heard towards the south; sheets of very brilliant lightning illuminated the sky, issuing in general from a small black cloud near the horizon. I was surprised, however, to observe, that, with the exception of a few thin black clouds, which were rendered visible by the lightning, the greater part of the sky was covered with shining masses, like those which form the aurora borealis. The stars were easily seen through this luminous matter, which was arranged in irregular masses separated by clear intervals, but having a tendency to assume the appearance of irradiations diverging from the cloud whence the lightning appeared to issue. When the lightning flashed, it was propagated in a particular manner along these masses of light; but, what was very singular, the luminous patches were constantly in a tremulous or undulating motion during the intervals of the flashes of lightning. They shifted their place and changed their form exactly like the light which appears in many of the varieties of the aurora borealis. As the luminous clouds now described did not appear in the northern part of the horizon, and were distinctly related in their position and form to the thunder-cloud from which the lightning emanated, we are entitled to refer the two classes of phenomena to the peculiar electrical condition of the atmosphere, and to suppose that the phenomena of the aurora borealis may have an analogous origin. It seems now to be clearly proved that auroræ exist not only at great heights in our atmosphere, such as from 62 and 105 miles, the lowest as given by Cavendish and Dalton, to 500 and even 1000 miles, as measured by other observers: but that they appear even close to the earth, in the lowest region of the atmosphere, is clearly established by a decisive observation of Captain Parry's.[1] In the first of these cases it would be in vain to look for electrical indications, when the meteor is so far beyond the sphere of our electroscopes and the reach of hearing; but, in the latter case, we may reasonably expect not only to observe the peculiar electric state of the atmosphere, but also to hear the sound which invariably accompanies the passage of the fluid. This view of the subject reconciles the apparently contradictory observations which have been made on the aurora; and the connection of the phenomenon with the magnetic meridian, as well as its influence in certain cases on the magnetic needle, present no difficulty since the recent discoveries respecting the connection between electricity and magnetism.

Fire-balls.

That the other luminous phenomena of the atmosphere

[1] Mr W. C. Trevelyan observed that the aurora borealis in Faroe and Shetland was often seen very low, not more than 40 or 60 feet above the sea, and he learned that in both countries it is distinctly heard.

Phenomena and Laws.

have their origin in its electricity cannot be doubted. Fire-balls or globes of fire have been observed at altitudes from 30 to 100 miles, and moving with velocities varying from 5 to 33 miles in a second. These balls of light sometimes leave behind them a luminous track after they have vanished. Sometimes they explode into globes of a smaller size, sometimes they are dispersed into divided sparks, and at other times they are accompanied with showers of meteoric stones. Falling or shooting stars are only the same phenomena on a smaller scale; they appear at all seasons, but most frequently during the prevalence of the northern lights, and generally in the lower regions of the atmosphere. The prismatic columns of light which were observed by Mr Fisher and others in the arctic regions have obviously an electrical origin. "On the afternoon of the 25th October Mr Fisher observed at Winter Harbour two vertical columns of prismatic colours, about 15° on each side of the sun, which was below the horizon; they were about 5° long, and their lower end touched the horizon: they continued for about an hour, from noon to one o'clock. Similar columns were observed two or three times, and about the same time the aurora appeared.

Columns of light.

Fire of St Elmo.

The fire of St Elmo, or Castor and Pollux, is a brilliant light which frequently appears on the summits of ships' masts, on the points of bayonets, on the tops of spears, and on the tips of the ears of horses. It is obviously nothing more than the electricity discharging itself either from or into pointed bodies. Its connection with the electrical state of the atmosphere is obvious from the following account of the phenomenon as given by Lord Napier, who saw it in the Mediterranean in June 1818. "About nine, when the ship was becalmed, the darkness became intense, and was rendered still more sensible by the yellow fire that gleamed upon the horizon to the south, and associated by the deep-toned thunder which rolled at intervals in the mountains, accompanied by repeated flashes of that forked lightning whose eccentric course and dire effects set all description at defiance. By half-past nine the hands were got aloft to furl the top-gallant sails and reef the top-sails, in preparation for the threatening storm. When retiring to rest, a sudden cry of St Elme and St Ann was heard from those aloft and fore and aft the deck. On observing the appearance of the masts, the main top-gallant-mast head, from the truck, for three feet downwards, was completely enveloped in a blaze of pale phosphoric light flitting and creeping round the surface of the mast. The fore and mizen top-gallant-mast heads exhibited a similar appearance. This lambent flame preserved its intensity for the space of eight or ten minutes, and then it gradually became fainter, till it diminished at the end of half an hour."

Observed by Lord Napier.

By Count Forbin.

An interesting case of the fire of St Elmo, in which the electricity first settled on the most prominent metallic body, and then on the bodies next in conducting power, is described in the memoirs of the Count de Forbin. "In the night," says he, "it became extremely dark, and it thundered and lightened fearfully. As we were threatened with the ship being torn to pieces, I ordered the sails to be taken in. We saw from different parts of the ship above thirty St Helmo's fires; amongst the rest was one upon the top of the vane of the mainmast, *more than a foot and a half in height*. I ordered one of the sailors to take the vane down; but scarcely had he taken the vane from its place when the fire fixed itself upon the top of the mainmast, from which it was impossible to remove it."

Sometimes the electricity of the atmosphere shows itself at the yard-arms and mast-heads of vessels, in the form of balls of fire. Captain Clavering of the Griper experienced a severe gale, which lasted three days without intermission, when about 100 miles to the west of the Fiord of Drontheim. This gale was remarkable for the small amount of the effect produced on the barometer, on its approach, during its continuance, or after its cessation; and Captain Clavering was induced, from this and other causes, to ascribe it to a disturbed state of electricity in the atmosphere. It was accompanied with very vivid lightning, which is particularly unusual in high latitudes during winter, and by the frequent appearance and continuance for several minutes of balls of fire at the yard-arms and mast-heads. Of these no fewer than *eight* were counted at one time. This phenomenon is obviously an interesting variety of the fire of St Elmo.

Chemical effects.

The observations which have been detailed in the preceding section place it beyond a doubt that the electricity generated in our atmosphere is identical with that which is developed by friction. Philosophers, however, have sought to establish their similarity as chemical agents. M. Bonjol, for example, has decomposed water by means of the electricity of the air collected by an insulated pointed rod, in stormy states of the atmosphere; and the late unfortunate Mr Alexander Barry, who lost his life in the cause of science, succeeded in August 1824 in decomposing a solution of sulphate of soda coloured with syrup of violets. Bubbles of hydrogen appeared in the tube connected with the string of the electrical kite, while bubbles of oxygen appeared in the tube connected with the ground. In about ten minutes the blue liquid in the first tube became green from the separation of the soda, while the sulphuric acid, by passing to the pole in the other tube, changed its contents as usual into red. See page 597.

CHAP. III.—ON THE CHANGES PRODUCED BY ELECTRICITY ON ORGANIC AND INORGANIC BODIES.

Changes produced by electricity.

That electricity is a powerful agent in the material world, has long been the opinion of those who have studied its effects. We have clearly seen that it performs a distinguished part in the economy of our atmosphere; but there is reason to believe that its agency is still more general, and that it exercises an influence almost universal over the laws of inorganic matter, as well as over the functions of organic life. Our knowledge, however, on these subjects is but in its infancy; and though the following sections will present to the reader many interesting and important phenomena, he will not fail to deduce from them the conclusion, that a wide field of discovery is yet unexplored, and that there is no branch of science more likely to reward the diligence of the young philosopher than that which treats of the agency of the electric fluid in animal and vegetable life, its effects upon inorganic matter, and its connection with the imponderable agents of light and heat. The general effects of electrical action may be comprehended under the following heads:

1. On the mechanical changes produced by electricity on inorganic bodies.
2. On the chemical changes produced by electricity on inorganic bodies.
3. On the changes produced by electricity on phosphorescent bodies.
4. On the changes produced by electricity on odoriferous bodies.
5. On the magnetic effects of electricity.
6. On the effects of electricity on animal bodies.
7. On the effects of electricity on vegetable bodies.

SECT. I.—*On the Mechanical Changes produced by Electricity on Inorganic Bodies.*

Mechanical effects of electricity.

Although we know nothing of the real nature of the electric principle, yet, from its properties and effects, it has been found convenient to speak of it as a fluid. Its action upon bodies which either obstruct its motion, or afford it a ready passage, renders its analogy with a fluid still more

Phenomena and Laws.

striking, and we are thus enabled to comprehend phenomena which it would otherwise be more difficult to understand. A canal with a smooth bottom and sides may be considered as a good conductor of the aqueous fluid, and a river with a rocky bed and a tortuous course may be regarded as a bad conductor. Small quantities of water turned into each of these conductors will find its way by a slow movement, without injuring the surfaces over which it flows, just as a small or a large wire will carry off small quantities of electricity without suffering any mechanical change. But when the current of water is deep and strong, it will overcome its obstructions, burst its barriers, and destroy the channel which at first confined it; while the same current running with the same velocity in a smoother bed will make its way without producing any change upon the materials over which it runs; in the same manner as a small metallic wire will sometimes be expanded and sometimes burst in pieces when it transmits with difficulty an electric discharge, whereas the same discharge will find an unobstructed passage through a wire of still greater diameter.

Expansion.

The influence of electricity in expanding solid bodies was discovered by Dr Priestley during his experiments on the effects of explosion through metallic substances, when he found that a chain *was actually shortened* after the charge of a battery had been sent through it. A length of chain of exactly twenty-eight inches, after having transmitted a charge of sixty-four square feet of coated glass, was shortened one-fourth of an inch, or $\frac{1}{256}$th part of the whole.

Mr Nairne found that a piece of hard drawn iron wire, ten inches long and $\frac{1}{100}$th of an inch in diameter, after receiving many times in succession a discharge of twenty-six feet of coated glass (or nine jars), was shortened $\frac{3}{40}$ths of an inch, or $\frac{1}{133}$d of an inch, by such discharge. Its length was examined after the sixth, ninth, and fifteenth discharges. The total contraction of the wire was fully one inch and one-tenth, or *one-ninth of the whole length.*

Mr Brooke obtained a contraction still higher than this, by passing a charge of nine bottles or sixteen feet of coated surface nine times in succession through a steel wire twelve inches long and $\frac{1}{100}$th of an inch in diameter. The wire was shortened *one inch and a half*, or *one-eighth of its whole length.*

If the wire, however, through which the shock is passed has suspended to it a weight so as to stretch it considerably, the wire will be increased in length, in place of being diminished. This effect is by no means inconsistent with those already described. The heat, which, as we shall afterwards see, is always evolved during the transmission of an electric charge, produces a softness short of fluidity, which allows the extending force to overcome the absolute tenacity of the wire.

It is very obvious that the contraction of the wire in one dimension in these experiments was owing to its expansion in a direction at right angles to the length, in the same manner as a piece of caoutchouc extended in one direction is shortened in the other. Mr Nairne indeed observed that the wire had increased in thickness; but though he used a pair of scales which turned with one-eighth of a grain, he could not observe any change in the weight of the wire.

The same phenomenon takes place in fluid metals. If, for example, we fill a capillary or thermometer tube with mercury, and transmit through the mercurial column an electrical charge, the metal will suffer such a degree of expansion as to burst the tube to pieces.

When the body which transmits the shock has a less conducting power than metals, the tendency to expand will of course be still greater. If a little water, for example, is placed in a glass tube, and a shock passed through the water, the tube will burst by the expansion of the fluid; and the experiment will succeed even if a common drinking glass is filled with water and substituted for the tube.

Beccaria placed a drop of water in the centre of a solid glass-ball, and burst the ball by transmitting a shock through the fluid drop. This experiment was beautifully varied by the Italian philosopher, who constructed a small mortar, and having put a ball into it, he placed behind the ball a drop of water, so as to lie between the two wires which passed through the side of the mortar. When an electric charge was sent through the two wires, the expansion sustained by the water drove out the ball with great velocity. M. Lullin gave the ball a still greater impulsion by substituting a drop of oil for the drop of water.

Phenomena and Laws.

Even when the conductor is air, a violent expansive effect is created during the transmission of the electric shock. This effect is well shown by fitting a cork cap into an ivory mortar having a cavity an inch deep and half an inch wide. When a shock is sent through the wire in this cavity, it is expanded so suddenly as to drive out the cork with great violence.

The mechanical effect of electricity is well shown in the following experiment:—Upon the surface AB of a dry piece of wood, paste a strip of tinfoil about 18 inches long and

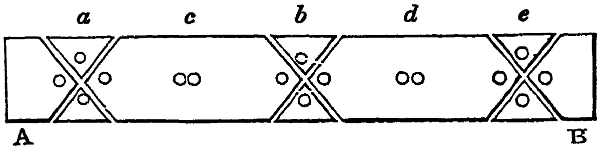


Fig. 10.

half an inch wide, and having cut out with a sharp knife small crosses at *a*, *b*, and *e*, place four wafers on each, as shown by the little circles in the figure. Place also wafers at *c* and *d*. If a strong electrical charge from a Leyden phial is passed from A to B, all the small wafers at the crosses will be violently thrown off, while those at *c* and *d* will remain in their place.

When the electric shock is made to pass through solid bodies which are imperfect conductors, such as wood, stone, sugar, and glass, they will be broken by the expansion which is produced. In the case of glass not very thick, it will be broken into innumerable pieces. When the glass is so thick as to resist the shock, it is marked with vivid prismatic colours, which Mr Henley supposes to be thin laminæ of the glass separated from one another by the shock.

The expansive effect created by the shock is finely exhibited by dipping a clean brass chain in melted rosin, and laying it upon paper. If the charge of thirty-two square feet of coated glass is sent through it, the resinous coating will be driven off from every part of the chain, which will be entirely cleared of it.

When a clean uncoated brass chain is laid upon a plate of glass, and a charge of thirty-two square feet passed through it, the glass will be marked in every part of its surface where it was touched by the chain, every marking having the width and colour of the link. The metal could be scraped off the glass at the outside of the mark, but it was actually driven in other places into the pores of the glass. Dr Priestley, who made this interesting experiment, produced a similar effect upon glass with a silver chain, and small pieces of other metals.

Diffusion of metals into vapour.

The reader who has perused with attention our chapter on Electric Light, will recognise in these experiments the origin of those beautiful results which have been obtained by Fusinieri, by passing the electric shock from a metallic ball to a polished metallic surface; and the diffusion of solid bodies into metallic vapour, as it may be called, is finely illustrated in the following experiments. Take three strips of window glass, each about three inches long and one wide, and having placed two narrow strips of gold leaf or leaf brass between them, so that the ends of the gold leaf project a little beyond the glass, transmit the charge of a large Leyden jar through the gold leaf. The gold leaf will be found to

be melted by the shock, and driven into the surface of the glass. The outer plates of glass are generally broken in this experiment, and the middle one, which frequently remains entire, has an indelible metallic stain upon each of its surfaces. This stain is obviously the metallic vapour of the gold driven into the pores of the glass.

Diffusion of metals into vapour.

The dispersion of gold or silver into a metallic vapour may be exhibited in another manner. Let a strip of gold or silver leaf, or Dutch metal, be fixed with gum to the surface of a piece of paper, and be placed in such a manner between the forceps of a universal discharger, that a strong electrical charge may be passed through it. The metallic strip will entirely disappear, in consequence of having been dispersed into a vapour or powder, part of which remains in a state of oxidation on the paper, which, from this cause, receives a greenish-brown tinge.

The metallic colours thus obtained have been employed for impressing ornamental figures upon paper or silk. In order to do this, trace the outline of the figures on thick drawing paper, and having cut it out as in stincil plates, place it on the silk or paper intended to be ornamented. When a gold leaf is laid upon it, and a card above the gold leaf, the whole is placed in a press or beneath a weight, and an electrical charge sent through it; the metallic stain is limited to the portion of the drawing paper that is cut away, and consequently any outline figure may be readily impressed upon the ground employed to receive it.

Dr Franklin was the first person who impressed metallic stains upon glass by electrical discharges. Fine gold communicated a reddish stain and silver a greenish one, and the metallic vapour, when driven into the pores of glass, was able to resist the action of the strongest aqua regia.

SECT. II.—*On the Chemical Changes produced by Electricity on Inorganic Bodies.*

Chemical changes produced by electricity.

The effects of electricity as a chemical agent are strikingly displayed in its power of evolving heat, and consequently of inflaming and fusing bodies, and its power of promoting chemical composition and decomposition. The influence of electricity in producing combustion may be shown by several beautiful experiments.

Evolution of heat.

Exp. 1. *To light a candle by Electricity.* Having wrapped some loose cotton wool round the extremity of a long brass pin or wire, roll the cotton in the powder of white or yellow rosin. Bring the naked end of the wire into contact with the external coating, while the cotton end is applied to the brass knob of a charged jar, and the rosin and cotton will be instantly inflamed.

By dipping the cotton in oil of turpentine, and using a large jar, the cotton may be inflamed in a similar manner; and its inflammation will be promoted by strewing upon it some fine brass dust.

Exp. 2. *To light a candle in another way.* Thrust a wire up through the middle of the candle to within a short distance of the wick, and having connected the outside coating of a charged jar, by means of a chain, with the lower end of the wire, touch the wick with the knob of the jar, and the candle will be lighted.

Inflammation of bodies.

Exp. 3. *To inflame Phosphorus, &c.* Having placed powdered phosphorus, rosin, or camphor, on some cotton wool, and wrapped it round one of the knobs of a discharging rod, apply the knob thus covered to the ball of a charged jar, and the naked knob to the external coating of the jar, and the powder will be set on fire.

Powdered rosin floating on water may be set on fire by transmitting a charge over the surface of the water between two points.

Exp. 4. *To inflame alcohol or ether.* The alcohol or ether being placed in an insulated metallic cup, electrify the cup, and upon taking a spark from the cup either with the knuckle or any other conductor, the fluid will be set on fire.

If ether is placed in a thin stratum upon the surface of water, in a clean wine glass, a spark taken from the surface will inflame the ether when the water is connected with the prime conductor.

Exp. 5. *To inflame gunpowder.* Upon the end of an insulated metallic wire fix a small cartridge, and when the cartridge is presented to the knob of a charged jar, the powder which it contains will be exploded.

Exp. 6. *To exhibit the heat evolved by electricity.* Take a wooden rod, for example one of red fir, about one inch thick and ten inches long, and place it between the ball of the conductor and the conducting wire; put the ball of a thermometer in a hole bored in the wood, and in a few minutes the mercury will rise to about 112°. Van Marum, who made this experiment, found that in three minutes the mercury rose from 61° to 88°, and in five minutes to 112°.

Sir William Snow Harris's thermo-electrometer for measuring the evolution of heat.

The evolution of heat by electricity is finely shown by means of a beautiful instrument constructed by Sir William Snow Harris. Mr Children and other philosophers had deduced from a variety of facts that the heat evolved by a metallic wire while transmitting an electric charge, is in some inverse ratio of its conducting power: and hence Sir William was desirous of measuring the relative degrees of heat so evolved by various metals and alloys in a gaseous medium such as air, and thus to discover their precise relations as conductors of electricity. The instrument which he used for this purpose is represented in Plate CCXXVII., fig. 1 A glass tube CDA, whose bore is regular, and somewhat less than one-tenth of an inch, has one of its extremities DA bent upwards and outwards for about two inches, and is united by welding to a spherical reservoir A, containing a coloured fluid.[1] This tube is fixed to a correctly divided scale E, supported by a suitable base; and the *zero* of the scale is at *o*, on a level with the coloured fluid in the reservoir A. Above the reservoir A is screwed air-tight, by means of brass caps closely cemented, a glass ball B, three inches in diameter; and through this ball a metallic wire *m n*, varying from $\frac{1}{100}$th to $\frac{1}{6}$th of an inch in diameter, may be passed air-tight by means of small flanges of brass *m*, *n*, fig. 2, cemented in and round two holes drilled through the ends, each flange having a small projecting shoulder to receive the wire, and, upon which are screwed two brass balls *a*, *b*, so as to render the whole air-tight. In order to fix the wire, the brass parts are made quite clean internally, and the wire being passed directly through them, is gently stretched, and then compressed in the holes by small pegs of tough wood, so as to insure a good contact. The pegs and the wire are allowed to project a little, to enable the observer to substitute different wires expeditiously. When an electrical explosion of sufficient force is now made to traverse the wire *m*, *n* in the ball B, the heat which it evolves will be made evident by the ascent of the coloured fluid along the scale E.[2]

Plate CCXXVII., figs. 1, 2.

Sir William now submitted to examination equal wires of different metals; and in order to insure the transmission of equal and similar explosions through each of them, he

[1] This fluid may consist of rectified alcohol, *one* part distilled water, *three* parts coloured tincture of cochineal, with a little sulphuric acid to make the whole sour.

[2] This instrument, which was invented by Sir Snow Harris in 1820, and described in the *Transactions of the Plymouth Institution for* 1825, has been appropriated by some foreign writers as their invention, and has been confounded by M. Fred. Ries with Kinnersley's gas thermometer, shown in Plate XXVIII. fig. 1, to which it has no relation.

Phenomena and Laws.

adopted the following contrivance. Two equal brass balls were fixed at a given distance, as in Lane's discharging electrometer. One of them, which was insulated, was placed in immediate connection with the positive side of the battery, while the other was connected with the negative side; the metallic wire to be examined forming part of the circuit. This last connection was made by means of two fixed copper wires inserted into the balls on each side of the glass, and made perfect at the points of junction. When the charge therefore of the battery was sufficiently intense to pass the given interval, the discharge took place through the wire in the ball. Sir W. Harris used a battery of *five* jars, each containing *five* square feet of coated surface. They were placed on a metallic base communicating with the negative conductor, and were charged by means of long copper rods projecting immediately from the bottom of each jar. The machine employed was a plate one, with a disc of glass three feet in diameter.

Sir W. Snow Harris's experiments on the evolution of heat by electricity.

The results which Sir William obtained from an extensive series of experiments are given in the following table.

	Metals.	Effects.
	Copper	6
	Silver	6
	Gold	9
	Zinc	18
	Platinum	30
	Iron	30
	Tin	36
	Lead	72
	Brass	18
Alloys.	Gold 1 part, copper 1 part	20
	Gold 3 parts, copper 1 part	25
	Gold 1 part, copper 3 parts	15
Alloys.	Copper 1 part, silver 1 part	6
	Copper 1 part, silver 3 parts	6
	Copper 3 parts, silver 1 part	6
Alloys.	Gold 1 part, silver 1 part	20
	Gold 1 part, silver 3 parts	15
	Gold 3 parts, silver 1 part	25
Alloys.	Tin 1 part, lead 1 part	54
	Tin 3 parts, lead 1 part	45
	Tin 1 part, lead 3 parts	63
Alloys.	Tin 1 part, zinc 1 part	27
	Tin 3 parts, zinc 1 part	32
	Copper 8 parts, tin 1 part	18

Considering the heat to be in the inverse ratio of the conducting power, it appears from this table, 1*st*, That the heats evolved from silver and copper are alike, and also those from iron and platinum, and from zinc and brass, while the heats evolved from lead and tin, from zinc and gold, and from brass and gold, are as 2 : 1. 2*dly*, That silver and copper being regarded as the *best* conductors, from being the *least* heated by the explosion, the conducting power of

Gold to copper will be as	2 :	3
Zinc or brass to copper or silver	1 :	3
Platinum or iron to copper or silver	1 :	5
Tin to copper or silver	1 :	6
Lead to copper or silver	1 :	12

3*dly*, That the conducting power of an alloy of *gold* and *copper*, or gold and silver, is less than either metal separately; and that the difference in the conducting power increases with the quantity of the inferior conductor alloyed; and that tin and lead in alloy have a conducting power equal to the mean of their two separate conducting powers. And, 4*thly*, that copper alloyed with an eighth part of its weight of tin becomes as much heated by an electrical explosion as iron.

Taking the heat of lead in the preceding table as unity, and the conducting power of the several metals named as being in a simple inverse ratio of the heat evolved; then the order and relative value of the given metals as conductors of common electricity will be as follows:

Metals.	Conducting power.	Metals.	Conducting power.
Lead	1	Zinc	4
Tin	2	Gold	8
Platinum, Iron	2·4	Copper, Silver	12

It appears from numerous experiments made with the aid of this instrument, that the heating power of the electrical discharge on metals increases as the square of the quantity of electricity discharged through them, without any relation to the intensity of the charge of the battery, as indicated by the common electroscopes or the extent of coated glass on which the given quantity is accumulated; so that the heating effect of the same quantity is always the same under the same conditions of circuit—a general law of quantity fully confirmed by Faraday in the course of his fine magneto-electrical researches. We may hence, with the data in the preceding table, easily deduce the relative quantities of electricity which the respective metals would transmit under the same elevation of temperature, and which would be nearly as follows—taking lead as unity:

Sir W. Snow Harris's experiments on the evolution of heat by electricity.

Metals.	Quantity.	Metals.	Quantity.
Lead	1	Zinc	2
Tin	1·4	Gold	2·8
Platinum, Iron	1·56	Copper, Silver	3·5

Viewing the question of conducting power in relation to the quantity of electricity which given metals can transmit under the same elevation of temperature, we should say that zinc had twice the conducting power of lead; gold twice the conducting power of tin, and so on. The relative numerical value of the metals as conductors of electricity will hence greatly depend on the particular way in which the measure of conducting power is considered. Thus it appears that the quantity which raised the temperature of lead, for example, 72° of the scale, only raised copper 6°, being in the ratio of 1 : 12. Taking these numbers as a measure of the resistance of the respective metals, and supposing the conducting power to be as the resistance inversely, then it would follow that copper has 12 times the conducting power of lead for any given quantity of electricity transmitted; it does not however follow from this, that copper can transmit 12 times the quantity of electricity under the same degree of heat,—for the resistance is found to increase with the heat evolved, and that is, with electricity of high tension such as lightning, as the square of the quantity of charge transmitted, so that it would only require about 3·5 times the quantity to raise the temperature of copper to that of lead transmitting a unit of quantity, all other things being the same.

In a further communication made to the Royal Society of Edinburgh in December 1831, the author has added considerably to our information upon this interesting question. Having adapted his instrument to the purposes of voltaic electricity, he proceeds to examine the heat excited in metallic wires by permanent electrical currents passed through them under a great variety of conditions. The following are some of the most striking of these experiments.

On exposing fine wires of different metals to electrical currents varying in intensity, he found that in certain cases the instrument ceased to be materially affected by the increased charge, the fine wire passing through the air thermometer ball not having sufficient conducting power to transmit the whole of the current, whilst in substituting wires of higher conducting power the fluid ascended the scale with great rapidity, a result identical with that arrived at by Sir H. Davy,[1] who states that in a battery where the quantity of electricity was very great and the intensity low, a foot of wire of platinum was scarcely heated whilst the same length of silver wire became red hot. It was therefore only when wires were employed of sufficient conduct-

[1] *Phil. Trans. for* 1821.

Phenomena and Laws.

ing power that we obtain indications proportionate to the increased electrical current, still no greater effect than was directly proportional to the increased power could be obtained, under any circumstances, as in the ordinary electrical discharges from the Leyden battery; a result depending probably on some peculiar condition of the species of electrical action.

In order to exemplify the effects of heat in diminishing the conduction, about six inches of the circuit transmitting the current through the instrument was made up of platinum wire of about the $\frac{1}{80}$th of an inch in diameter, and to this part of the circuit heat and cooling liquids were alternately applied; the result was that the fluid invariably descended the scale on the application of heat to the circuit wire, and ascended when that wire was cooled by evaporation, thus clearly evincing a diminished and increased power of transmission.

With a view of determining the relative conducting power of various metals, the given metal, the subject of experiment, was drawn into a wire of a given length and diameter, and caused to transmit a given current accumulation upon the wire passing through the ball of the electrometer. In order to avoid any error arising from elevation of temperature, the current wire was placed in a cool fluid medium. The facility with which the given metal transmitted the current electricity became, in this case, approximatively measured by the indications of the instrument. The order of the metals as conductors of this kind of electricity were found to be as follows:—

Silver.	Platinum.
Copper.	Lead.
Zinc.	Antimony.
Gold.	Fluid Mercury.
Tin.	Bismuth.
Iron.	

This order, with the exception of tin, is nearly the same as that already given by the ordinary electrical discharge: it was found liable to exceptions in placing the wires within the ball, as done in the preceding experiments, from the circumstances already explained—viz. that in certain cases the best conductors may appear to be the most heated.

Great care appears to have been taken in the manipulation of the experiments, and all the sources of anomaly or error liable to vitiate the result fully traced in operating upon fluid mercury, antimony, and bismuth. These metals were cast into small bars, and compared with zinc, tin, and lead, similarly heated.

Fusion of metallic wires.

Many beautiful experiments have been made by different philosophers, on the fusion of metallic wires. Mr Kinnersley, in the presence of Dr Franklin, transmitted the charge of a case of bottles through a fine iron wire. After first appearing red hot, the wire was melted into spherical drops like small shot. With a battery of thirty-two square feet, Dr Priestley melted into globules wires even so large as the seventieth of an inch in diameter, sometimes placing them in tubes of glass, and sometimes in paper. Mr Brooke, Van Marum, Baron Kienmayer, Mr Cuthbertson, and Mr Singer, made many successful experiments on the fusion of wires by electricity, and succeeded in melting them in considerable lengths; but they have given us no sufficient data for determining any of the relations of this kind of electrical action, although we find the experiments accompanied with many important and interesting observations.

Mr Singer found that the power of any coated surface to melt wires varies with the thickness of the jars; which confirms the conclusion of Mr Cavendish, that the quantity of electricity necessary to charge different jars of the same extent of coated surface is inversely as the thickness of the jars.

Mr Singer's experiments.

"The effects of gradually increasing the power of the charge," says Mr Singer, "when wires of the same length and diameter are employed, are very remarkable. If the wire be iron or steel, its colour is first changed to *yellow*, then (by an increased charge) *blue*, by a further increase it becomes *red hot*, then red hot and *fused into balls*; if we continue to increase the charge, it becomes red hot and *drops into balls*, then *disperses in a shower of balls*, and lastly disappears with a bright flash, producing an apparent smoke, which, if collected, is a very fine powder, weighing more than the metal employed, and consisting of it and a portion of the oxygen of the atmosphere, with which it has combined."

In the course of these experiments Van Marum observed the curious fact, that when a charge of 225 square feet of coated surface was transmitted through fifty feet of iron wire, *the jars were not entirely discharged*, and the residual charge was capable of melting two feet of the same wire.

The only general deductions from these experiments are by Mr Singer, who observes "that the action of electricity on wires increases in the ratio of the increased power;" because he found "that two jars charged to any degree will melt four times the length of wire melted by one jar. Mr Singer, however, found the law to vary with different jars; which would necessarily be the case so long as no quantitative measurement of the actual amount of electricity employed could be referred to. Of this, the common electrometers formerly employed show little or nothing.

With the view of determining the relative fusibility of different metals, Van Marum applied the same electrical charge to wires of different metals drawn to the same diameter. The following were the results with wires the 32d of an inch in diameter:—

Metals.	Length of Wire Fused.
Lead	120 inches.
Tin	120 ...
Iron	5 ...
Gold	3½ ...
Silver	½ ...
Brass	½ ...
Copper	½ ...

Hence he concludes that lead and tin are the worst metals for conductors, and copper, brass, and silver, the best.

Although these experiments are by no means wanting in scientific interest, they are still manifestly deficient in absolute quantitative measurement; a defect which renders them more or less indefinite and inconclusive. By means of the unit jar and other quantitative processes employed by Sir W. Snow Harris in this class of experiments, we can now determine the actual quantity of electricity in action, and estimate the relations subsisting between the indications of the intensity electrometer, and the conditions under which the charge is accumulated, whether on one or more electrical jars, or on thick glass or thin. We can estimate and measure the heating effect in relation to the quantity discharged, and determine the law of its operation, and all this in easy and intelligible terms. By means of such measurements it is now fully proved that the heating effect of a given electrical discharge is altogether independent of the indications of an intensity electrometer, and of the extent of coated glass upon which the given quantity has been collected, whether upon one, two, or more jars, or upon thick glass or thin. A given measured quantity of electricity may exhibit, under these varying conditions, all sorts and degrees of intensity, as indicated by an attractive or repulsive electrometer—such as those of Brookes and Cuthbertson; and yet at the instant of the discharge through a metallic wire the heating effect is always the same, and this heating effect is invariably as *the square of the quantity of electricity discharged* through the wire. For a given extent of coated glass taken as a constant, the quantity accumulated will be always as the square root of the attractive or repulsive force of the intensity electrometer, or commonly the indications of the intensity electrometer will be always as the square of the accumulation, all other things being

Phenomena and Laws.

the same. When the given quantity is accumulated on a greater or less extent of coated glass, these indications will be as the thickness of the glass directly and the square of the coated surface inversely—laws vital to the accuracy of experiments such as those just quoted; *e. g.*, it would not follow that in setting the slider of Cuthbertson's steelyard electrometer first at 5 grains and then at 10 grains, we should obtain quantitative accumulations in the battery in the proportion of 1 : 2. To obtain a double quantity under this kind of measurement, the slider would require to be set at 20 grains. The practical value of the ordinary intensity electroscopes and electrometers as measures of quantitative accumulation on coated glass is very small. The only certain measure of quantity, with perhaps the exception of Lane's discharging electrometer, is the unit jar. This instrument enables us to free our experiments from a complication of apparatus, which only serves to embarrass the manipulator. The accumulation being once obtained in units of quantity, we have merely to discharge our battery at pleasure by an ordinary discharger, and observe its effects on the subject of experiment.

Oxidation of metals.

Another of the chemical effects of electricity is its power of promoting the combination of metals with oxygen, or, what is the same thing, of oxidating them. Beccaria and others had observed this property of electrical action, but it is to Mr Cuthbertson and Mr Singer that we owe the most complete series of experiments on this subject. The apparatus used by Mr Cuthbertson is represented in Plate CCXXVI., fig. 5, where AB is a cylinder of glass two inches and a half in diameter and eight inches high. A brass cap is screwed on the lower brass cap B, and in the interior of the vessel is fixed a small roller CD, on which is coiled a quantity of wire attached to a pack-thread at intervals of four inches. Into the centre of the upper cap A is screwed a brass tube F, about three inches long; the end of the pack-thread and wire is pushed through it by means of a long needle, and hog's lard is placed in the tube so that the thread and wire may move through it air-tight. By this means the wire is stretched along the axis of the glass cylinder, and when one length of it is exploded, another is drawn forward by the contiguous pack-thread, without opening the cylinder. The quantity of air absorbed in the process is indicated by a gauge. It consists of a glass tube, about ten inches long, screwed into the lower end of the stop-cock, and plunged in a vessel of quicksilver, the rise of which, when the stop-cock is opened, will be a measure of the air absorbed. Mr Cuthbertson found that the air was always deprived of a portion of its oxygen. When hydrogen or nitrogen was used in place of atmospheric air, no oxidation took place in the wire, and the wire was melted and minutely divided. The results obtained by Mr Cuthbertson are given in the following table, each wire being ten inches long.

Mr Cuthbertson's apparatus. Plate CCXXVI., fig. 5.

Mr Cuthbertson's experiments.

Metals.	Diameter of wire.	Charge in Grains of Cuthbertson's Electrometer.	Colour of the Oxide when collected.
Lead............	$\frac{1}{90}$	20	Light gray.
Tin	$\frac{1}{90}$	20	Nearly white.
Zinc............	$\frac{1}{90}$	45	Nearly white.
Iron............	$\frac{1}{150}$	35	Reddish-brown.
Copper..........	$\frac{1}{150}$	35	Purple-brown.
Platina	$\frac{1}{150}$	35	Black.
Silver	$\frac{1}{150}$	40	Black.
Gold	$\frac{1}{150}$	40	Brownish-purple.

Mr Singer's experiments.

Mr Singer repeated these experiments with shorter and finer wires, and with a moderate electrical charge. The wires were not placed in receivers, but stretched parallel to the surface of a sheet of paper at the distance of one eighth of an inch. The following were his results with wires five inches long.

Metals.	Diameter of wire.	Charge in Grains of Cuthbertson's Electrometer.	Colours of the Figures on Paper.
Lead............	$\frac{1}{180}$	12	Brown and blue-gray.
Tin	$\frac{1}{180}$	11	Yellow and gray.
Zinc............	$\frac{1}{180}$	17	Dark brown.
Iron............	$\frac{1}{180}$	12	Light brown.
Copper	$\frac{1}{180}$	12	Green, yellow, & brown.
Platina.........	$\frac{1}{180}$	13	Gray and light brown.
Silver	$\frac{1}{180}$	18	Gray, brown, & green.
Gold	$\frac{1}{150}$	18	Purple and brown.

When Mr Singer made the explosion over glass, he found that a portion of the metal appeared immediately under the wire in an unoxidated state, while the oxidated portion produced round the other a figure of some width. The figures are in this way more beautiful, though less permanent, than when they are produced upon paper.

Dr Wollaston's experiments.

The oxidating power of common electricity is finely exhibited in the following experiment, given by Dr Wollaston. Having coloured a card in a strong infusion of litmus, a current of electric sparks was passed along it by means of two fine gold points, which touched the card at the distance of an inch from each other. After a very few turns of the machine, and when the card was nearly dry, a *redness* at the place of the positive wire was distinctly manifest to the naked eye; and when the experiment was repeated with the negative wire on the same spot, it was restored to its original *blue* colour.

Revival of metallic oxides.

The metallic oxides may be revived, or restored to the metallic state, by means of electricity. Beccaria, who discovered this property, revived the oxide of zinc, and produced quicksilver from cinnabar by exploding a jar between two pieces of the calces. The following method of making this interesting experiment is given by Mr Singer. Introduce into a glass tube some oxide of tin, so that the oxide may cover about half an inch of the lower internal surface of the tube when it is laid horizontally. Place the tube on the table of Henley's discharger, and introduce the pointed wires into its opposite ends, that the oxide may lie between them. When several strong charges have been sent through the tube, a part of the tube will soon be stained with metallic tin, which has been revived by the transmitted electricity. The charge of a very moderate-sized jar is sufficient to revive the mercury and sulphur which composes vermilion.

Deoxidating power of negative electricity.

The deoxidating power of negative electricity is well illustrated by the following elegant experiment of Dr Wollaston's. Having coated with wax about two or three inches of the middle of a fine silver wire, the hundred and twentieth of an inch in diameter, he cut the wire through in the middle of the wax, so as to expose a section of it. The two coated extremities of the divided wire were plunged in a solution of sulphate of copper, placed in an electric circuit between the two conductors, and sparks taken at the distance of one-tenth of an inch were passed through the solution. After a hundred turns of the machine, the wire communicating with the negative conductor had a precipitate formed upon its surface, which by burnishing was clearly copper, whereas there was no such coating upon the other wire. The direction of the electric current being reversed, the order of the phenomena was reversed, and the copper was shortly re-dissolved by the aid of the oxidating power of common electricity, and a similar precipitate formed upon the opposite wire. Dr Wollaston obtained similar results from gold wires and a solution of corrosive sublimate.

Influence of electricity in chemical composition and decomposition.

The influence of electricity in effecting chemical composition and decomposition forms one of the most interesting departments of electrical and chemical science. The most valuable researches which have been made on this subject were carried on by means of the voltaic battery, and must necessarily be detailed under another article; but the dis-

Phenomena and Laws.

coveries which were made through the agency of the electrical machine fall to be recorded in the present section.

Experiments of Mr Warltire;

One of the earliest experiments on the influence of electricity as a powerful chemical agent, was made by Mr Warltire, who fired a mixture of atmospheric air and hydrogen gas by means of electricity in a close copper vessel containing about three pints. Although no air could escape by the explosion, yet a loss of two grains was perceived in every experiment. When the vessel which contained the gases was clean and dry, a dewy moisture was found adhering to the inside of the vessel. Guided by this indication, Dr Priestley entered upon the subject. Having placed a blue solution of water and litmus in a glass tube, he transmitted through it a current of electrical sparks from a brass wire. In two or three minutes the blue liquor became red, particularly at the part where the sparks entered, and the air inclosed in the tube was diminished. The appearance of an acid having been formed at the expense of the air confined in the tube, induced Dr Priestley to place the tube in the receiver of an air-pump, so that by gradually exhausting the air, the part of it inclosed in the tube expanded and pushed out the discoloured liquor. Upon again admitting the air, a new portion of the litmus solution was introduced, while the confined air remained the same as before, and resumed the space which it had occupied after the passage of the electric current. After this the electrical sparks were no longer able to alter the colour of the solution, or to cause any decrease in the volume of the confined air.

of Dr Priestley;

In passing a current of electric sparks through olive oil, turpentine, oil of mint, and ether, Dr Priestley found that an inflammable gas was evolved.

In his experiments on the gases Dr Priestley was more successful in transmitting the spark through ammoniacal gas; he found that two hundred shocks passed through a given quantity of the gas produced an increase of volume equal to one-fourth of the whole. Upon subsequently admitting water, the original quantity operated upon was absorbed, and the remaining gas, equivalent to the expansion effected by the electric shocks, was found highly inflammable.

Dr Priestley likewise passed an electrical current, consisting of slight shocks continued for about an hour, through an inch of carbonic acid gas confined in a glass tube one-tenth of an inch in diameter, when, upon admitting the water, one-fourth part only was absorbed. In a similar manner Dr Priestley succeeded in decomposing carburetted hydrogen, the charcoal being deposited in a pulverulent form on the interior of the tube. When a succession of electric sparks from a moderate-sized conductor during the space of five minutes had failed in effecting this decomposition, he found that two shocks of a jar, each of which might be produced in less than a quarter of a minute with the same machine in the same state, were sufficient to cover the whole of the inside of the tube with the black carbonaceous matter. Dr Priestley remarked in these experiments that no shock, however powerful, would decompose the gas, if the quantity operated upon were great.

of the Hon. Mr Cavendish.

The power of electricity as a chemical agent was studied with peculiar success by the Honourable Mr Cavendish. In the year 1781 he fired 500,000 measures of hydrogen with about two and a half times that quantity of atmospheric air, and having by this means obtained a hundred and thirty-five grains of pure water, he was led to the conclusion, previously indicated by Mr Watt, that water was composed of two gases, viz., oxygen and hydrogen. In pursuing these inquiries Mr Cavendish made use of the apparatus shown in fig. 6 of Plate CCXXVI. The air to be examined was confined in a bent glass tube A, filled with mercury, and having its ends immersed each in a vessel of the same fluid. The air to be electrified was introduced by a piece of glass tube ABC, fig. 7. In order to use this apparatus, the tube ABC being filled with mercury, is introduced as in fig. 7, with its bent extremity uppermost, into the vessel containing the gas, and standing in the pneumatic trough. In this part of the process the orifice at C is stopped by a finger, by withdrawing which a little mercury will descend through C, and an equal volume of the gas will enter at the end A. When the gas has been admitted in sufficient quantity into the tube ABC, it is withdrawn and reversed, the end C, which is placed uppermost, remaining carefully closed. The extremity A, which fits the end of the tube in fig. 6, is introduced beneath the mercury in either of the glasses, and by withdrawing the finger from the upper end C of the transferring tube, the mercury will descend, and the gas will be forced into the tube A, fig. 6. The orifice of the transferring tube should not be greater than that of a common thermometer tube.

Plate CCXXVI., fig. 6.

Fig. 7.

Experiments of Mr Cavendish.

In order to introduce portions of air successively during the same experiment, Mr Cavendish used a tube AB of a small bore (see fig. 8), a bulb C, and a tube DE, having a bore larger than that of AB. This apparatus having been first filled with mercury, the bulb C and tube AB are filled with the gas, by introducing the end A beneath the inverted jar, upon the shelf of the pneumatic trough, and then drawing the mercury from the leg D by means of a syphon. The aperture A being closed, the apparatus is weighed. The extremity A, fig. 8, is then fitted into the end of the tube A, fig. 6. When it is required to force air out of this apparatus into the tube, a wooden cylinder with a tight fitting is thrust down into the tube ED, an additional quantity of mercury being occasionally poured in at E to supply the place of what is forced into the bulb C. When the experiment is completed the apparatus is again weighed. The increase of weight is due to the mercury introduced, and its volume is equal to that of the air transferred to the tube A, fig. 6. The bore of the tube A was generally one-tenth of an inch in diameter, and the aerial column in the bend of the tube from one-half to three-fourths of an inch.

Fig. 8.

In transmitting the electric spark through this tube, Mr Cavendish, instead of making one end of it communicate with a conductor, placed an insulated ball at such a distance from the conductor as to receive a spark from it, and made a communication between that ball and the mercury in one of the glasses, the mercury in the other glass communicating freely with the ground.

In transmitting the electric spark through common air in contact with a blue aqueous solution of litmus, a red tint was produced in the solution. When lime-water was inclosed in the tube instead of litmus, and sparks transmitted till there was no further diminution in the volume of the included air, no cloudiness appeared in the lime-water, and the diminution of volume, amounting to one-third of the original bulk of the air, exceeded the diminution from deoxidation alone, which would have been only one-fifth.

When this experiment was repeated with some impure oxygen gas, a considerable diminution of volume was produced, but there was no cloudiness in the lime-water, and none could be perceived by adding to it a little carbonic acid gas; a small portion of caustic ammonia, however, produced a brown precipitate. Hence it is obvious that the lime-water was saturated with some acid formed in the process.

Having inclosed in the tube some of the same impure oxygen in contact with soap leys, the diminution of volume proceeded faster than with the lime-water, the greater strength of the alkaline lixivium acting as a more powerful absorbent of the acid which was generated.

When pure oxygen or pure azote was used, no absorption took place; but when five volumes of pure oxygen were mixed with three of common air, the absorption was almost total; and as common air contains about one part of oxygen and four of azote, the mixture of five parts of oxygen and three of common air was equivalent to seven parts of oxygen and three of azote.

Mr Cavendish now supplied the interior of the tube with

Phenomena and Laws.

a little alkaline ley, and having introduced a mixture of seven parts of oxygen and three of azote, he transmitted a current of electric sparks, admitting fresh gas as the volume of air diminished. When the diminution ceased, a little pure oxygen, and afterwards a little common air, were added, in order to see if the absorption ceased from any want of a proper proportion in the two elements. As this was not the case, the soap leys were separated from the mercury, and were found to have become perfectly neutral, from their having no effect on the colour of litmus. When the leys were evaporated a dry *nitrate of potash* was obtained. By repeating this experiment on a more extended scale, Mr Cavendish demonstrated that the soap leys had been converted into a solution of nitre, and therefore established the great truth that nitric acid had been formed during the process, and that nitric acid is a compound of oxygen and azote.

Nitric acid formed.

Apparatus and experiments of Van Marum, and others.

By means of the great Teylerian electrical machine at Haerlem, Van Marum, Van Troostwyk, &c., made many experiments on the chemical agency of electricity. The apparatus which they used, shown in Plate XXIV. fig. 9, consists of a tube of glass DE, twelve inches long and a quarter of an inch in diameter, hermetically sealed, and having a gold or platina wire D*d* an inch and a half long fixed at D. Another platina wire E*e* was carried up from the open end of the tube E to *e*, within one eighth of an inch of the end *d* of the upper wire. The tube DE having been filled with distilled water, the open end of it E was immersed in a vessel V containing quicksilver, and the upper end D of the wire D*d* was brought into contact with the insulated brass ball C, placed at a little distance from AB, the prime conductor of the electrical machine. The lower wire E*e*, immersed in quicksilver, communicated with a chain VG connected with the outer coating of a Leyden jar containing about a hundred and forty-four square inches of coated glass, and having its ball M in contact with the prime conductor AB. When the electrical discharges were sent through the distilled water, the gas was disengaged as long as the ball C was in contact with the conductor; but upon increasing its distance, a position was found where the gas was disengaged, and ascended to the top of the tube. The evolution of the gas continued till it reached nearly the lower extremity of the upper wire, and then a discharge caused the whole gas to disappear, its place being supplied by water. With this apparatus the Dutch philosophers made the following experiments.

Oxygen gas from red precipitate had its original volume diminished one twentieth, and the properties of what remained were not changed.

Nitrous gas had its volume diminished to less than one half. There were no red fumes when it was mixed with atmospheric air, neither was there any condensation. It would not support combustion, and it lost its usual smell. A kind of powder covered the surface of the mercury, consisting of a new combination formed from the mercury.

Hydrogen gas, obtained from sulphuric acid and iron, suffered no diminution. Owing probably to some admixture of common air, it gave a slight redness to tincture of turnsol.

Olefiant gas from sulphuric acid and alcohol had its original volume tripled, and in some degree lost its inflammability.

Sulphurous acid gas, from sulphuric acid and charcoal, had only one eighth of its volume absorbed by water. Black spots were formed on the inside of the glass receiver. It had little smell, and extinguished a candle.

Muriatic acid gas experienced a considerable diminution of volume, but the remainder was readily absorbed by water. The electric sparks would not pass through more than two inches and a quarter of this gas.

Carbonic acid gas from sulphuric acid and chalk had its volume increased a little, and was made less absorbable by water.

Ammoniacal gas had its volume at first almost doubled, and then experienced a slight diminution. It became incapable of being absorbed by water, and exploded by the contact of flame.

Fluoric acid gas experienced no perceptible change.

Atmospheric air gave a slight redness to tincture of turnsol, and at the same time became sensibly deoxygenated. The diminution of volume was $\frac{151}{600}$ths, the mean of three experiments; and of the same air not electrified $\frac{182}{600}$ths, the mean of three experiments.

The Dutch philosophers made many other experiments which we have not space to describe, and in 1789 they succeeded in repeating the experiment of Cavendish on the decomposition of water.

Dr Wollaston's experiments and apparatus.

Hitherto a powerful apparatus was deemed necessary for effecting the decomposition of water, and a succession of discharges from a coated surface was deemed indispensable. Dr Wollaston, however, considering that the decomposition must depend upon a proper proportion between the quantity of water and the decomposing force, conceived the idea of reducing the surface of communication between the air and the metal which conveyed the electricity.

"Having procured," says he, "a small wire of fine gold, and given it as fine a point as I could, I inserted it into a capillary glass tube; and after heating the tube so as to make it adhere to the point, and cover it in every part, I gradually ground it down till, with a pocket lens, I could discern that the point of the gold was exposed.

"The success of this method exceeded my expectations. I coated several wires in the same manner, and found that when sparks from the conductors before mentioned were made to pass through water by means of a point so guarded, a spark passing to the distance of one eighth of an inch would decompose water when the point exposed did not exceed one seven hundredth of an inch in diameter. With another point, which I estimated at $\frac{1}{15000}$th, a succession of sparks one twentieth of an inch in length afforded a current of small bubbles of air.

"I have since found that the same apparatus will decompose water with a wire one fortieth of an inch diameter, coated in the manner before described, if the spark from the prime conductor passes to the distance of four tenths of an inch of air.

"In order to try how far the strength of the electric spark might be reduced by proportional diminution of the extremity of the wire, I passed a solution of gold through a capillary tube, and, by heating the tube, expelled the acid. There remained a thin film of gold lining the inner surface of the tube, which, by melting the tube, was converted into a very fine thread of gold through the substance of the glass.

"When the extremity of this thread was made the medium of communication through water, I found that the mere current of electricity would occasion a stream of very small bubbles to rise from the extremity of the gold, although the wire by which it communicated with the positive or negative conductor was placed in absolute contact with them. Hence it appears that decomposition of water may take place by common electricity as well as by the electric pile, although no discernible sparks are produced. The appearance of two currents of air may also be imitated, by occasioning the electricity to pass by fine points of communication on both sides of the water; but in fact the resemblance is not complete, for in every way in which I have tried it, I observed that each wire gave both oxygen and hydrogen gas, instead of their being formed separately, as by the electric pile.

"I am inclined to attribute the difference in this respect to the greater intensity with which it is necessary to employ

Phenomena and Laws.

common electricity; for, that positive and negative electricity so created have each the same chemical power as they are observed to have in the electric pile, may be ascertained by other means."

Dr Wollaston's experiments and apparatus.

Observations of Dr Faraday.

The preceding experiment, which is only an elegant repetition of one formerly made by Dr Pearson and the Dutch philosophers, has excited much attention, and cannot be regarded as any proof of the identity of ordinary and voltaic electricity; Dr Faraday justly remarks that it should never be quoted as establishing true electro-chemical decomposition, because the law which regulates the transference and final place of the evolved bodies has no influence here. The water is decomposed at the two poles by an independent action, and the oxygen and hydrogen evolved are the elements of the water existing at the wires the instant before. The substitution of the finger for one of the points will not interfere with the action of the other. But although Dr Wollaston did not decompose water in any way analogous to that of the pile, yet Dr Faraday seems to have succeeded in doing it by the same apparatus; but when he considered that he had obtained the true effect, the gas evolved was so small in quantity that he could not ascertain whether or not oxygen was emitted at the one wire and hydrogen at the other, as ought to have been the case.

Dr Faraday's apparatus and experiments.

The inability of Dr Wollaston's apparatus to exhibit in an unquestionable manner true electro-chemical decomposition being thus obvious, Dr Faraday devised the following ingenious arrangement for effecting chemical decomposition by ordinary electricity, and by means of it he effected true electro-chemical decompositions, perfectly identical with those produced by voltaic electricity. The plate machine which he used had its glass disc fifty inches in diameter. It had two sets of rubbers. The prime conductor consisted of two brass cylinders, connected by a third, the whole length being twelve feet, and the surface in contact with air was 1422 inches. When well excited, one revolution of the plate gives ten or twelve sparks, each an inch long; and sparks or flashes from ten to fourteen inches long may easily be drawn from the conductors. When moderately worked, each turn of the machine is made in four fifths of a second. The electric battery consists of fifteen equal jars, each twenty-three inches in circumference, and coated eight inches upward from the bottom, so as to contain 184 inches of glass each, coated on both sides, independent of the bottoms, which are thicker glass, and contain each about fifty square inches.

In order to carry off instantaneously electricity of the feeblest tension, Dr Faraday formed what he calls a *discharging train*. This discharging train consisted in connecting a sufficiently thick wire metallically, first with the metallic gas pipes of the house, then with the metal pipes of the public gas works of London, and lastly with the metallic water-pipes of London. This arrangement was so effectual that the electricity even of a single voltaic trough was instantly carried off; and this was essential to the success of many of his experiments.

Plate CCXXVII., fig. 3.

The arrangement for applying the apparatus now described to chemical decomposition is shown in Plate CCXXVII., fig. 3. Two pieces of tinfoil *a*, *b* are placed upon a glass plate raised above a piece of white paper to prevent the interference of shadows. One of these pieces *a*, is connected by an insulated wire *c*, or by a wire and wet string, with the electric machine, and the other piece *b*, by a wire *g*, with the discharging train or the negative conductor. Two pieces of fine platina wire must then be provided, bent as in fig. 4, so that the part *d* shall be nearly upright, whilst the whole rests on the three points *e*, *f*, *p*. By this means we can obtain at pleasure surfaces of contact as minute as possible; the connection can be discontinued or removed in a moment, and the substances which are acted upon can be readily examined. With this apparatus Dr Faraday obtained the following results.

Fig. 4.

1. Having made a coarse line on the glass plate with a solution of sulphate of copper, the ends *p* and *n* of the platina wires were put into it, the foil *a* being connected by a wire and wet string with the positive conductor of the machine, so that no sparks passed. After twenty turns of the machine there was so much copper precipitated on the end *p* that it looked like copper wire, no apparent change having taken place at *n*.

2. A large drop of a mixture of equal parts of muriatic acid and water coloured a deep blue by sulphate of indigo was placed on the glass, so that the ends *p* and *n* were plunged in opposite sides of it; *one* turn of the machine evolved sufficient chlorine to exhibit bleaching effects round *p*. *Twenty* revolutions produced no effect at *n*, but there was so much chlorine got free at *p*, that when the drop was stirred the whole became colourless.

3. Having mingled a solution of iodide of potassium with starch, the ends *p* and *n* were immersed in a drop of it as before; on turning the machine, iodine was evolved at *p*, but not at *n*.

Dr Faraday improved his apparatus still further by wetting a piece of filtering paper in the solution to be examined, and placing it on the glass beneath the points *p*, *n*. The paper will retain the substance evolved at the point of evolution; its whiteness will render visible the least change of colour, and will allow the point of contact between it and the wires *p*, *n* to be contracted to the utmost degree. Dr Faraday found a piece of paper moistened in the solution of iodide of potassium and starch, or of the iodide alone, to be with certain precautions a most admirable test of electro-chemical action; and when it is placed and acted upon in the manner already described, it will exhibit the evolution of iodine at *p* by half a turn only of the machine. He found, indeed, that with these adjustments, and the use of iodide of potassium on paper, chemical action is sometimes a more delicate test of electrical currents than the most delicate galvanometer.

A piece of litmus paper wetted in a solution of muriate or sulphate of soda was quickly reddened at *p*, and a similar piece wetted in muriatic acid was soon bleached at *p*, no similar effects taking place at *n*.

A piece of turmeric paper wetted in a solution of sulphate of soda was reddened at *n* by two or three turns of the machine, and by twenty or thirty turns abundance of alkali was evolved at the same place. By turning the paper round so that the spot came under *p*, and working the machine, the alkali soon disappeared, the place became yellow, and a brown alkaline spot appeared in the new part under *n*.

Dr Faraday next combined a piece of turmeric paper with a piece of litmus, wetting both with a solution of sulphate of soda. The paper was placed so that *p* was on the litmus and *n* on the turmeric paper. By a few turns of the machine, acid was evolved at *p* and alkali at *n*, as in galvanic decomposition. These various decompositions were equally effected whether the electricity passed to the foil *a* from the machine through water or wire only, by *contact* with the conductor, or by *sparks* there, provided the sparks were not so large as to cause the electricity to pass in sparks from *p* to *n*, or towards *n*.

Dr Faraday's final experiment deserves peculiar notice, as affording a case in which there is the most perfect analogy between the effects of ordinary and voltaic electricity. Three compound pieces of litmus and turmeric paper, when wetted by a solution of sulphate of soda, were disposed on a plate of glass as shown in fig. 5. The wire *m* was connected with the prime conductor, *t* with the discharging train, and the wires *r* and *s* connected the moistened pieces of paper, each wire resting on three points, one of the points, at *r* and *s*, being on the glass, and the others on the papers, the ends *p*, *p*, *p* resting on the litmus and *n*, *n*, *n* on the tur-

Plate CCXXVII., fig. 5.

Phenomena and Laws.

meric paper. When the machine had been worked for a short time, acid was evolved at all the poles *p*, *p*, *p*, by which the electricity entered the solution; and alkali at the other poles *n*, *n*, *n*, by which the electricity left the solution.

The precaution above referred to, in using the iodide of potassium as a test of electro-chemical action, is that no sparks should be passed in any part of the current, and no increase of intensity allowed by which the electricity may be induced to pass between the platina wires and the moistened papers, *otherwise than by conduction;* for if the electricity burst through the air, a different effect is produced. The litmus paper is in this case reddened by the spark, and iodine will be evolved from paper moistened by iodide of potassium. This effect is owing to the formation of nitric acid by the oxygen and nitrogen of the air. The acid thus formed reddens the litmus paper, or prevents the exhibition of alkali in the turmeric paper, or evolves iodine from the iodide of potassium. We have thus a simple and elegant method of illustrating Mr Cavendish's experiment of forming nitric acid from the atmosphere.

M. Bonjol's experiments.

M. Bonjol of Geneva was among the first who decomposed water by common electricity. The electricity was obtained from an insulated lightning rod; and the decomposition is said to have proceeded continuously and rapidly even when the electricity of the atmosphere was by no means powerful. M. Bonjol also decomposed potash and chloride of silver, by passing the sparks of an ordinary machine through these substances placed in narrow tubes. Dr Faraday justly regards these as not cases of true electro-chemical decomposition, but as analogous to that of Dr Wollaston's apparatus, arising either from a very high temperature acting upon minute portions of matter, or perhaps connected with the results produced in air by the passage of the spark.

Experiments of Dr Barry.

One of the most remarkable decompositions, however, which has been obtained previous to Dr Faraday's experiments, is that of the late Dr Barry. This experiment is given as a proof of the chemical action of atmospheric electricity; but, as Dr Faraday has shown, it possesses a much greater interest if confirmed. The following is his own account of it:—"In August 1824 I elevated the kite in an atmosphere favourable to the exhibition of its phenomena. It was raised from an apparatus firmly fixed in the earth, and was insulated by a glass pillar. The usual shocks were felt on touching the string, which simple fact I am induced to mention from the circumstance of no electrometer having been employed. The portion of string let out, with a double gilt thread passed through it, was about 500 yards. I then made the connection shown in fig. 6, where the straight glass tubes, A, B, having platina wires passed from above half down their axes, and standing in their respective glass cups C, D, were filled with a solution of sulphate of soda coloured with syrup of violets connected also with each other by the bent glass tube E, likewise filled with the above solution in the usual manner. A portion of gilt thread *d* was then brought from the tube at A, and united to the kite-string K, whilst a similar thread *b* was carried from B to the earth. Bubbles of hydrogen in A, and of oxygen in B, soon appeared. In about ten minutes the blue liquid in A became green from the separation of the soda, whilst the sulphuric acid, by passing to the pole in the tube B, changed its contents, as usual, red.[1]

Plate CCXXVII., fig. 6.

Dr Faraday's observations on them.

The effect now described as produced by *atmospheric electricity* was never produced by *common electricity*. Dr Wollaston and other philosophers could not obtain the gases in separate vessels, and Dr Faraday kept his powerful machine in action for a quarter of an hour, during which 700 revolutions were made, without producing any sensible effect, although the shocks that it could then have given must have been more numerous and powerful than could have been taken with any chance of safety from the kite-string of Mr Barry. Dr Faraday thinks "it just possible that the air which was passing by the kite and string, being in an electrical state sufficient to produce the 'usual shocks' only, could still, when the electricity was drawn off below, renew the charge, and so continue the current. The string was 1500 feet long, and contained two double threads; but when the enormous quantity which must have been thus collected is considered, the explanation seems very doubtful." Dr Faraday therefore considers Mr Barry's experiment as a very important one to repeat and verify; and he remarks, that if it is confirmed, it will be the first recorded case of the true electro-chemical decomposition of water by common electricity, and will supply a form of electrical current which is exactly intermediate, both in point of quantity and intensity, between those of the common electrical machine and the voltaic pile.

Effects of electricity on gases.

The effects of electricity on mixed and compound gases have been given by Mr Singer in his work on electricity. These effects are regarded by Mr Singer as mechanical, and as arising from the momentary agitation into which the various media are thrown by the action of the spark, which tends to promote a new arrangement of parts. This theory, of which Mr Singer himself not only saw but has stated the difficulties, cannot now be maintained with any show of reason; and there can be no doubt that the effects in question arise from a molecular polarity related to the two poles of the electric circuit, or to the two kinds of electricity which exist in nature.

Influence of electricity on putrefaction

It has been asserted, but not from any extensive series of accurate experiments, that putrefaction and fermentation are promoted by electricity. M. Achard of Berlin, considering that, in animals killed by lightning, the process of putrefaction advances with great rapidity, cut a piece of beef into three parts, and electrified one piece positively for ten hours, another negatively during the same time, while the third was not electrified at all. On the fourth day the electrified pieces had an intolerably fetid smell, while the unelectrified piece had only begun to smell a little. The same result was obtained with a piece of boiled veal. M. Achard also killed several birds by electrical shocks, and having killed others by sticking a needle through their heads, he placed them all under similar circumstances. The birds killed by electricity became putrid much sooner than the rest. The influence of electricity on fermentation was studied also by M. Achard. A handful of rye brought into a state of fermentation for the purpose of being distilled, was separated into two portions, one of which was electrified and the other not. Five hours afterwards the vinous fermentation had ceased in the electrified portion, but did not cease in the other portion till after the lapse of eight hours.

and fermentation.

Influence of electricity on colours.

The influence of electricity upon colours is a subject of peculiar interest, and cannot fail to prove a rich field of discovery to those who may enter upon it with ardour. That electricity does alter the colour of particular bodies is undoubted; but whether it produces a real chemical change on these bodies, or merely a transient change in their power of absorbing specific rays of the spectrum, remains to be determined. The few experiments made by Cavallo are extremely vague. He found that vermilion, carmine, verdigris, white and red lead, had their colour altered by the electric shock; and that the colours of orpiment, gamboge, sage-green, red ink, ultramarine, Prussian blue, and of a few other compounds, were not altered. The eye, however, is no judge of a real change of colour. It can judge only of the general result of the change, without indicating the nature of the change or changes that have taken place. A body, too, which may have lost or gained

[1] *Phil. Trans.* 1831. Part I., pp. 165, 166.

Phenomena and Laws.

the power of absorbing definite rays of the spectrum, may often appear to have suffered no change at all, provided that the sum of the changes is a colour similar to the original colour of the body.

In producing these effects, namely, putrefaction, fermentation, and change of colour, the electric fluid may act, not by any virtue of its own, but by the intermedium of those ponderable substances which the spark carries along with it, and consequently leaves in bodies.

Sect. III.—*On the Changes produced by Electricity on Phosphorescent Bodies.*

Influence of electricity on phosphorescence.

Although the phenomena of phosphorescence have been lately much studied, yet philosophers are very little acquainted with its cause, whether it is developed by the light of the sun, the action of heat, or the transmission of electricity.

Almost all bodies may be rendered luminous during the transmission of an electric discharge through their substance; but unless this luminosity continues after the discharge is over, the body cannot be said to have been rendered phosphorescent by electricity. In his numerous experiments on this subject, Mr Skrimshire invariably kept his eyes closed till the sound of the discharge had been heard, and therefore the light which he then saw was not the light of the electric spark, modified by its transmission through the body, but was a real phosphorescence, which continued after the original cause of it was withdrawn.

The substances which he submitted to examination, including minerals of all classes, were placed on a horizontal brass plate, fixed to the ball of the prime conductor, and he then tried to obtain a spark from the body by means of a common discharger. The body was next placed upon a table, and the charge of a Leyden phial passed *over it*, at the distance of about a quarter or half an inch above its surface; and, as a last trial, the charge of the jar was made to traverse its surface by resting the points of the discharging rod at an inch or more distant from each other, upon the specimens under examination.

As many bodies possess the property of becoming phosphorescent by heat, the phosphorescence produced in the preceding experiments may in general be ascribed to the heat which accompanies an electrical discharge. But although the heat thus produced may be either the sole or an auxiliary cause of the phosphorescence which is excited in bodies which are known to be phosphorescent by common heat, yet it is obvious from other experiments, that electricity exercises a specific influence upon that peculiar structure or condition of bodies which causes them to give out light when heated.

Experiments of Dessaignes.

M. Dessaignes seems to have been the first person who established a relation between electricity and phosphorescence. He found that the metallic powders, such as those of zinc and antimony, which are the most phosphorescent, lose their luminous qualities in a damp state of the atmosphere. Even in dry weather antimony loses its power of phosphorescing if it be rubbed in a metallic mortar; whereas, in an insulated mortar the light is very much increased. Glass pounded in dry weather becomes much more luminous than when it is pounded in a damp state of the air. It loses this property entirely in wet linen; but being as it were self-insulated, it is not deprived of its phosphorescence, like antimony, by being pounded in a mortar, which is a conductor of electricity. In order to make adularia phosphoresce briskly it must be pounded in an insulating or insulated mortar, and the handle of the pestle should likewise be insulated. M. Dessaignes also found that *if glass be calcined till its phosphorescence is diminished, it resumes that property by being exposed on an insulated support, and subjected to a few electrical discharges, or to a current of electrical matter.* Other substances which have *lost their phosphorescence* by calcination resume it when electrified; but our author remarked *that electricity does not restore the phosphorescence of those substances which have been deprived of it by the light of the sun.*

In pursuing this branch of the subject M. Dessaignes found that those phosphorescent substances which are imperfect conductors of electricity, are susceptible of receiving the luminous property from the action of the sun's rays; that *non-conductors* will not thus phosphoresce at all, or at least very imperfectly; and that most conductors give out no light whatever. Orpiment, and some of the oxides of arsenic, tin, zinc, and lead, are exceptions to this remark, and also the muriate of tin, and the sulphate and phosphate of lead. Non-conductors, and conductors which refuse to phosphoresce after feeble electrical discharges, become luminous after strong ones; while imperfect conductors that phosphoresce after weak electrical discharges give no light whatever when the discharges are much increased. In support of the analogy between electricity and phosphorescence, M. Dessaignes remarks that phosphorescence is affected by the presence of points. Fluor spar, which has the asperities produced by fracture, phosphoresces readily, while the entire and smooth crystal remains dark. The same is true of calcareous spar, adularia, apatite, emerald, and common salt. If both sides of the glass be rough, it phosphoresces throughout; but if one side be rough and the other polished, it only shines when the rough surface receives the heat. It is a fact still more curious, that when Iceland crystal with smooth faces is exposed to the solar rays, it acquires very little phosphorescence; whereas, if but one of the faces is roughened and exposed to the sun, it readily becomes luminous. In like manner, arragonite becomes luminous when a fractured face is exposed to the sun, but acquires very little light when the smooth natural surface is exposed to it. M. Dessaignes likewise maintains that nearly all the bodies that are susceptible of phosphorescence by friction become luminous by heat, by electricity and by exposure to light. The general view which our author takes of these phenomena is, that phosphorescence is produced by a particular fluid, which is set in motion by light, by heat, by electricity, and by friction, and that it is dissipated by overheating or too long exposure to light.

Experiments of Mr Pearsall.

The influence of electricity upon phosphorescence and the colours of certain bodies has been examined by Mr Pearsall, who has amply confirmed the general result deduced experimentally by M. Dessaignes, that bodies which have lost their phosphorescent property by calcination acquire it again when an electrical discharge is passed through them. Having submitted a piece of chlorophane to a powerful heat, it gave out a strong phosphorescent light of a *pale violet colour;* but the specimen decrepitated so much during its calcination that a piece of sufficient size to be electrified could not be preserved. He therefore placed the calcined fragments in a glass tube, and sent through them three electrical discharges, the effect of which was the emission of a *deep violet light.* He then heated the fragments upon platinum, and they emitted a phosphoric light of different colours. Some of the fragments appeared *green,* others *yellow,* and all of them finished by emitting a *deep violet light.* These colours are evidently distinct from those of the natural mineral, for a portion of the latter heated at the same time produced only a *feeble violet colour.* Another portion of the same specimen, calcined but not electrified, emitted no light when heated.

A specimen of chlorophane, whose phosphorescence had been destroyed by an intense heat, was exposed to the solar rays for two days without any of its phosphorescent quality being restored. A single electrical discharge, however, restored its phosphorescence, which increased in the ratio of the number and the intensity of the shocks it received.

Phenomena and Laws.

Experiments of Mr Pearsall.

The green light emitted by the action of heat was more deep and of longer continuance after three, six, or even twelve discharges, than after one. Mr Pearsall obtained the same results with apatite and some diamonds; but electricity produced no effect in developing phosphorescence by heat in amethyst, sapphire, ruby, garnets, and other mineral substances which he tried.

In the course of his experiments Mr Pearsall observed the curious fact, that the specimens of fluor spar, though colourless in their natural state, received a bluish tint when electrified, and the acquired phosphorescence was proportional to the depth of the tint. When a number of fragments were used, the larger fragments were of a blue colour, and emitted a blue light when heated, whereas the smaller fragments emitted only a pale yellow light. Mr Pearsall thinks it probable that the phosphorescent property is communicated by electricity only to the surface, which he considers as explaining the fact that fragments of different dimensions emit differently coloured lights.

In resuming the investigation of this subject, Mr Pearsall found, that bodies not naturally phosphorescent, such as statuary marble in its natural or calcined state, ivory when its carbonaceous part was removed, calcined mother of pearl, calcined oyster shells, calcined petuncles, egg shells, and lime, were not only rendered phosphorescent by heat after being strongly electrified, but acquired this property with a beauty, a variety, and an intensity of colour superior to those which occur in specimens that possess a natural phosphorescence. We regret that our limits will not permit us to give in detail a second series of experiments which Mr Pearsall performed with twelve different varieties of fluor spar, all of which gave distinct phosphorescence previous to their being electrified; but the general result of them may be thus expressed. When the natural spars emit by heat a light of different colours, the electric action produces only one of them; but when the mineral yields only one natural colour by heat, this is replaced, when electricity is applied, by a phosphorescence of various colours, among which the primitive tint does not appear. As the colours change with the number of electrical discharges, Mr Pearsall found the following to be the order of progression. The specimen was a green fluor.

1 discharge,		pale purple light when heated.
2	... ...	pale green, changing into purple.
3	... ...	the same colours, more intense and durable.
4	... ...	purple, with increased intensity.
6	... ...	green, brighter and deeper.
10	... ...	green bright: fine and more durable purple.
20	... ...	deep and more durable colours.
40	... ...	very rich colours, the purple at last inclining to red.
100	... ...	green colour, highly brilliant, and becoming yellowish. The purple had now a superb tint.
160	... ...	an intense light nearly white, followed with a brilliant green light, then with a durable purple, and then with a yellow accompanied with violet tints.

This specimen had been successively heated and electrified nearly fifteen times, and had suffered no deterioration in its phosphorescent property.

Mr Pearsall next shows that the property communicated by electricity was preserved even for *three* months, when the specimen was kept in the dark. Out of twelve fragments, two had completely lost their acquired phosphorescence by exposure to the sun for twenty-one days, five had nearly lost it, and six had experienced a modification in their colours by this exposure.

Mr Pearsall now examined the influence of electricity on the natural phosphorescence of bodies, and he found that an augmentation of intensity was produced, of which it is difficult to give an idea. Specimens of fluor whose pyro-phosphorescence was feeble or uncertain, were raised to the rank of highly phosphorescent bodies, and some of them even rivalled the Siberian fluor. At the end of fifty days some of these specimens still preserved the excess of phosphorescence which had been communicated to them, while others continued to exhibit the same order of colours.

Phenomena and Laws.

Experiments of Mr Pearsall.

Mr Pearsall has brought forward several experiments to prove that the phosphorescence of bodies, and the modifications it experiences, depend on their structure and mechanical condition. Phosphate of lime, for example, which in the form of *apatite* has an intense natural phosphorescence, has none when aggregated from a precipitation of it in a solution of muriatic acid, nor when obtained from powdered or calcined apatite. A calculus of phosphate of lime, however, gave green, yellow, and orange light when heated after having been calcined and exposed to twenty electrical discharges. Mr Pearsall also several times observed that the power of phosphorescence returned after it had disappeared.

With the view of showing that the phosphorescence was not owing to any radiating matter which was carried along with the sparks, Mr Pearsall inclosed coloured chlorophane in glass tubes hermetically sealed, and found them phosphorescent after 225 discharges. He found voltaic electricity capable of producing phosphorescence in some cases and not in others; so that it differs greatly from common electricity in this property.

In explaining the preceding phenomena, Mr Pearsall considers the intense electricity of the Leyden jar as altering the structure upon which phorphorescence depends, by the vibratory motion which it communicates, and which allows the particles to take a new arrangement. When the body has had a new structure communicated to it by the vibrations or shocks of each electrical discharge, the action of heat is supposed by our author to permit the body to return to its primitive structure; and he conceives that the vibrations of the atoms during these changes of structure may produce light.

Sect. IV.—*On the Changes produced by Electricity on Odoriferous Bodies.*

Influence on odoriferous bodies.

It was discovered by M. Libri of Florence that electricity exercises a curious influence over odoriferous bodies. Having caused a continued current of electricity to traverse a piece of camphor, the odour of this substance became more and more feeble, and at last entirely disappeared. When the camphor has suffered this change, and is withdrawn from all electrical influence, and put in communication with the ground, it will remain without odour for some time, but it will afterwards resume its former properties slowly and gradually. M. Libri seems to have obtained a similar result with other odoriferous bodies; but he has not, so far as we know, given any more particular account of his researches.

Sect. V.—*On the Magnetic Effects of Electricity.*

Magnetic effects of electricity

During almost every period of the history of electricity, philosophers have pointed out strong resemblances between the phenomena which it exhibits and those of magnetism. Some of the most striking points of resemblance were, that each consisted, as it were, of two powers or directions of powers, of an opposite nature, and subjected to similar laws of attraction and repulsion; that the action of magnetism has a great analogy with that of electricity; that the distribution of the forces in an electrified body differs very little from that of the forces in a magnet; and that the pyro-electrical tourmaline has the strongest resemblance to an artificial magnet.

These views were powerfully confirmed by the fact, often observed, that magnetism was communicated to bodies by a stroke of lightning, and that the compass needles of ships have had their polarity changed by a similar cause The

Phenomena and Laws.

Effects of lightning on compass needles.

ship Dover was struck by lightning in the Atlantic on the 9th January 1749; and in four compasses on board, one of which was in a brass box, and the other three in wooden boxes, *all the needles had lost their virtue.* At first their polarity seemed to have been nearly reversed, but after a little while they moved about in every direction, and were of no use. Mr Gowin Knight, having examined one of these compasses, observed that the outward case was joined together by pieces of iron wire, sixteen of which were found in the sides of the box and ten in the bottom. By applying a small needle to each of these wires, Mr Knight found that they were all strongly magnetical, particularly those which had joined the sides.

Another very remarkable case occurred on board the New York Packet, in its voyage from America to Liverpool in 1827; and as a very accurate description of it was communicated by the Rev. Mr Scoresby to the British Association at York in 1831, we shall lay before our readers his own abstract of it. "Soon after the commencement of the voyage, this vessel encountered a severe thunderstorm, and received a stroke of lightning, which shattered the masts in several parts, and started some of the exterior planks of the bends. This was in the morning before day-light. The weather continuing unsettled, and the air in a highly electric state, with water-spouts in various directions around, the captain, fearing another explosion from the highly charged atmosphere, put up a lightning conductor which he had on board. In the afternoon of the same day the ship was a second time struck, but preserved by the conductor, though the iron of which it was composed was destroyed, and fell in melted globules upon the deck. No lives were lost, though some of the crew received heavy shocks; whilst one person, an invalid passenger, derived essential benefit from the electric discharge. Mr Scoresby had an opportunity of examining the vessel immediately on her arrival in Liverpool, when, on investigating the condition of the iron on board, he found almost every article capable of permanent magnetism, with sensible polarity. Table-knives and forks were capable of lifting needles or small nails, and one knife sustained a travelling-trunk key. Most of the watches on board suffered by the magnetic influence, especially those which were under the pillows of their owners in bed. These were all stopped, and on examination were found so highly magnetic that portions of the steel-work were capable of suspension by each other, in a chain of three or four pieces. Of one of these pieces (the cap-spring) Mr Scoresby made a pocket compass, which was exhibited when his communication to the association was made, and was observed to be in all respects a delicate and perfect instrument."

Experiments of Franklin.

In enumerating the points of analogy between lightning and electricity, Dr Franklin remarks that they have both the power, not merely of reversing the poles of magnets, but of completely destroying their magnetism. By discharging four large jars through a common sewing needle, he communicated to it such a degree of magnetism, that it placed itself on the plane of the magnetic meridian when it was made to float on water. If at the time of receiving the discharge the needle lay east and west, the end at which the discharge entered pointed north; but if the needle lay north and south, the end which lay to the north continued to point to the north, at whatever end the discharge entered. He found also that the magnetic intensity developed in a needle was a *maximum* when the needle lay north and south, and a *minimum* when it lay east and west, at the time of receiving the electrical discharge. If the charge of a large jar or battery is transmitted through a steel wire perpendicular to the horizon, it will be permanently magnetized, and the lower end, at the time of the discharge, will afterwards turn to the north when it is made to traverse in a horizontal plane. If we now replace the wire in its vertical position, the end which was formerly the lowest being now the highest, and again transmit the discharge, the polarity of the needle will either be completely destroyed, or the poles will be reversed.

It has been found also that the polarity of a natural magnet may be completely destroyed by transmitting through it the charge of a battery.

Experiments of Beccaria;

In repeating the experiments of Franklin, Beccaria discovered that lightning always communicates the magnetic polarity to bodies containing iron, and he observed this phenomenon even in common bricks that had been struck by lightning. Guided by the observations which he made on the polarity of such bodies, he was able to trace the directions which the lightning had taken in passing through them.

of Van Marum.

A series of elaborate experiments were made by Van Marum, on the magnetic effects of electricity. He employed a battery of 135 jars, containing 130 square feet of coated surface, and he transmitted the powerful charges which it yielded through watch-spring needles from three to six inches long, and also through steel bars nine inches long, between a quarter and half an inch broad, and nearly a line thick.

In this way he found that when the needle or bar was placed horizontally in the plane of the magnetic meridian, its north end acquired north polarity, and its south end south polarity, in whatever direction it received the discharge. When the bars possessed some degree of polarity before receiving the shock, it was either diminished or reversed after receiving it. When the needle or bar received the shock in a vertical position, its lower end became the north pole whether it had been previously magnetic or not. Generally speaking, the degree of magnetism which was communicated was as strong in a horizontal as in a vertical position. When the needle was placed in the magnetic equator, and received the discharge longitudinally or along its axis, it received no magnetism whatever; but when the *shock was passed through its width, or at right angles to its axis,* the needle received a considerable degree of magnetism, the end which pointed to the west becoming the north pole, and that which pointed to the east the south pole.

When the charge was so powerful as to render the needle hot, no sensible polarity was communicated to it.

Discovery of electro-magnetism by Professor Oersted.

Such was the state of our knowledge respecting the connection between electricity and magnetism, when Professor Oersted of Copenhagen, led by theoretical views, established a most interesting relation between these two powers, and laid the foundation of the new science of *Electro-magnetism*, or *Magneto-electricity*. The fundamental fact which Mr Oersted discovered may be thus expressed.

When a wire conducting electricity is placed parallel to a magnetic needle properly suspended, the needle will deviate from its original or natural direction. This deviation follows a regular law.

1. If the needle is *above* the conducting wire, and the positive electricity goes from right to left, the *north* end of the needle will be moved *from* the observer.

2. If the needle is *below* the wire, and the positive electricity passes as before, the *north* end of the needle will be moved *towards* the observer.

3. If the needle is in the same horizontal plane with the wire, and is between the observer and the wire, the *north* end of it will be *elevated.*

4. If the needle is similarly placed on the opposite side, the *north* end of it will be depressed. In these two experiments the needle must be very near the wire.

From these simple facts Mr Oersted concludes, *that the magnetical action of the electrical current has a circular motion round the wire which conducts it.* This law will be understood by inspecting Plate CCXXVI., fig. 10, where, if

Phenomena and Laws.

AB is the conducting wire or the direction of the positive electricity, the circle *c d e f* will be the plane in which the magnetical circulation takes place. The small arrows show the direction of the austral or polar magnetism, the sharp ends or heads of the arrows indicating the direction in which the *austral* magnetism, and consequently the *north end* of the needle is *repelled*, and the *boreal* or north-polar magnetism is attracted; while the opposite ends of the arrows indicate the direction in which the *boreal* magnetism, and consequently the *south end* of the needle is *repelled*, and the opposite magnetism attracted.

Dr Colladon's experiments with ordinary electricity.

The preceding discovery was made with the electricity of the galvanic battery, but it is equally true when a strong current is obtained from the common electrical machine. An electric spark sent along a conducting wire passes too quickly to move the needle, and a current produced by the electrical machine does not appear to contain a sufficient quantity of electricity to act upon the needle, or rather to show its action. If the electrical effect of the current, however, is multiplied, its action upon the needle becomes apparent. In order to do this we must use, as Dr Colladon first did with success, Schweigger's multiplier, which is shown in fig. 11, where ABCDE is the wire which conducts the electrical current, bent several times, and covered with three folds of silk for the purpose of insulation. The needle NS is then inclosed within the coils of the wire, and the effect of the current upon it is obviously quadrupled by the *four* coils of the wire which surround it. The coils should be as near to each other as possible; and as they can be repeated a great number of times, the multiplication of the effect is almost unlimited. The needle is suspended by a single fibre of silk, and the sensibility of the instrument may be increased by using a magnet for the purpose of diminishing the directive power of the needle. When Dr Colladon brought the two ends of the wire of this apparatus to the two conductors of an electrical battery of 4000 square inches, so as to make the discharge go a little way through the air before it entered the wire, a current of sufficient strength and of some duration was obtained, which produced a considerable deviation in the needle. Dr Colladon also obtained a deviation of several degrees with this multiplier, by means of the electrical current obtained from an electrical machine.

Fig. 11.

Experiments of Dr Faraday.

These interesting experiments of M. Colladon have been amply confirmed and beautifully extended by Dr Faraday. Although MM. Arago, Ampere, and Savary had witnessed a successful repetition of M. Colladon's experiments, yet the conclusions to which they led were doubted by some and denied by others. Dr Faraday was therefore induced to repeat them with great care. He employed for this purpose the electrical machine, battery, and discharging train already described (see page 596).

The galvanometer which he used was sometimes a single one, consisting of sixteen or eighteen convolutions of copper wire covered with silk, and sometimes a double one, consisting of two independent coils, each containing sixteen feet of silked copper wire. The glass jar which covered the galvanometer and supported the needle was coated inside and outside with tinfoil, the upper part (left uncoated for the purpose of examining the motions of the needle) was covered with a frame of wire-work with numerous sharp projecting points. When this frame and the two coatings were connected with the discharging train, an insulated point or ball, connected with the machine in its most active state, could be brought within an inch of any part of the galvanometer, without the inclosed needle being affected by any ordinary electrical attraction or repulsion.

Dr Faraday expected, by means of the retarding power of bad conductors, to obtain from ordinary electricity the powers of voltaic electricity. After the connections were properly made, a battery charged positively by about forty turns of the machine was discharged through the galvanometer, when the needle immediately moved. By repeating this experiment when the needle was vibrating, its vibrations were extended to above forty degrees on each side of the line of rest: on reversing the galvanometer the needle was equally well deflected in the opposite direction, the deflections being in the same direction as if a voltaic current had passed through the galvanometer, the positive surface of the battery coinciding with the positive end of the voltaic apparatus. Similar effects were obtained by taking the electrical current directly from the prime conductor, and dispensing with the battery altogether. When the electricity, too, was passed through an exhausted receiver to imitate the aurora borealis, and then through the galvanometer to the earth, it was equally efficacious in deflecting the needle.

From these and other experiments, Dr Faraday concludes that a current of common electricity, whether transmitted through rarified air, water, brine, acids, and other imperfect conductors, or through wire, or by means of points in common air, is still able to deflect the needle (the only thing necessary being to allow time for its action), and is just as magnetic as a voltaic current.

As it is by the galvanic battery, however, that this subject has been studied, we cannot pursue it any farther at present, and must refer our readers to the articles already mentioned, in which a full view of this new science will be given.

Sect. VI.—*On the Effects of Electricity upon Animal Bodies.*

Influence of electricity on animal bodies.

The influence of electricity on the human frame, whether it is administered in small quantities so as to excite and surprise us, or in the more powerful and awful form of a stroke of lightning, must be well known to the least informed of our readers.

When any part of the body receives an electric shock, a disagreeable sensation is felt in the place; and, according to Dr Robison, it is sharper when taken from a long wire than from a large body. When the human frame forms part of the electric circuit, or when the charge of a Leyden phial is made to enter the body at one hand and pass out of it at the other, a violent concussion or shock is felt along the line of its passage across the breast and through the arms. This electrical shock, and the involuntary motion which accompanies it, arises no doubt from the obstructions which an imperfect conductor like the human body, composed of fluids and solids of different conducting powers, presents to the free passage of the electric fluid. If the charge is increased, the patient through whom it passes falls down under its influence, and suffers a temporary suspension of vital action; and if it is increased to a still greater degree, it will produce instantaneous death. This case is frequently exemplified when persons are killed by lightning; and a very remarkable instance of the laceration of the human body occurred several years ago which could have arisen only from an obstruction to the free passage of the fluid. The case to which we refer presents us with a most singular variety of action exhibited by the lightning in passing through animal bodies; and it is so interesting, and so well described by Mr B. Boddington, the father of the gentleman who was struck with the lightning, that we shall present our readers with an abstract of it.

The electrical shock.

Singular effects of lightning.

On the 13th of April 1832, Mr and Mrs T. F. Boddington left Tenbury, occupying the hind barouche seat of their post-chariot, the servants being in the inside. About half past three o'clock, with the sun shining, and a serene sky, they observed a dark cloud to arise in the direction of their route. Soon after a clap of distant thunder was heard, but no lightning was seen. A few drops of rain having begun to fall, Mr Boddington put up an umbrella, and, after giving it to his wife, he put up another, and when he was in the

Phenomena and Laws.

Singular effects of lightning.

act of extending the latter, a flash of lightning struck them both senseless, threw the horses on the ground, and cast the post-boy to a distance. One of the servants, after recovering from his alarm, looked out of the window, and saw the head of Mr Boddington hanging over the seat, and apparently lifeless. Jumping from the carriage, he raised his master's head, and found his clothes on fire, while Mrs Boddington was standing up tearing off her bonnet and shawls. She had neither seen the flash nor heard the thunder, but felt a sense of suffocation, and was putting off her things to obtain air. She and the servant then proceeded to extinguish the fire, which was still consuming her husband's dress. The lightning, passing down through the umbrella, penetrated through the bonnet into Mrs Boddington's neck, and zigzagged along the skin of her neck to the steel busk of her stays, leaving a painful but not a deep wound, and affecting the hearing of the left ear. From the lower end of the busk the lightning pierced through all the garments down to her thighs, where it made wounds on both; but the one on the left was so deep and so near the femoral artery, that the astonishment is she escaped with her life, the hæmorrhage being very great. None of her clothes were burnt, notwithstanding their inflammable nature, nor did any of her wounds present the appearance of burns. Mr Boddington, after remaining insensible for ten minutes, revived, and felt a pain all over him. The main force of the shock passed down the handle of the umbrella to his left arm, though a portion of it made a hole through the brim of his hat, and burnt off all the hair that was below it, along with his eye-brows and eye-lashes. The fragments of the burnt parts falling into the eyes, deprived him nearly of sight for two or three days. The electric stream shattered his left hand, melted his gold shirt-buttons, and tore the clothes in a most extraordinary manner, forcing parts of them, with the buttons, to a distance, and inflicting a deep wound under their position on the wrist. The arm was laid bare to the elbow, a severe wound was made in his body, and every article of his dress torn away as if by gunpowder. It then passed to the iron of the seat, wounding his back, the whole of which was literally flayed. The horse rode by the postilion was killed. A very striking difference was observed in the wounds of Mr and Mrs Boddington. Hers were fractures of the flesh. His, on the contrary, whether deep or shallow, were all burns, and had a white and blistered appearance. No wound was visible on the dead horse, excepting an indentation on the head where the fluid entered, discolouring the spine in its passage.

Experiments of Van Marum on eels.

For the purpose of determining in what manner death is produced by a powerful electric discharge, Van Marum sent the electric shock through eels one and a half and three and a half feet long. The smaller eels were instantly killed when the shock was sent through their whole body; but when the charge was only sent through individual parts, these parts only lost their irritability, while the rest retained it. When the shock went through the upper and fore part of the head of the large eels, the under jaw, as well as the muscles of the neck and belly, and even the lower part of the body, preserved their irritability, while the parts which conveyed the charge had totally lost it. When smaller shocks were sent through warm-blooded animals, similar effects were observed; and hence it has been inferred that the circulation of the blood cannot take place when such an effect has been produced, and that the suspension or destruction of life must arise from this cause. When the shock does not affect the large arteries the animal may recover, provided that the spinal marrow and the cerebellum are not injured.

Various experiments have been made by Mr Morgan and others, with the view of ascertaining the influence of electricity on the animal functions. Mr Morgan found that if the diaphragm forms part of the circuit between the inside and outside coating of a jar containing two square feet, the lungs will make a sudden effort, followed by a loud shout. When a small charge is similarly applied, a violent fit of laughter is always produced, even on the gravest persons. A strong charge transmitted through the diaphragm is frequently accompanied by tears and sighs, and sometimes by fainting. When a strong charge is sent through the spine of a person standing, he will frequently either drop on his knees, or fall prostrate on the floor. A strong charge having been transmitted accidentally through Mr Singer's head, he felt the sensation of a violent but universal blow, which was followed by transient indistinctness of vision and loss of memory, but no permanent injury was received. When the charge of a battery is sent through the head of a bird, its optic nerve is always injured or destroyed; and when a smarter shock is given to a larger animal, a tremor and depression, with a general prostration of strength, is produced.[1]

Experiments of Morgan;

of Mr Cavendish;

Mr Cavendish observed that the sensible shock depended more on the quantity than on the intensity of the charge, a double degree of intensity with only half the quantity invariably producing a less powerful shock. According to Volta, only a little more electricity is necessary to produce an equal shock from a larger surface A surface, for example, 16 times as large required only an elevation of the electrometer to one-tenth of the number of degrees. Dr Robison informs us that the shock obtained from a small charge given to a large surface, yields a less unpleasant shock than a large charge given to a small surface. As these observations, however, depend upon individual feeling, and as it is known that different persons are affected in very different ways with the same degree of electricity, they may not be generally correct.

of Dr Robison.

Effects of electricity on the pulse.

The influence of electricity on the pulse has been examined by different authors, though with some variety of result. M. Trembley found that the arterial pulse was quickened in persons electrified. M. Boze was of the same opinion; but the Abbé Nollet could not discover any increase in the rapidity of the circulation of various animals which he electrified. Cavallo, on the contrary, informs us that an experienced medical electrician assured him that, "in a diseased state of the body, an obvious acceleration of the pulse was observed to result from the application of electricity."

Experiments of Nollet.

In the experiments made by M. Nollet, his attention was directed to other points besides the state of the pulse. His experiments were made with birds, cats, and the human subject; and having selected and carefully weighed pairs of the animals, he communicated to them a current of electricity for some hours, when they were again weighed. The loss sustained was ascribed to perspiration. The general result was, that the animal which was electrified was always found to be lighter than the one which was not. The persons who submitted to these experiments suffered no inconvenience from them. They experienced a slight degree of exhaustion, and an increase of appetite, but none of them found themselves sensibly warmer.

Experiments of Van Marum.

In order to settle these questions respecting the influence of electricity on the pulse and on insensible perspiration, Van Marum selected *eleven* persons, and repeated the experiment *four* times upon each, with negative as well as with positive electricity. They were placed in a room so remote from the machine that they could not hear the noise which was made in working it. They were placed on insulating stools, and their pulse was felt and carefully

[1] Dr Young observes, that a minute tremor communicated to the most elastic parts of the human body, particularly to the chest, occasions a nervous agitation, not unlike the effect of weak electricity.

Phenomena and Laws.

counted both when the machine was in motion and at rest. The general result was, that no decided acceleration was observed, a few additional beats having taken place in some cases. In general, however, *there was a great irregularity in the pulse.*

The next experiment of Van Marum was a very interesting one. He placed a boy eight years old in one scale of a delicate balance, which scale was insulated by means of a silk cord. The boy being connected with the conductor, the balance was brought to a state of exact equilibrium. Having determined that the boy, previous to being electrified, lost 280 grains in an hour, he electrified him, and found that the loss was 295. In another experiment the boy lost 330 grains before, and 310 after being electrified. A girl seven and a half years old lost 180 grains before, and 165 after being electrified. A boy eight and a half years old lost 430 grains before, and 290 after being electrified. A boy nine years old lost 170 before, and 240 after being electrified. As this boy had remained very quiet during the experiment, the increase was ascribed to electricity, and the experiment was carefully repeated. He now lost 550 grains before, and 390, 330, 270, 550, and 420 after being electrified. Hence it appeared that the insensible perspiration had rather decreased than augmented.

Medical electricity.

The powerful influence of electricity on the human frame led the more sober part of the medical profession to view it as a valuable auxiliary in the healing art, while those who were more sanguine regarded it as an universal medicine, which might be resorted to in every form of disease. Charlatans of every degree found the electrical machine a lucrative article of trade; and there were not wanting well-meaning enthusiasts who contributed to prolong the reign of medical electricity.

But though electricity has not yet taken up a position in the healing art, there can be no doubt that in various disorders its application has been found advantageous, and that patients have, in a particular class of diseases, experienced instantaneous relief.

Electrical machine for medical purposes. Plate CCXXIX., fig. 16.

The machine used for medical purposes should have sufficient power to yield a continued current of strong sparks. The diameter of the plate in a plate machine should be about twenty inches, and that of a cylinder about ten or twelve inches. The only apparatus necessary is a jar fitted up with Lane's electrometer (see Plate CCXXIX., fig. 16), and a pair of directors, each consisting of a glass handle surmounted by a brass cap, with a wire a few inches long, carrying a ball at its extremity. A wooden point is sometimes substituted for this ball. When it is required to pass a shock through any part of the body, the directors are applied at the opposite extremities of the part, one director being connected by a wire with the inside coating, and the other with the outside coating of the jar, or, what is the same thing, with the receiving ball of Lane's electrometer, previously placed at such a distance from the ball of the jar as to yield a charge of the proper magnitude. When sparks are to be administered, it is done with the director and brass ball; but when the organ is very delicate, such as the eye, a stream of electricity is thrown upon it from the wooden point, held at the distance of about half an inch. An insulating stool, capable of holding a chair for the patient, is also necessary. In certain cases a brass plate, communicating with the inside of the jar, is placed in the bottom of the chair, so as to apply itself to the lower part of the body, when the electricity is required to pass through the abdomen or adjacent parts.

Sect. VII.—*On the Effects of Electricity upon Vegetable Bodies.*

It has been distinctly shown by Priestley, Ingenhousz, and Sennebier, but especially by Theodore Saussure, that the various parts of plants act upon atmospheric air; that they insensibly disengage a large quantity of carbonic acid at the expense of the oxygen; and that, owing to some combination within the plant, they sometimes exhale pure oxygen. Now, as all carbonic acid has vitreous electricity, this exhalation of the acid from the plants ought to furnish an abundant supply of it to the atmosphere. M. Pouillet, of whose researches we have already given an abstract, has placed this truth beyond a doubt.

Electrical Apparatus.

Effects of electricity on vegetables.

From this fact alone we might reasonably infer that electricity performs an important function in the phenomena of vegetation; but so little attention has been paid to this subject, that we have some hesitation in laying before our readers the very imperfect and unsatisfactory experiments which have been recorded. The best experiments, indeed, have entirely a negative character; and the general result of them is given when we say that electricity appears to have no decided efficacy as a stimulus to vegetable life.

The recent discoveries, however, which have been made on endosmose and exosmose by M. Dutrochet, render it extremely probable that an electrical action is the cause of the ascent of the sap in plants; but as M. Poisson has ascribed these curious facts to capillary action, and other philosophers to other causes, we must wait for further experiments before we can treat this subject as a branch of electricity.

PART II.

DESCRIPTION OF ELECTRICAL APPARATUS.

Electrical apparatus.

In the preceding part of this treatise we have already had occasion to refer to several pieces of electrical apparatus, and particularly to two or three varieties of the best machines for generating electricity by friction. Notwithstanding this slight anticipation, however, we must resume the subject at some length, on account of its great importance in a popular and practical view of the science.

The various kinds of electrical apparatus may be classed under the four following heads:—

1. Instruments for generating and collecting electricity.
2. Instruments for accumulating electricity.
3. Instruments for indicating the presence of electricity, and measuring its quantity.
4. Instruments for miscellaneous purposes.

CHAP. I.—DESCRIPTION OF INSTRUMENTS FOR GENERATING AND COLLECTING ELECTRICITY.

Instruments for generating electricity.

The instruments which belong to this chapter are, electrical machines, atmospherical conductors, and electrophori.

Sect. 1.—*Description of Electrical Machines.*

The simplest of all pieces of apparatus for generating electricity is a tube or rod of glass, which, when rubbed with a piece of woollen cloth, will yield as much electricity as will charge a jar in a short time. In consequence, however, of the labour which attends this operation, it has been usual to turn a sphere or cylinder of glass round an axis by a simple winch, or by a double wheel and band, for the purpose of generating electricity rapidly, and without fatigue to the operator.

We have already exhibited two of these machines in Plate CCXXII., figs. 1, 2, 3, 6, & 7, and described their general construction. It is easy to modify this construction in various ways;—and for particular purposes and particular classes of experiments particular forms of the machine may be most convenient: But as the philosopher is best capable of introducing such modifications for his own use, we shall not occupy our pages with the descriptions of electrical machines which have sprung more from the fancy and caprice of individuals than from the wants of the science.

Electrical Apparatus.

There can be no doubt that the plate-glass machine is the most commodious and the most powerful form of the electrical machine. But whether the glass has the form of a plate or a cylinder, it should be of that kind which has the least quantity of alkali in its composition. Bohemian glass, and glass pretty old, is preferred to modern glass. It has also been stated that a glass plate will derive great electrical power by a considerable exposure to the sun's rays.

We have already described, and given representations of very excellent plate-glass machines in Plate CCXXII., figs. 1, 2, and 7, and in Plate CCXXIII., figs. 1-5, of the last of which we shall give a fuller description; but we have reserved to the present chapter the description of the best form of the electrical machine with which we are acquainted, and which we owe to the ingenuity of Sir Snow Harris, F.R.S., Plymouth.

1. *Description of Sir W. Snow Harris's Electrical Machine.*

Sir Snow Harris's electrical machine. Plate CCXXVII., fig. 7.

This machine, which is shown in perspective in Plate CCXXVII., fig. 7, consists of a circular disc of plate glass ZZ, three feet in diameter, mounted on a horizontal axis, resting on two horizontal supporters of mahogany. These supporters are themselves sustained by four vertical mahogany columns, fixed upon a firm frame as a base. To the lower side of this frame are fixed four legs M, N, O, P, upon which the whole machine rests; and these legs again rest upon another steady frame RST, furnished with rollers, so as to move it easily into any required position, and likewise with three levelling screws, RST, for placing it horizontally. By these means the machine may be so adjusted and fixed that the axis of the plate of glass, which has a free motion backwards and forwards in the holes in which it turns, may not tend more to one side than to the other, and occasion an unequal action on the rubbers. The rubbers, which are four in number, are insulated on pillars of glass A, B, one placed at each extremity of the horizontal diameter A, B, of the plate. The positive conductor CBD projects in a vertical position in front of the plate ZZ, while the negative conductor passes in a curvilineal direction behind, and connects the rubbers of each side.

The plate of glass is turned by an insulated handle, immediately in front of which is placed a short index, which is fixed to the axis, and which moves over a graduated circle L, attached to the horizontal part of the frame, and through the centre of which the axis passes. In this manner the number of revolutions of the plate may be accurately registered.

In order to strengthen the centre of the plate, two smaller plates are cemented to each side by varnish; and a small stop is inserted into the axis, to prevent the pressure from increasing beyond a certain point.

Fig. 7.

When the machine is used for ordinary purposes, the conductors shown in fig. 7 are employed; but when it is employed to accumulate electricity, the conductors should have the smallest extent possible, and, excepting at the receiving points, where they collect the electricity from the edge of the silk flaps about H, H, they should be covered with sealing wax. In this case the positive conductor is formed of small straight tubes, as shown in fig. 8, and its extremities terminate in balls of varnished wood, through the substance of which the metallic communications pass.

Fig. 8.

2. *Description of Van Marum's Electrifying Machine.*

Van Marum's electrical machine. Plate CCXXIII., figs. 1-5.

This machine, to which we have made a brief reference in Sect. III. Chap. II. Part I., is represented in elevation and in section in figs. 1 and 2 of Plate CCXXIII. The plate of glass AB, which is thirty-one inches in diameter, is sustained by a single pillar E, at the upper extremity of which are two similar brass collars I, I, one of which is shown separately in fig. 4. The horizontal axis MN rests upon these collars, and this axis carries a counterweight L, in order to balance the plate of glass and its appendages, and thus equalize the friction on the collars. The rubbers, which cannot be seen in the section, fig. 2, are shown at *m*, *n*, fig. 1. The pair at *m* is attached to the ball O, and supported by the glass pillar *e*; and in like manner the pair at *n* is attached to the ball P, and supported by the glass pillar *f*. A horizontal section of the rubbers and balls is shown separately in fig. 3. A semicircle of brass CD is attached to an axis *g* that turns on the ball G, resting on the pillar F, so as to give the conductor CGD a motion round that axis. Collectors six inches long and two and a half in diameter are placed at C and D, to collect the electricity from the revolving plate AB. At the outer end of the axis *g* is a copper tube H*h*, terminating at its lower end in a ball H, and its upper end in a smaller ball *h*, two inches in diameter, which, screwing into G, will fix the tube H*h* in any position round *g*. An arch of brass wire *cId*, half an inch in diameter, is fixed to the end of the bearing piece K, and moves round I into any given azimuth, so as to be placed, as in fig. 1, opposite the rubbers *m*, *n*, or at right angles to them. In like manner, the conductor CGD can be placed either horizontally, so that the collectors C and D may be opposite the rubbers *m* and *n*, or vertically, as shown in fig. 1. By this apparatus it is easy to produce either positive or negative electricity. In the position of the conductor shown in fig. 1, where CGD is at right angles to the rubbers, and where the rubbers are connected with the ground by the arch *cId*, and by the wire KK, fig. 2, the conductor G will give *positive* electricity; but when we wish *negative* electricity, the conductor CGD is placed horizontally, with its collectors C, D opposite the rubbers, and the arch *cId* is placed vertically, so as to insulate the rubbers.

A mahogany cap T covers the metallic caps of the supports, in order to insulate them more perfectly. A hollow ring of mahogany, VX, is, for the same reason, made to cover the metallic socket into which the support is inserted. In fig. 3, *a*, *b*, *a*, *b*, are four pieces of gum-lac. In figs. 1 and 2, W is the handle by which the machine is wrought.

3. *Description of Hare's Electrical Machine.*

Hare's electrical machine. Plate CCXXII., fig. 7.

This machine, which we have previously noticed, differs from those generally made, in having its glass plate horizontal; and it is considered by its inventor, Professor Hare of Philadelphia, as giving negative electricity in a way preferable to that in which it is obtained in Van Marum's machine. The glass plate MN, thirty-four inches in diameter, is supported on an upright iron bar PR, about an inch in diameter, and covered by a stout glass cylinder, sixteen inches high and four and a half inches in diameter, open only at the base, through which the bar is introduced so as to form its axis. At the top of the bar PR is a block of wood turned to fit the cavity at the apex of the cylinder, and cemented therein. The external apex of the cylinder, is fixed by cement into the brass cap which carries the plate. The glass cylinder, which is liable to no strain, effectually insulates the plate from the iron axis PR. The brass cap seen at P is surmounted by a screw and flange, which, with the aid of a corresponding nut and discs of cork, keeps the plate firm. The wheel W, driven by a handle, communicates by means of a band with another wheel about twenty inches in diameter, placed on the iron axis RS.

"Nearly the same mode of insulation and support," says Dr Hare, "which is used for the plate is used in the case of the conductors. They consist severally of arched tubes of brass (ABC, DEF), of about an inch and a quarter in diameter, which pass over the plate from one side of it to the other, so as to be at right angles to, and at a due distance

Electrical Apparatus.

from, each other. They are terminated by brass balls and caps, which last are cemented on glass cylinders of the same dimensions nearly as that which supports the plate. The glass cylinders are suspended upon wooden axes, surmounted by plugs of cork turned accurately to fit the space which they occupy. The cylinders are kept steady below by bosses of wood which surround them. In this way the conductors are effectually insulated, while the principal strain is borne by the wooden axes."

The collectors are shown at MN in connection with the *positive* conductor ABC, and the rubbers are shown between P and the balls D and F in connection with the *negative* conductor DEF. The advantage of this form of the machine over that of Van Marum is, that the two conductors are permanently fixed in their places, and that positive and negative electricity can be at any time obtained without any change in the machine. Dr Hare considers the band as of advantage in preventing the plate from being cracked by any hasty effort to put it in motion when it adheres to the cushions, as it often does. Dr Hare uses a winch on the other side of the wheel, so that two persons, or one with both hands, may drive it.

The great expense of large cylinders and plates of glass, and their liability to injury, have induced artists to construct electrical machines of different substances. M. Walckiere de St Amand of Brussels constructed a machine of extraordinary power, which consisted of a web of varnished silk twenty-five feet long and five feet wide, revolving upon two wooden cylinders covered with woollen serge. During the revolutions of the cylinders, the silk moves between two cushions, each seven feet long and two inches in diameter, covered by cat's skin or hare's skin, and moveable so as to vary the friction. The machine was driven by four men, and it had so great power that it gave sparks fifteen inches long, and nobody durst take a spark from it but with the shoulder and elbow.

Machines of silk webs;

Dr Ingenhousz constructed machines with discs of pasteboard four feet in diameter, and soaked in copal or amber varnish dissolved in linseed oil. They were covered with the same varnish, and were mounted upon an axis or flat board, three inches broad, and covered with flannel or hare's skin, being placed between each two discs, so as to act as a rubber. Sparks one and even two feet long were given out by the front disc when the knuckle was presented to it.

of varnished pasteboard;

Wooden discs, and cylinder discs of gum-lac partly immersed in mercury, which acted on the rubber, and stretched varnished ribbons, have been all used in the construction of electrifying machines, but it would be an unprofitable task to describe them.

of wooden discs.

4. *General Observations on the Construction and Use of the Electrical Machine.*

Observations on the electrical machine.

Although, in fine dry weather, and in a warm and dry place, a good electrical machine may be brought into an excellent state of action merely by wiping it with a warm linen cloth and afterwards with a silk handkerchief, yet in a different state of the atmosphere, and in humid apartments, every precaution is necessary to insure the vigorous and steady action of the machine. By turning the machine before a fire, or placing it in a current of heated air, or, as Dr Faraday suggests, by placing it over a sand-bath or a hot iron plate whose temperature does not exceed 212 degrees, the different parts of the machine will be thoroughly dried and heated without affecting the cements.

Methods of heating the machine.

We have already described (see page 536) the improvement of Mr Ronalds, who heats the inside of the machine, &c., by a spirit-lamp. Dr Faraday recommends the heating of a cylinder machine by placing a chemical Argand lamp with a low flame beneath the cylinder, and to support a plate of metal nearly six inches square about an inch above the chimney of the lamp. This plate, by being heated, varies the air above it, and produces a large moderately heated current, which encircles the cylinder and thoroughly warms it. Care must be taken not to heat the cylinder in spots, but to bring it, and especially the insulating parts, to an uniform temperature, which shall never be sufficient to melt the cement which is used in any part of it.

The state of the rubbers requires particular attention. They must be carefully freed from dust, and supplied with a soft and uniform coating of amalgam, which should always be rubbed in a mortar with tallow previous to being used. Large spots of amalgam should be removed from the cylinder or plate, either by the nail or a piece of wood. Dr Faraday remarks that a few spots of amalgam rather increase than diminish the activity of the machine, and that the silk which proceeds from the rubber is better when impregnated with amalgam than when free from it. Dr Faraday adds that it is often useful to hold a piece of silk, with some amalgam adhering to it, against the revolving plate or cylinder, and also to rub the surface of amalgam on the rubber with the same amalgamated silk. When the machine is thus put into good action, and the prime conductor removed, it should discharge a continued series of brushes from the edge of the silk, and abundance of sparks flying round the glass.

Armstrong's Hydro-Electric Machine.

Armstrong's hydro-electric machine.

This powerful electrical machine, the history of which we have already given, is represented in the annexed figure, where AB is a steam-boiler made of the usual material, $6\frac{1}{2}$ feet long, and $3\frac{1}{2}$ broad, or of a less size if required. It is

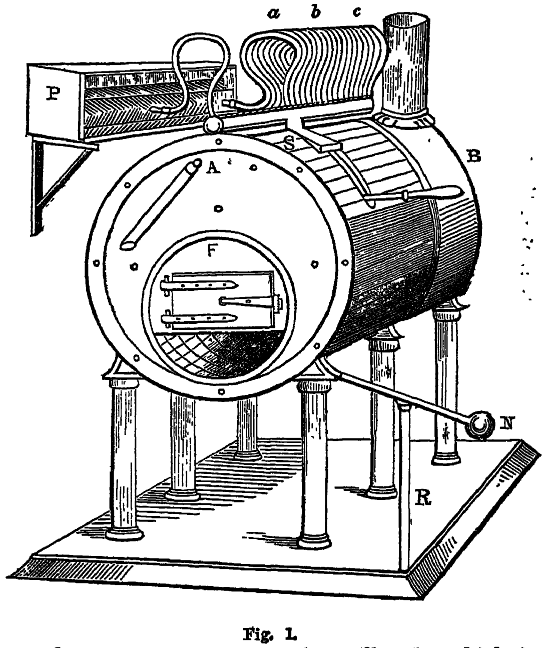


Fig. 1.

supported on four or six strong glass pillars by which it is insulated. The steam generated by the heat of the furnace F, escapes from the common steam pipe by a stop-cock S; and issues through a great number of bent iron tubes *a*, *b*, *c*, terminated in jets or adjutages of box-wood. A conductor N insulated by a glass rod R projects from the boiler, in order to collect from it the excited electricity, and another conductor P is placed in front of the jets to carry off the opposite electricity of the steam, and prevent it from neutralizing that of the boiler. The tubes are often inclosed in a box containing water for the purpose of cooling the tubes, which are kept wet, not by contact with the water, but by cotton threads which carry it up to them by capillary attraction. In this way minute drops of water are pro-

Electrical Apparatus.

duced, which being carried away by the steam produce the electricity by their friction upon the wooden adjutages. According to Dr Faraday, the steam performs no other part than that of making the particles of water rub upon the wood through which they pass. A magnificent hydro-electric machine has been erected at the Faculty of Sciences in Paris, with no fewer than 80 jets. Its enormous sparks succeed one another so rapidly as to form continuous and brilliant jets about a foot in length, and some inches in breadth.

Sect. II.—*Description of the Electrophorus.*

Electrophorus of Volta. Plate CCXXVII., fig. 9.

This ingenious instrument, which was invented by the celebrated Volta, is shown in Plate CCXXVII., fig. 9. It consists of a circular metallic disc A, or a plate of wood covered with tinfoil, having an insulating handle of glass screwed into a nut E, made of wood or brass. The plate A is called the *upper conductor*, or *cover*. The next plate B, called the *resinous plate*, consists of a plate half an inch thick, composed of equal parts of shell-lac, common resin, and Venice turpentine, poured when hot upon a marble or stone table. The next plate is a metallic one C, called the *lower conductor*, or *sole*, which may be either separate or not from the *resinous plate* which rests upon it. The edge of the first plate A must be pretty thick, and made smooth and round. The following is the method of generating electricity with this apparatus.

The *cover* A being held in the left hand, rub the upper surface of the *resinous plate* B with a piece of dry fur, or whip it with a fox's tail or stripe of cat's skin. It will thus be excited *negatively*. Place the upper conductor above the resinous plate, and while it is there touch it with the finger, and then raise it by its glass handle. It will exhibit signs of positive electricity, and will yield a spark either to the knuckle or to the knob of a Leyden phial. If the cover A is again placed upon B, and, after being touched, again raised, it will give another spark, and *twenty* of these sparks will charge a Leyden jar of a moderate size. If the upper conductor A is not touched by the finger when placed upon B, it will exhibit, when raised, very faint, if any, traces of electricity. Now, as the resinous plate B continues, without any new excitation, to charge the upper conductor A, it is manifest that its electric condition is not destroyed by the contact and removal of A; and as it is necessary to connect the upper conductor with the ground, by touching it previous to its being raised, it is obvious that the electricity acquired by A is derived from its contact with B.

Fig. 10.

In order to explain the theory of the electrophorus, let us insulate the *lower conductor* C, by placing it on a glass stand, as in fig. 10, and let this conductor communicate with the pith balls of an electroscope. As soon as the upper surface of the cake B is excited, the pith balls will diverge with negative electricity. The negative electricity developed by the excitation of the upper surface has decomposed the natural electricity of C, by attracting the positive part and repelling the resinous part into the electroscope where it is indicated. If we now touch the conductor C, its negative electricity is carried off, and the positive undergoes no diminution; but, owing to the escape of the negative portion, the balls will collapse. If we now make the upper conductor A approach to B, and rest upon it, touching it at the same time with the finger, so as to connect it with the ground, the positive electricity of the cake B will decompose the natural electricity of A, repelling its negative electricity to the earth through the finger, and attracting its positive portion to its lower surface. This positive electricity of A attracting the negative electricity of the surface of B, and repelling the vitreous electricity of C, thus doubly tends to diminish the force by which this positive electricity is rendered latent or detained. Some of it, therefore, will be set free, and the pith balls will diverge with positive electricity, the divergence increasing as the conductor A comes nearer and nearer to the plate B. But as the positive electricity of the lower conductor has a tendency to repel the positive electricity with which we wish to charge the upper conductor A, we must cause the lower conductor C to communicate with the earth, as in fig. 9. By this means the electricity of C is reduced to its natural state, and the electricity of the upper surface of the cake B renders latent the maximum quantity of positive electricity on the upper conductor B.

Fig. 9.

Although the air produces a gradual dissipation of the electricities which are not rendered latent in an excited electrophorus, yet a well-constructed electrophorus will remain for months in full energy.

Lichtenberg's electrical figures.

M. Biot has ingeniously applied the principle of the electrophorus to explain what have been called the figures of Lichtenberg. If, when the electrophorus is charged, we raise the conductor A, and replace it on the cake B, by making it rest obliquely and upon its edge, then its positive electricity, accumulating itself wholly in the part which touches B, will become much stronger. It will escape from A, and will completely neutralize the negative electricity of the places towards which it goes, and after some contacts thus repeated upon different parts of the cake B, it will be all discharged. Hence we may deduce the following curious experiment:—Instead of bringing back upon the negative electricity the positive which it has developed by its influence, carry it to another resinous cake B′, in its natural state. It will likewise attach itself to the surface of this cake, which will become positively electrified, and be capable in its turn of developing by its influence negative electricity. When the second cake B′ is thus charged, place upon its surface a disc of metal. We shall then have an electrophorus of an opposite kind to the first; and if this last is used to charge a third cake B″, the latter will have negative electricity; and in this way we may have any number of cakes, which will be electrified positively and negatively alternately. By this process we may electrify each surface only in certain parts, by attaching to the conductor A a rod and metallic button. If we then touch the resinous cake with this button, the electricity will be carried wholly to the point of contact. These points may be so chosen as to form the outlines of any regular or picturesque figures. In order to render these forms or pictures visible, we have only to strew on the surface of the resinous cake some light powder formed by a non-conducting substance, such as pounded resin or sulphur. The small particles of the resin, for example, will attach themselves only to the electrified spots; so that, by inverting the plate, all the rest will fall down by their own weight. These small particles affect regular and different arrangements, according to the nature of the electricity which makes them adhere; so that, by forming figures with the two electricities in different parts of the same plate, we obtain at the same time two sorts of figures.

Lichtenberg's method of making these figures visible is exceedingly beautiful. Having triturated sulphur and minium or red lead together in a mortar, so as to have a mixture of a yellow and red powder, he traced his figures on the resinous cake with the knob of a jar charged with vitreous electricity, and repeated them with the knob of a jar charged with resinous electricity. The compound powder being now projected, either with a powder puff or by means of a pair of bellows, upon the cake, the particles of sulphur which are electrified positively by trituration will attach themselves to the negatively electrified spots, while the negatively electrified particles of red lead will adhere to the positively electrified spots, so as to form a series of red and yellow figures when the cake has been inverted, and the rest of the powder has fallen from it. Many beautiful variations of this experiment have been devised;

Electrical Apparatus.

and Mr Bennet has shown how to make the figures permanent, by transferring them to paper.

When this experiment was first made, some German philosophers observed that the powder of rosin had sometimes a progressive motion which was not regular, and a new theory was the consequence of this. It was found, however, that they were very small insects of the genus *acarus* which happened to be in the powder, and which walked over the surface of the plate.

When well made and properly used, the electrophorus is a very powerful and useful instrument. Dr Klincock of Prague has shown, that if we transfer alternately the upper conductor from one resinous cake to another, and touch it after it is placed on the cakes, both cakes continually acquire more and more electricity, so that the upper conductor returns from either plate quite overcharged; and Leyden jars may be so strongly charged by them as to burst by the charge. The conductor returns from one plate charged with positive, and from the other charged with negative electricity.

M. Cavallo informs us that an electrophorus made of sealing-wax spread upon a thick plate of glass six inches in diameter was capable, when once excited, of charging a Leyden jar several times in succession, and so strongly as to perforate a card with the discharge. The upper conductor, when separated from the plate, was sometimes so strongly electrified that it darted strong flashes to the table upon which the electric plate was laid, and even into the air.

2. *Mr J. Phillips' Modification of the Electrophorus.*

Phillips' electrophorus. Plate CCXXVII., fig. 11.

As the contact of the operator's finger is of no other use than to connect the upper conductor with the earth, Mr John Phillips of York conceived the ingenious idea of producing the same effect by a momentary contact between the upper and under conductors. In effecting this he adopted three methods. The *first* consisted in raising a brass wire and ball from the lower conductor above the edge of the resinous cake, so that the edge of the upper conductor, or a brass ball upon it, may be brought in contact with it. This method answered very well with small instruments, in which the upper conductor can be easily directed to any particular point of the sole. In the *second* mode he fixed a narrow strip of tinfoil across the whole diameter of the resinous surface, so as to join the metallic sole or lower conductor. This construction answers perfectly, and is particularly suitable to large circles, whose upper conductors will infallibly touch some point of the metallic strip. The *third* method is to perforate the resinous disc quite through at the centre, and at any other point, and to insert in these perforations brass wires with their smoothest tops level with the resinous surface.

These three methods are represented in fig. 11, where *a* represents the ball in the *first* method, *b* the slip of tinfoil in the *second*, and *c, c, c* the conducting wires in the *third* and best method.

"On two of the largest electrophori," says Mr Phillips, "which I have made, both the second and third methods have been tried with equal success, but I much prefer the latter construction. The largest instrument has a cast-iron basis 20·5 inches diameter, resinous surface 19·75 inches, cover 16·25 inches. The resinous composition was made according to the directions in Mr Faraday's work on Chemical Manipulation. The cover is made of a plate of thin copper, strengthened at the edge by a thick brass wire, from which three radial brass wires pass to the upper part of a central brass tube. In consequence of the angle they thus form with the plane of the plate, they act as pretty strong braces to maintain its figure, and the whole is very light. This central brass tube receives a cylindrical piece of wood, into which the insulating glass handle covered with sealing-wax is screwed by its wooden foot.

"With ordinary excitation this instrument will yield loud flashing sparks two inches long or more, and speedily charge considerable jars. The cover can be easily charged and discharged fifty or a hundred times in a minute, by merely setting it down and lifting it up as fast as the operator chooses, or the hand can work. In charging a jar or plate, I placed one knob of the connecting rod near the insulated surface of the jar or plate, and the other some inches above the cover; then the cover being alternately lifted up and set down, the jar is very quickly charged.

"One instrument nine inches in diameter, which I have made from the second plan above described, has very often surprised me by its remarkable power of retaining electrical excitation.

"The following example is worthy of notice. Early in September 1832 this instrument was removed from a house in York, where it had been for some time laid by, and brought to my present residence, distant one third of a mile. It was placed on a shelf on my book-cases, where it remained untouched until the 23d March 1833, and was then taken down *covered with dust*. It was found to be in a state of feeble excitement, so as to give sparks, visible in the day light, nearly one fourth of an inch long."

3. *On Dr Faraday's Improvements on the Construction of the Electrophorus.*

Improvement on the electrophorus.

As the electrophorus is an excellent substitute for an electrical machine in the laboratory of the chemist, from its being capable, when in good order, of inflaming the greater number of explosive mixtures operated upon in eudiometers, Dr Faraday has given the following simple and ingenious methods of constructing this instrument.

He recommends the *cover* to be made of a piece of flat deal board one third or one half of an inch thick. This board is to be covered with pasted tinfoil laid on smoothly, particularly at the edges, and having all asperities rubbed down. The smoothest and flattest side being reserved for the lowest, a piece of glass tube seven or eight inches long is to be fixed on the centre of the other side for a handle; and towards the edge, on the same side, there should be fixed a piece of thick wire, about two inches long, bent outwards, and carrying a smooth metal ball at its upper end.

In order to make the resinous plate, a sheet of tinfoil one or one and a half inch wider than the cover is laid smoothly in the bottom of a flat dish, so that its edges may rise up all round, or in the inside of a hoop. Shell-lac, common resin, and Venice turpentine, in equal proportions, are then to be melted together in a metallic vessel, and kept in a state of fusion from 230 to 240 degrees of Fahrenheit, till the vapour has ceased to evolve, and the fluid is quiet. When it has thickened by cooling, it must then be poured quickly, to avoid the formation of bubbles, upon the tinfoil, so as to form above it a cake one third or one half of an inch thick. The tinfoil should then be trimmed round its edge, and the cake should rest upon or be attached, by its tinfoiled side, to a board, to serve as a base and prevent it from injury. Dr Faraday observes that the *cover*, instead of a board, may be a plate of tin turned up round a thick wire, so that no sharp edge or angle may be presented outwards; and that for the resinous plate may be substituted a sheet of thin crown glass, having for its metallic base a sheet of tinfoil pasted to it. He adds also, that a large plate of mica without fissures, and coated in the same manner with tinfoil on one side, makes an excellent electrophorus. When glass, however, is employed, it must be well warmed at first, and kept warm during the experiments. The glass should be excited by being *rubbed* with a piece of silk with some

Electrical Apparatus.

amalgam spread upon it. It should be passed briskly over its surface backward and forward, and finally slid quickly off at its edge, so as not to rest upon any one point of the glass, lest it should discharge that portion of its surface.

Use of the electrophorus.

To return, however, to the use of the electrophorus first described. The resinous plate, when warm and dry, should be placed horizontally on its board, with the tinfoil below, and connected by a wire or chain with the ground, or with a discharging train when it can be obtained. See page 596. A piece of warm flannel, doubled up loosely into a roll about ten inches long, is to be held in the hand by one end; and the other end, being swung round in an inclined direction with a quick motion of the wrist, should strike the surface of the plate obliquely each time it passes, so as to produce an effect between that of a rub and a blow. When the whole surface of the warm resinous cake has been thus struck, it will be excited to a considerable degree. The *cover* of the electrophorus, being previously warmed, must now be lifted by its glass handle and placed on the middle of the resinous cake; and if the knob or metallic ball of the cover be now touched, a spark will pass from it to the finger. The cover is next to be lifted by its handle in a horizontal direction; and when it is two or three inches above the plate, the knob upon it is again to be touched by the finger or a ball, when a spark stronger than the first will be obtained. The cover being again put down on the plate, a third spark will pass between the knob and the knuckle. The cover being again lifted as formerly, a spark as strong as the second may be taken from it. By repeating this process, similar effects may be obtained for a long time. The sparks which are taken by the knuckle after putting the cover down are negative, and those which are taken after lifting it up are positive. Hence we charge a jar either positively or negatively, according as we take the spark when the cover is up or down. In order to obtain strong positive sparks, the cover, when on the resinous plate, must be touched with the finger, which must be removed before the cover is lifted up; and to obtain the strongest negative sparks, the cover when raised should have all its electricity carried off by the hand or some other conducting body before it is again placed on the plate. As the cover ought to be in a state of good insulation, the handle should be made of sealing-wax and gum-lac, or if made of glass, it should be varnished with sealing-wax dissolved in alcohol.

SECT. III.—*Description of Conductors for bringing down Electricity from the Atmosphere.*

Conductors.

Various means have been adopted for collecting the free electricity of the atmosphere, either for the purposes of experimental investigation, or in order to defend buildings and ships from lightning. The apparatus for the first of these purposes is essentially different from that which is used for the last.

1. *Electrical Kites.*

Electrical kites.

When the lower atmosphere is charged with electricity, it is not difficult to collect it for the purposes of experiment; but in ordinary states of the air, or when the free electricity exists at some height above the earth, it is necessary to bring it down by means of a kite. For this purpose a schoolboy's kite is sufficient. It is only necessary to twist a copper wire round the hempen string. Dr Franklin covered the frame of his kite with a thin silk handkerchief, in order that it might the better sustain the violence of a thunder-storm. In order to compensate for this additional weight, he made the framework of two strips of cedar wood in the form of a cross. The string of the kite terminates towards the observer in a silk string or cord, which insulates the kite and its conducting string; and in order to protect the observer still farther, a safety chain has been sometimes suspended from the extremity of the conducting string, so as to reach the ground and carry off the electricity in case of its becoming too powerful.

Mr Cuthbertson sometimes found it necessary to use three kites all connected together. On one occasion when he could collect no electricity from the atmosphere with a kite having a string 500 feet long, he succeeded in obtaining it by adding other two kites, each of which had strings of the same length. Mr Cuthbertson likewise employed an apparatus for raising his kites, in which the strings were lengthened or shortened by coiling them round a drum.

2. *Exploring Conductors.*

Exploring conductors.

Read's hand-exploring rod.

One of the simplest instruments for collecting atmospherical electricity is the *hand-exploring* rod used by Mr Read. It was of the same material, length, and thickness as a common fishing-rod, and had small wire twisted round it from one end to another. Standing on an insulating stool, he raised the rod in a vertical position, and after a minute or two he touched with his other hand an electrometer, which indicated the nature and intensity of the electricity brought down. When the electricity thus obtained was very weak, he placed on the rod a lighted torch, keeping it as far up the rod as the strength of his arm would permit; and he always found that the flame attracted the electricity more powerfully than the end of the rod.

Read's fixed thunder rod. Plate CCXXVII. fig. 12.

Mr Read, however, found it necessary to use a fixed conductor or thunder-rod; and we have shown in Plate CCXXVII., fig. 12, the apparatus which he used in his experiments on the electricity of the atmosphere, of which we have already given some account. The principal part of it is a wooden rod AA, twenty feet long, one inch in diameter at the top, and two at the bottom. Into the lower end of it is cemented a solid glass pillar B, coated with wax, and twenty-two inches long. This pillar rests on a wooden pedestal C, carried by a bracket D. At thirteen inches above D, the rod passes through a glass tube F, coated with wax, and supported by a strong arm of wood E. A lining of cork lies between the rod A and the tube F, to prevent the latter from being broken when the rod is bent by the wind. Several sharp-pointed wires G stand out from the top of the tube. Two of them are of copper, about one-eighth of an inch thick, one of them being twisted round the rod to the right, and the other to the left, as shown in the figure, so as to reach the brass collar at the top of the lower funnel H, to which they are soldered. The use of the two funnels H, H is to defend the glass rods B, F from the weather. Through a hole in the wall at I passes a glass tube coated with sealing-wax, through which a strong brass wire passes from the rod at M into the room. At the end of the tube this wire passes through a brass ball L, two inches in diameter; and, after proceeding a little farther, it suspends from its extremity a pith-ball electrometer K, about twelve inches from the wall. A bell N, carried by a strong wire, is placed two inches from the brass ball L, three tenths of an inch in diameter, suspended from the nail O. The bell N, which has a metallic communication R with the moist ground, is rung by the ball L. Jars and other pieces of apparatus are placed when wanted upon the small shelf P; and all this part of the apparatus is protected from the weather by being inclosed in a wooden box.

Cavallo's atmospherical collector, fig. 13.

M. Cavallo's apparatus, called an atmospherical collector, merits a description here, on account of its simplicity and ingenuity. A common jointed fishing-rod AB, fig. 13, has its smallest joint replaced by a slender glass tube C, coated with sealing-wax. From a cork D at its outer end is suspended a pith-ball electrometer. A piece of string AHGI,

Electrical Apparatus.

is fixed to the end A of the rod, and supported at the point G by a piece of twine FG. When a pin at the end I of the cord is pushed into the cork D, the electrometer is uninsulated; but it is insulated for the purposes of observation in the following manner:—The pin being fixed in the cork D, and the rod held by the hand at A, it is held out of one of the highest windows. at an angle of about 50° or 60° to the horizon, and kept there for a few seconds. The cord is then pulled at H, so as to disengage the pin from the cork D, and the string drops into the dotted position KL, leaving the electrometer insulated and electrified in a state opposite to that of the atmosphere.

3. *On Lightning Conductors.*

Lightning conductors.

We have already seen that electricity is from various causes generated and set free in our atmosphere, and that individual clouds and masses of clouds are often highly charged with electricity, and insulated by the surrounding air. The earth and the sea are good conductors of electricity; and, generally speaking, their natural electricity is undisturbed. The attraction, therefore, of the electricity of the clouds for the opposite electricity in the earth or the sea, may become so powerful as to break through the resisting medium which intervenes. If the clouds are above a mountain or rising ground, this discharge of electric matter into the earth is attended with no danger. The effects have sometimes been traced in the fusion of portions of the rocks which crown these exposed summits. If a tree stands in the stratum of air through which the cloud discharges itself, the lightning passes through it, cleaving it, dissipating its sap into a visible vapour, and sometimes splitting the lower part of it into fibres like lucifer matches. If a house obstructs its path, the electricity descends through its walls, seeking the quickest and easiest passage to the earth. It will follow bell-wires, iron rods, damp walls, and gilded pictures, and find out any matter, whether organized or unorganized, living or dead, which is placed near its path and is capable of advancing it on its rapid and breathless errand to the earth. If a living animal grazing, or a human being walking, in an open field, intervenes between the overcharged cloud and the ground, the one or the other will become the chosen path of this irresistible foe. If a ship floats under an electrified canopy of vapour, it has less chance of escape than the tree, the house, or the living being.

The only terms upon which we can meet this relentless enemy, is a humble admission of its supreme and irresistible power, and a resolution to give it the freest and the fullest passport. We must supply it, in short, with a railway of metal, the only species of road upon which it can travel with a suitable speed, and a harmless intention. The moment it ceases to find a conducting body, it begins its devastation among imperfect or non-conducting substances, till it again gets into a safe and easy path.

The common practice of using cylindrical rods of copper or iron for conducting the lightning to the ground affords to buildings a very imperfect security. It has been supposed that such rods would influence the discharge from a cloud at a distance equal to two-thirds of the height of the rod, and therefore give protection to that extent. This, however, is not the case, for buildings have been often struck in one place when there was a conductor not very far from the spot that was struck; and, in the case of ships, the foremast has been frequently struck when a lightning chain was applied at the mainmast.

Lightning conductors for buildings.

In securing buildings, one or more capacious channels of conduction should be applied systematically to certain parts of them along the walls, terminating above in solid projecting points, and below by two or more branches under the surface of the earth. These main channels should consist of the best metallic conductors. Copper is to be preferred, and they may either consist of stout copper tubing, from an inch to 2 inches in diameter, and not less than $\frac{1}{8}$th of an inch in thickness; or otherwise, of copper plates, varying from 2 to 4 inches in width, and of a similar thickness. These may be carried down either within or without the building, as circumstances may require. When copper tubing is employed, the joints must be well secured over solid plugs by screw joints, and be firmly pinned to them. When plates are used, it would be desirable to place them in two layers, one over the other, so as to admit of the continuous portions of the one covering the joints of the other. The plates should be firmly united at the joints, and should be $\frac{1}{8}$th to $\frac{1}{16}$th of an inch in thickness. These lines of conduction should be secured immediately against the masonry, and not be placed at any distance from the building, or pass through rings of glass or other insulators, as is sometimes erroneously done. It is to be here remembered, that the materials of which a building consist are already conductors of electricity to a very considerable extent, and will of themselves allow large quantities of atmospheric electricity a fair passage to the earth. The object in applying metals along the walls is to complete the conducting power of the general mass up to the point required for a full transmission of a shock of lightning without intermediate explosion, and therefore the closer the conductor is applied to the walls the better. The notion of keeping the electrical discharge out of the building by insulating the conductor from its walls is evidently very futile, and can only arise out of a false view of the nature of the electrical discharge, which (as we have already seen experimentally) is determined to the surface of the earth in a path of least resistance, which the conductor itself supplies. We can not therefore imagine that the electrical agency will leave a good capacious conductor, immediately in its line of action, and in which the resistance is a minimum, to move in a bad conducting circuit out of that line, in which the resistance is a maximum. But if we were to admit that such an effect were possible, even then it is not to be supposed that a small mass of bad conducting matter, such as a small ring of glass or a little pitch, could arrest such a terrible agency in its onward course. An agency which can shiver immense oak trees, split solid rocks asunder, and break down half a mile thick of air, would scarcely be arrested by an insignificant mass of glass or pitch. It has been the custom in some instances to place balls of glass on the pinnacles of towers and on the masts of ships, under the impression that glass is a repeller of lightning, but it is evident that glass is no more a repeller of lightning than the air itself. The spire of Christ Church at Doncaster had a ball of glass placed on it, with a view to its security from lightning. In November 1836, however, it was struck by the electrical discharge, and the spire totally destroyed.[1]

The main conducting channels being complete to the earth and applied in selected positions in the way alluded to, we should be careful to link into connection with them, so far as possible, all the vicinal detached masses of metal in the building, either by branches or immediate contact; and in this way bring the general mass into that passive electrical state it would have as regards the electrical discharge, supposing the whole structure were metallic throughout, or at least as nearly as may be, so that in case of lightning striking with fury on any point of the building, the explosive action may vanish, and the discharge have unlimited room for expansion in all directions upon the surface of the earth to which it is always determined.

Lightning conductor for ships.

The necessity of providing against the destructive agency of lightning on ship board has been long felt. The continuous and fixed metallic conductors available for build-

[1] *Times* Newspaper, 7th March 1836.

Electrical Apparatus.

ings were not however equally applicable in ships, in consequence of the masts, the only parts to which they could be well attached, being subject to motion in a variety of ways, to frequent elongation and contraction, and to the necessity which frequently arises for removing the higher portions of the mast altogether. It was hence proposed to substitute long flexible chains, or links of copper about the size of a goose quill. These being supplied to ships packed in boxes, were hoisted up to the truck as occasion required, were stepped along the rigging, and allowed to hang overboard in the sea. Of late years copper wire rope has been somewhat extensively applied in this way as rigging, and there is little doubt but that these temporary forms of lightning conductors for ships may occasionally transmit very heavy shocks of lightning. Unfortunately, however, the many trying and variable circumstances under which a ship is placed—the liability of damage to the ropes and rigging, and the complication of changes to which the whole is subject, has, generally speaking, baffled all these attempts to secure ships against the electrical discharge; so that notwithstanding that ships have been commonly supplied with such lines of conduction, the amount of destruction in the royal navy and in the merchant service has been very frightful, as appears by parliamentary papers, printed by the House of Commons in December 1854. Hence the necessity of some more capacious and permanent security, and which from time to time has been repeatedly called for. Mr Singer, in his excellent work on electricity, suggested the possibility of joining continuous rods applied to the masts by flexible spiral wires, observing at the same time, "that the conductors employed to protect ships from lightning are by no means so efficient as requisite, that they are kept packed in boxes, so that, partly from inattention, and partly from prejudice, they frequently remain in the ship's hold unemployed altogether." But besides these mechanical objections, such temporary forms of conductors are not always secure on account of their small capacity. The Hotel des Invalides at Paris, having a conductor of twisted wire ropes was struck by lightning in June 1839, the wire was knocked in pieces and the building damaged.[1] The same thing happened in H. M. ship "Hazard," struck by lightning at Sarawak, Borneo, in June 1846. This vessel had a conductor of copper wire rope—the wires were twisted in pieces, torn from the ship's side; the electrical discharge divided between the main-mast and rope, a portion of it shivered the spars, and went into the hull. The commission appointed by the Board of Admiralty in 1838 under the countenance of the House of Commons, to inquire and report on the best form of lightning conductors for H. M. ships gave, in their report, many examples of the insufficiency of temporary conductors applied as rigging, to meet the exigencies of the case, and concurred fully in the opinion advanced by every practical seaman, that if lightning conductors be applied on shipboard, they should be applied under a capacious and permanent form, so as to render them secure and independent of the officers and crew of the ship.

Sir W. Snow Harris's inquiries.

About the year 1820, Sir W. Snow Harris having devoted himself to the investigation of the best means of guarding the royal navy from lightning, and the general laws of atmospheric electrical discharge, proposed to the Board of Admiralty a new method of capacious electrical conductors for ships, to be permanently fixed and systematically applied along the masts, and generally throughout the hull, so as to render the vessel secure from lightning at all times and under all circumstances, without the officers and crew of the ship incurring any responsibility whatever for due attention to their application or care in handling them under various trying circumstances, as in the case of the ordinary chains, and not unfrequently to their great peril and annoyance. Adopting the broad general principles we have already laid down as the true theoretical ones for lightning conductors, the inventor came to the conclusion that if a ship were perfectly conducting in all its structure, no damage could arise to it when struck by lightning; since at the instant of the electrical discharge falling on any point aloft, the explosive action would vanish, and would be converted into a comparatively quiescent current action with unlimited room of expansion upon the surface of the sea in all directions, that is upon one of the surfaces to which the discharge is determined.

Sir W. Snow Harris's ship-conductors.

In order to afford a ship effectual protection from lightning, Sir W. Snow Harris conceived it to be essential that the conductor be as continuous and direct as possible from the highest points to the sea; that they be permanently fixed in the masts throughout their whole extent, so as to allow one part of the mast to move upon another; and, if any part of the mast should be accidentally or wilfully removed along with the conductor attached to it, that the remaining portion of the conductor should still be perfect, and capable of transmitting an electrical discharge into the sea. To accomplish these objects, a sort of double conductor should be formed, consisting of two laminæ of sheet copper, placed one above the other, so that the extremities of the laminæ of one layer should be opposite the middle of the laminæ of the other layer. These laminæ are each about four feet long, from six inches to one and a half broad; the thickness of the under layer being one eighth, and of the upper layer one sixteenth, of an inch. The copper bands thus formed are fixed in a fine dove-tailed groove in the aft sides of the different masts, and are secured in their place by wrought copper nails, so as to form a smooth surface, the nails being driven at each side, so as to be about four inches apart. Before inserting the conductor, the groove should be painted over with white lead, and must be deep enough to allow the copper to lie a little beneath the surface of the wood. "The metallic line," says Sir S. Harris, "thus constructed, will then pass downward from the copper spindle at the mast-head, along the aft sides of the royal-mast and top-gallant-mast, being connected in its course with the copper about the sheeve-holes. A copper lining in the aft side of the cap through which the top-mast slides now takes up the connection, and continues it over the cap to the aft side of the top-mast, and so on as before, to the step of the mast; here it meets a thick wide copper lining, turned round the step, under the heel of the mast, and resting on a similar layer of copper fixed to the keelson; this last is connected with some of the keelson bolts, and with three perpendicular bolts of copper, of two inches diameter, which are driven into the main keel upon three transverse or horizontal bolts, brought into immediate contact with the copper expanded over the bottom. The laminæ of copper are turned over the respective mast-heads, and secured about an inch or more down on the opposite side; the cap which corresponds is prepared in a somewhat similar way, the copper being continued from the lining in the aft part of the round hole over the cap, into the fore part of the square one, when it is turned down and secured as before, so that when the cap is in its place the contact is complete. In this way we have, under all circumstances, a continuous metallic line from the highest points to the sea, which will transmit the electric matter directly through the keel, being the line of least resistance."[2]

[1] *Comptes Rendus*, 1839.

[2] "Since the mizen-mast does not step on the keelson, it will be necessary to have a metallic communication at the step of the mast, with the perpendicular stancheon immediately under, and so on to the keelson as before, or otherwise carry the conductor out at the sides of the vessel."

Electrical Apparatus.

This metallic line is shown in Plate CCXXVII., figs. 14, 15, 16, by the dotted line ABCD; and it will be seen that any elongation or contraction of the masts, as in figs. 14 and 15, or the removal of either of them, as in fig. 16, which brings them into a new position, will in no way disturb the continuity of the line ABCD, which evidently remains the same, and is therefore, under these different circumstances, the shortest and best conducting line between the mast-head at D and the sea at S. When the sliding masts are struck, a part of the conducting line necessarily remains below the cap and top; but as this is quite out of the circuit, it will not at all influence the passage of the electric fluid along the shorter line. For this invention Sir William Snow Harris has received from the government the sum of L.5000, a very inadequate reward for so great a service.[1]

Plate CCXXVII., figs. 14, 15, 16.

CHAP. II.—DESCRIPTION OF INSTRUMENTS FOR ACCUMULATING, CONDENSING, AND MULTIPLYING ELECTRICITY.

Instruments for accumulating electricity.

The instruments which have been employed for the purposes of accumulating, condensing, doubling, and multiplying electricity, may be divided into four classes:

1. Jars and batteries.
2. Condensers.
3. Doublers.
4. Multipliers.

SECT. I.—*On the Construction and Action of Jars and Batteries.*

Jars and batteries.

By means of the prime conductor of an excited electrical machine, we can obtain electricity in sufficient quantity and intensity for many important researches; but when we wish to accumulate it in great quantities, and to obtain a powerful charge, it is necessary to employ the Leyden phial or jar; and by increasing the number of jars, and uniting them together, we can accumulate electricity to an unlimited extent.

Electrical jar.

An electrical jar, in its best form, is shown in Plate CCXXVIII., fig. 1, where AB is a glass jar having its lower end CDEB coated both on the outside and the inside with tinfoil, which is made to adhere to the glass by means of gum water. The jar should have no cover, as it generally has, and the charge should be conveyed to the bottom of the jar by a copper tube FGH, three eighths of an inch in diameter. This tube terminates in a ball, F, of baked wood, and is kept in its place by a convenient foot, firmly cemented to the bottom of the jar, which is previously covered with a circle of pasted paper, leaving a central portion of the coating free for the perfect contact of the charging rod FGH, which passes through the centre of the foot, as shown by the dotted lines in the figure.[2] When the jars are either employed singly, or united so as to form a battery, they should be placed on a conducting base, supported by short columns of glass, or some other insulating substance, such as rosin or brimstone, so that the whole can be insulated when necessary.

Fig. 2.

In order to allow the jars to be charged and discharged with precision, Sir W. Snow Harris connects them with what he calls two centres of action, A, B, shown in fig. 2. The first of these, A, consists of a brass ball, which slides with friction on a metallic rod AD, so as to admit of its being placed at any required height. This ball has a number of holes perforated in its circumference, to receive the points of the rod or rods which connect it with the jar or jars. The rod AB which supports this ball may be either insulated on a separate foot, and connected with the prime conductor, or it may be inserted directly into it. The second centre of action consists of a larger ball of metal, B, attached to a firm foot, and placed on the same conducting base with the jar, so as to be perfectly connected with it. When the first centre of action, A, requires to have a separate insulation, the insulating glass rod is screwed immediately into the lower ball B, and sustains the metallic rod above described, by the intervention of a ball of baked wood, D, the opposite end of the rod terminating in a similar ball, C, through the substance of which the conducting communication with the machine passes when it is placed on a separate foot. All the metallic connection should be covered with sealing-wax, except at the points of junction, and the wooden balls and different insulations should be carefully varnished.

Electrical battery, fig. 3.

A battery constructed in this manner, and containing six jars, is shown in fig. 3, A and B being the two centres of action, and C and D the two balls of baked wood, as shown in fig. 2. The communication with the prime conductor is made by a wire CE passing through the ball C, and the jars communicate with the centre of action A by means of wires entering the ball A, as shown in the figure.

In order to charge the jar shown in fig. 1, it is only necessary to make the copper tube FG communicate with the prime conductor of the electrifying machine by means of a wire passing through F. It was formerly the custom to make the copper rod HG terminate above in a brass ball at F; and when this was the case the jar could be charged by bringing the ball F near the conductor, or by holding the jar by the outside coating, and bringing the brass knob close to the conductor.

When the jar is fully charged, it may be discharged by holding the outside coating in one hand, and touching with the other the copper tube FG, or the ball F if it is a brass one; but in this case the person will receive a shock, the electrical charge passing into his body. The jar may be discharged without receiving a shock, by a very simple instrument called a *discharging rod*, shown in fig. 4. It consists of two bent wires BC, BD, having a brass ball C and D at each end, and uniting at B, where they are fastened at their common junction into a glass handle AB. The operator takes hold of the glass handle, and placing the lower knob D on the outside coating of the jar, and the upper knob C in contact with the copper wire FG, or the brass ball at F, if there is one, the discharge takes place with a loud snap the instant that the knob C touches F.

Discharging rod, fig. 4.

Fig. 5.

A more convenient form of discharging rod is shown in fig. 5, where the two balls C, D, and the branches CE, DE, correspond to the balls C, D of the branches CB, DB, in fig. 4; but in place of attaching one insulating glass handle to the joint E, a separate glass handle, viz. A and B, is attached to each branch. By this means, by taking the handle A in one hand, and B in the other, we can open the balls C, D to the required distance without touching the metallic branches CE, DE, and also with greater facility and certainty.

If the jar is connected with the piece of apparatus BC, fig. 2, so that the centre of action A communicates with the internal coating of the jar, and the centre of action B with the external coating, then the jar will be discharged by making the knob D of the discharging rod touch B, while the knob C touches A. In like manner the whole battery in fig. 3 may be discharged by making the knob D of the discharging rod touch B, while the knob C touches A.

Henley's universal discharge. Plate CCXXVIII. fig. 6.

A general instrument for discharging jars and batteries, invented by Mr Henley, has been much used, particularly in the deflagration of metals by electricity. It is shown in fig. 6, where A and B are insulating glass pillars, cemented into a wooden stand. A brass cap with a horizontal and vertical motion is fixed on the top of each of these pillars;

[1] See the *Edinburgh Review*, Oct. 1844, vol. lxxxi. p. 442.

[2] The method of constructing the jars and batteries here described is that used by Sir William Snow Harris, and described in his valuable paper on the Laws of Electrical Accumulations.

and at the top of this joint is a spring tube, through which the handles D or C can be slid backwards or forwards. These handles are made of strong brass wire, terminating at one end in a ball, or point, or a pair of forceps, and at the other in a solid glass rod for an insulating handle. A small wooden table F, about five inches in diameter, has a slip of ivory glued into its upper surface, and may be raised or depressed in its socket by the screw-nut G. Sometimes a small mahogany press accompanies the instrument. It consists of two boards, which can be pressed together by two nuts, and is put into the socket in place of the table F, when it is necessary to fix or hold steady the body through which the discharge is to be passed. The body to receive the charge must either be laid on the table or fixed in the press, or held between the balls, points, or forceps. The two sides of the jar or battery are then connected with the two brass caps at the tops of the pillars A, B; and, by means of the insulating handles, the distance is regulated through which the charge has to pass.

This instrument was originally constructed without any insulating handles; and the wires, and the handles C and D, were thick brass wires, terminating on one side in a ball or point, and on the other in a ring of brass, with which the connection with the jar or battery was formed.

Coated plates of glass.

Although it has proved advantageous to use jars for receiving and accumulating electricity, yet this form of the recipient is by no means essential. The very same effect is obtained if a plate of glass is coated on both sides within an inch of its edges; for a jar may be considered as a plate of glass rolled up into a cylindrical form. Hence a battery may be composed of a number of coated plates of glass; and it was actually with one of this kind, consisting of eleven panes of window glass, that Dr Franklin performed most of his experiments.

When one of these panes of glass is fitted up as in the annexed figure, it is called the *sparkling pane*, or the *magic picture*, and is a good illustration of the Leyden jar. A sheet of tinfoil, TT, is attached to its two surfaces, leaving a space of two or three inches between the edges of the tinfoil and the edges of the plate of glass, both fixed in a frame. When one of the sheets is electrified, and the other is put in communication with the ground, a bright spark is obtained by making the two sheets communicate by means of a discharging rod. A Leyden jar or phial is therefore nothing more than a pane turned into a cylinder, the coating on the inside of the jar representing one side of the pane, and the outside coating the other.

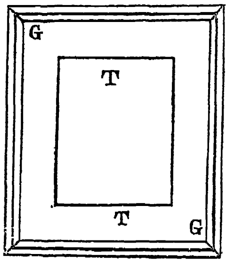


Fig. 12.

If, instead of the sheets of tinfoil, we cover the space which they occupy with metal filings stuck upon the glass by gum, and electrify one side as before, the discharge produced by the discharging rod will produce an infinite number of brilliant sparks passing from each metallic particle to its neighbours, and occasioning the sparkling from which the name is derived.

Franklin's theory of the Leyden phial.

Dr Franklin was the first person who explained the principle upon which the action of the Leyden jar depends. He began by examining the electricities of the inside and outside coatings. A cork ball suspended by a silk thread was attracted by the outside and repelled by the inside coating. When the jar was charged with the opposite electricity, the ball was repelled by the outside and attracted by the inside coating. Hence it follows that *the outside and inside coatings of a Leyden jar are charged with opposite electricities.*

When the inside coating was charged from the prime conductor, its electricity was positive, while that of the outside was negative; but when the outside of the jar was charged from the same conductor, the outside was positively electrified, and the inside negatively, and the charge was as strong as before.

In order to show that the negative electricity of the one coating was equal to the positive electricity of the other, Dr Franklin hung a small linen thread near the outside coating of a charged jar, and every time that he touched the knob or wire of the jar the thread was attracted by the coating, the electricity taken from the inside by the finger being equal to what was drawn in on the outside by the thread. He then repeated this experiment when the jar was placed upon an insulating stand, and he found that at every successive contact a portion of the electricity of the outside became free, and the linen thread sprang to the outside coating to receive and carry off the superfluous electricity.

Richman's experiment to show the equality of the two electricities. Plate CCXXVIII. fig. 7.

The equality of the two electricities is still more clearly evinced in the fine experiment of Professor Richman, shown in fig. 7. Having coated with tinfoil the opposite sides of a plate of glass AB, to within two inches of its edges, the glass was then placed vertically, and a linen thread *m* was suspended to the upper part of each of the two coatings. When the plate was not charged, the two threads hung down parallel to each other, and touched the tinfoil; but when the plate of glass was charged, the threads were repelled from the glass, and formed equal angles with it on both sides. When any conducting body, such as the finger, was brought near one coating, the thread on that side sunk, and formed a less angle with the glass, while the thread on the other side rose to a greater angle, the augmentation of the angle on one side being exactly equal to its diminution on the other. When the finger touched one coating, the corresponding thread fell down entirely, and the thread on the other side rose to a double elevation, so that the angle formed by the two threads was a constant quantity, depending on the intensity of the charge communicated to the plate.

Franklin's experiments. Fig. 1.

The next point of inquiry to which Dr Franklin applied himself, was to ascertain where the two electricities resided, and what was the function performed by each coating. Having charged a jar, and placed it on an insulating stand, he took out the ball F, and rod FH, fig. 1, and found that they did not contain any electricity. He then touched the outside coating with one hand, and putting the finger of another hand into the mouth of the bottle, he received a shock as powerful as if the ball and rod FH had been in their place. He next put into the phial some clean water, which, being a conductor, answers the same purpose as tinfoil, and having charged the jar, and poured out the water into an insulated bottle, he found that it would not give the shock. Upon filling the phial with fresh water, and without giving any new charge to the jar, he received a shock as at first, which clearly proved to him that the electricity resided in the glass. This important truth may be clearly established in the following manner:—Take a cylindrical jar, and let the outside and inside coatings of tinfoil be nicely fitted, and applied to the surface without any cement. When this jar is charged in the usual manner, place it on an insulating stand or a glass plate, and holding it by the uncovered part, lift out the interior cylinder of tinfoil without injuring its shape, and then lift the glass cylinder out of its exterior coating. If we now touch the outside of the glass cylinder with one hand, and at the same time the inside with the other, we shall obtain no perceptible shock. In like manner, no shock will be experienced by touching the outside coating of tinfoil with one hand, and the inside with the other, nor by touching either separately. But if the two coatings are again replaced on the glass cylinder, the one on the outside and the other on the inside, a shock will be obtained in the usual way. Hence it follows, as Dr Franklin concluded from the same experiment in another

Electrical Apparatus.

form, that the electricity is accumulated on the surface of the glass, and that the metallic coatings, or other conducting substances, which are placed in contact with both sides of the glass, perform only the function of forming a perfect communication between every point of the external with every point of the internal surface of the glass at the instant of the discharge.

Theory of the Leyden jar. Plate CCXXVIII. fig. 8.

In order to explain the theory of the Leyden jar, let us place a jar AB uncharged upon an insulating stand, and make its outside coating B communicate with a pair of insulated pith balls m, n, as shown in fig. 8. From the prime conductor convey a few sparks of positive electricity to the jar by the knob F, the pith balls m, n will diverge with positive electricity, owing to the decomposition of the natural electricity of the external coating. If we now touch the pith balls, the positive electricity which made them diverge will escape, and they will fall into their natural vertical position. But we have not thus removed all the positive electricity which was communicated to the interior coating. A portion of it has become *fixed* or *latent*, or *disguised* or *dissimulated*, which can only happen from the influence of a portion of resinous electricity. If we now touch, indeed, the brass ball F, the portion of positive electricity which remains free in the inside coating will cause the pith balls communicating with the outside coating to diverge with negative electricity.

Disguised electricity.

If, when the pith balls are divergent with positive electricity supplied from the conductor, we touch them so as to allow it to escape, the repulsive force which it exerted on that in the interior coating will cease, and the ball F and the interior coating will be capable of receiving an additional quantity from the conductor. The pith balls will again diverge with positive electricity; and if this be removed, the ball F will again be able to receive a farther supply from the conductor, so as to make the pith balls again diverge. The interior coating will be receiving more and more positive electricity, till its repulsive power becomes so great as to resist the introduction of any more. The jar is now charged, and will give a shock in the usual manner, or may be discharged by the discharging rod. Hence we may conclude that the positive electricity introduced into the inside coating of the jar decomposes the natural electricities of the outside, drives away from it the positive and fixes the negative electricity, which, by its reciprocal attraction, fixes also a part of it in its turn.

Plate CCXXVIII. fig. 9.

From the principles above established, it may be shown that a given quantity of electricity from the prime conductor may be made to charge two or more jars, almost as powerfully as if the whole quantity was communicated to one jar only. The jars being placed as in fig. 9, the electricity from the prime conductor is conveyed by a chain A to the ball B of the first jar. The ball F of the second jar has a similar connection with the coating of the first, and by a third chain the coating of the second jar is connected with the earth. When the inner coating of the first jar receives positive electricity, the outer coating has its natural electricity decomposed; the negative portion is fixed by the influence of the positive electricity within, and the positive portion is repelled to the interior of the second jar, where it does the very same thing which was done by the same electricity within the first jar. The positive electricity set free at the exterior of the second jar is repelled to the earth, and any requisite portion of negative electricity is conveyed to the outer coating of the same jar, in order to fix by its influence the positive electricity which arrives at the interior of the jar. If we now remove all the connections, the two jars will have received their full charge; and the same will take place with any number of jars similarly arranged for the purpose.

As the accumulation of electricity in a jar depends upon the mutual attraction of the two electricities, and as this force varies inversely as the square of the distance of the molecules, the intensity of charge which any jar can receive should increase with the thinness of the glass which separates the two fluids. Mr Cavendish inferred from his researches, that the intensity of the charge was inversely as the thickness of the glass; but we cannot avail ourselves of this principle in practice, as a certain thickness of glass is necessary to the due strength of the jar; and it has been proved by experiment, that when the glass is thin, the mutual attraction of the two electricities has been capable of forcing a passage through the glass itself. The common glass jars, therefore, are as thin as they can be made with perfect safety. Mr Brooke always placed a layer of paper between the tinfoil and the glass, for the purpose of enabling the jar to contain a charge of greater intensity.

An insulated wire in water a Leyden jar.

A very remarkable apparatus, similar to a Leyden jar, is made by a long wire insulated with gutta percha, and placed in water. We owe this beautiful experiment to Dr Faraday, who made it with a wire 140 miles long, one end of which communicated with a pile of 360 elements of zinc and copper, charged with acidulated water. The pile was perfectly insulated, and communicated with the ground by its second extremity. The insulation of the wire was so perfect that the remaining current produced only a deviation of 5° in the galvanometer. When the communication of the pile with the long wire was cut off, the following phenomena were observed. Upon touching with the finger either extremity of the long wire, a powerful sensation was felt, which was repeated after a great number of successive touches of the finger. The sensation was felt even after an interval of five minutes. If, instead of discharging the electricity with the finger, the wire is connected with a galvanometer, a very great deviation is produced, and is still perceptible half an hour after the pile is removed from the wire. All this is easily explained. *The wire is a Leyden phial!* The copper wire is the inside coating, the gutta percha is the glass, and the water the external coating; and when one end of the wire communicates with a source of electricity, it becomes charged. When the wire is placed in air the phenomena disappear. In one of Mr Faraday's experiments the wire was 1·6 millimetre in diameter, and the insulating layer of gutta percha 2·5 millimetres. Hence the interior coating of this species of Leyden jar had a surface of nearly 770 square metres, and the exterior coating a surface of 3050 square metres.

Cavallo's self-charging jar.

Before concluding this section, we shall describe a pretty little instrument invented by M. Cavallo, called the *self-charging* jar. Having procured a glass tube eighteen inches long and one and a half inch in diameter, coat one half of the inside of it with tinfoil, and close the aperture of the coated end with a cork, through which there passes a wire touching the inner coating, and terminating in a brass ball fixed at the uncoated end of the tube. If we now hold the uncoated part of the tube in one hand, and rub the outside of the coated part with the other, and after every three or four strokes touch with the rubbing hand the brass knob or ball, the hand will communicate to it a spark, and the inside coating will thus be gradually charged. If we now grasp the outside of the coated end with one hand, and with the other touch the brass ball, we shall discharge the tube and receive a shock.

The lateral explosion.

If we insulate a metallic tubular or solid rod rounded at the extremities, and about an inch or less in diameter, and place it against the external coating of a charged jar, and then place another metallic cylinder of five or six feet long within about half an inch of its opposite extremity, it will be found that at the instant of discharging the jar by means of a common discharging rod and a chain resting on the table near the outside of the jar, a small spark will be ob-

Electrical Apparatus.

served to pass between the insulated conductor, touching the outer coating of the jar, and the conductor near its opposite extremity. Or if we connect a piece of metallic chain any how with the outer coating, and discharge the jar through another circuit independent of the chain, then at the instant of the discharge the links of the chain will appear luminous, showing that some kind of electrical action has been produced in it. This phenomenon has been called "Lateral Explosion," and as it has been sometimes associated with the passage of lightning along lightning conductors, it will be requisite to see in what this kind of electrical action consists. The most critical analysis as yet made of this phenomenon appears in a paper by Sir Snow Harris in the London and Edinburgh Philosophical Magazine for December 1839, to which we must refer the reader.

Sect. II.—*On the Construction of Condensers of Electricity.*

Condensers of electricity. Plate CCXXVIII. fig. 10.

An apparatus for condensing electricity in a conducting body was the undoubted invention of M. Æpinus, who also gave the true theory of its action. Volta, however, had the merit of first applying it to an electrometer for indicating small quantities of electricity.

The condenser shown in fig. 10 consists of two separate parts, the first of which is a metallic disc B, supported by a metallic stand BD, and the second is a similar disc A, having a glass handle C rising from its tube, and a small metallic pin and knob P projecting from its circumference. The upper surface of the plate B and the lower surface of A are covered with a thin film of a non-conducting substance, such as varnished silk, rosin, or glass. If it is now wished to condense any feeble electricity from any body, as, for example, from a feebly electrified conductor, bring the metallic pin P into contact with the body or electrified conductor; and while it is in contact let the metallic disc B be brought close under it, as in the figure, the varnished surface of A resting on the varnished surface of B. In this state withdraw the whole from the prime conductor; and having removed the plate B, apply the plate A to two suspended pith balls, which will separate to a very considerable angle in consequence of the electricity having been condensed by the contact of the disc B. That this is the case may be readily proved by applying A to the pith ball before the disc B was joined to A, when their divergence will be greatly less than before. The explanation of this is very simple. The positive electricity, for example, conveyed by the prime conductor to the plate A decomposes the natural electricity of B. The positive portion of B is repelled to the earth by the similar electricity in A, while the negative portion is attracted to the upper surface of B by the opposite electricity in A. In this position it is capable of attracting to the inner surface of A an additional quantity of the free electricity in the prime conductor; and this additional quantity will in its new position produce a farther decomposition of the natural electricity of C. All these effects will take place simultaneously till an equilibrium is established between the free positive electricity supplied to A by the prime conductor, and the negative electricity which the attractive force of this electricity can draw from the earth.

It is manifest, from these observations, that the principle of the condenser is exactly the same as that of the Leyden jar. The upper disc A which receives the electricity corresponds with the inner coating of the jar, the under disc C with the outer coating, and the film or films of rosin, &c. with the glass of the jar.

Volta's condensing electrometer, fig. 11.

The condensing electrometer of Volta is shown in fig. 11, where CAB is the condenser above described. From the lower side of the plate B are suspended, by two metallic wires, two perfectly even and straight straws m, n, and on the mouth of the bottle DEFG is fixed the disc B, so that the two straws hang freely in the axis of the neck of the bottle. A graduated circle seen below mn is pasted on the outside of the bottle, to estimate the angular separation of the straws, which affords a mean of the electricity condensed in the manner already described.

Cuthbertson's condenser, fig. 12.

Mr Cuthbertson's condenser, shown in fig. 12, consists of two flat circular plates of brass, A, B, about six inches in diameter. The receiving plate A is supported by a glass pillar, firmly fixed to a wooden stand, while the condensing plate B is sustained by a brass pillar, but so as to move round a joint at its lower end, in order that it may be thrown back into the dotted position shown in the figure. When the plates stand parallel and vertical, the receiving one A is connected by a wire with the body whose electricity is to be condensed. In this state it is allowed to continue for a short time, when the wire is removed and the plate B thrown back into the dotted position. The electricity will then be found condensed in the plate A.

Fig. 13.

When this instrument is applied to an electrometer, as in fig. 13, it forms an excellent condensing electrometer; and the effect may be greatly increased by uniting Cuthbertson's condenser with that shown in fig. 13. This may be done by merely uniting the moveable plate of the former to the fixed plate A of the latter by a small brass pin.

Nicholson's spinning condenser, fig. 14.

Nicholson's spinning condenser, which is a very ingenious instrument, is shown in fig. 14, where A is a metallic vase, which revolves about a steel axis EK, whose pivot K runs in the adjustable socket C at the bottom of the stand H. A circular disc of glass D, one and a half inch in diameter and two-tenths thick, is fixed to the vase A, and revolves along with it, while a similar plate E is fixed on the top of the stand H. These two discs are shown separately in fig. 15. In the edge of the plate E are drilled two holes to receive metallic hooks F, G, and into the edge of the upper plate D are cemented two small tails of the flattened wire used in making silver lace. These tails are bent down so as to strike the hooks F, G during their revolution, without touching the rest of the apparatus. The two adjacent faces of the glass discs are coated with segments of tinfoil, as shown in fig. 15; and they may be set at any distance by means of the screw C. Each tail communicates with the tinfoil coating of D; the hook F communicates with that of E, but the hook G is insulated so as to communicate only with the electrified body. The coating of E communicates with the earth by means of the stand H.

Fig. 15.

If the vase A, the plate D, and the axis EK, are now set a spinning by the action of the finger and thumb applied at T, one of the tails will strike the hook G, and receive through it from the electrified body some of its electricity, which it will convey to D, which will thus assume the electric state of the body. The tail which has struck G proceeding onwards, will after half a revolution touch F, and will convey the free electricity received at G to the two coatings, which with the hook F constitute one insulated mass. The tail advances, acquires more electricity from G, deposits it at F, and thus condenses it, on the principle of the common condenser, till it is capable of affecting the pith balls at F. The instrument constructed by Mr Nicholson was five inches high, and condensed very small degrees of electricity.

Sect. III.—*On the Construction of Electrical Doublers.*

Electrical doublers.

This class of instruments operate by continually doubling small quantities of electricity till the common electrometer is capable of indicating its presence and qualities.

Bennet's doubler.

The doubler invented by Mr Bennet consists of three plates, A, B, and C, fig. 16. The plate A, which is of brass,

Electrical Apparatus.

has an insulating handle rising from its centre; the plate B, which is also of brass, has a similar handle fixed in its circumference. The third plate, C, also of brass, is placed on Bennet's gold-leaf electrometer. The under side of A, the upper side of C, and both sides of B, are varnished. The body whose electricity it is required to double is brought into contact with the under side of C, which rests on the cap of the electrometer, while B is touched with the finger of the other hand. The communication with the electrified body being broken off, B is lifted up by its glass handle. If the electrometer leaves do not diverge, A is placed by its handle upon B, thus lifted up; and A being now touched by stretching a finger over the juncture of its insulating handle and immediately withdrawing it, A is separated from B. In this situation two of the plates have obviously nearly equal quantities of one kind of electricity, while the third plate has the opposite kind. The plate A is then made to touch the under surface of C, resting on the electrometer, and at the same time C is covered with B. The plate B is now touched by the finger as A was; and removing A, and withdrawing the finger from B, and lifting it up from C, the electricity is doubled. By repeating this operation ten or twenty times, which may be done in forty seconds, the electricity will, by continual duplication, be augmented 500,000 times When sparks are required, C must rest on an insulating stand in place of the electrometer.

Bennet's doubler. Plate CCXXVIII. fig. 16.

It was found by Mr Bennet, Cavallo, and others, that the doubler became strongly electrified even when no electricity was communicated to it. To remove this evil, M. Cavallo used three plates without varnish, and he placed them on insulating stands, so as to have a vertical direction, and to stand within one-eighth of an inch of each other, the plates of air being a substitute for the varnish. The method of doubling is exactly the same as before. Dr Robison adopted the same idea, but he kept his plates horizontal, making them rest on each other by three small spherules of glass or sealing-wax. Notwithstanding these precautions, however, electricity was still produced.

In order to perform the operation of doubling with more rapidity, Dr Darwin proposed the *moveable doubler*, or one in which the plates could be moved by wheel-work into their proper positions. Dr Nicholson improved upon this idea by producing the whole effect with the simple revolution of a winch.

Nicholson's revolving doubler. Plate CCXXVIII. fig. 17.

This *revolving doubler*, as it has been called, is represented in fig. 17. It consists of two fixed plates of brass A, C, two inches in diameter, insulated separately, and placed in the same plane, so that a revolving plate B may pass near them without touching. A brass ball D is fixed on the end of the axis which carries B, and is loaded within at one side so as to counterpoise the plate B, and allow it to rest in any position. The axis PN, and the axes that join the three plates with the brass axis NO, which passes through the brass piece M, by which the plates A and C are supported, are made of varnished glass. One end of this axis carries the ball D, and the other is connected with a rod of glass NP, upon which the handle L is fixed, and also the piece GH insulated separately. The pins E, F rise from the back of the plates A, C, at equal distances from the axis. The arm K is parallel to GH, and the ends of both are armed with pieces of harpsichord wire, so as to touch the pins E, F in certain points of their revolution. A pin I is fixed on M to intercept a small wire proceeding from the revolving plate B. These wires are so bent that, when B is opposite to D, GH connects the two fixed plates, A, C, while the wire and pin at I connect the ball D and plate B. On the other hand, when B is opposite C, D is connected with C by the contact of F with the wire at K, the plates A, B being then entirely unconnected with any other part of the instrument. In all other positions the three plates and the ball D will have no connection with each other. The operation of this instrument is thus described by Mr Nicholson: "When the plates A and B are opposite to each other, the two fixed plates A and C may be considered as one mass, and the revolving plate B, together with the ball D, will constitute another mass. All the experiments yet made concur to prove that these two masses will not possess the same electric state; but that, with respect to each other, their electricities will be *plus* and *minus*. These plates would be simple, and without any compensation, if the masses were remote from each other; but as that is not the case, a part of the redundant electricity will take the form of a charge in the opposed plates A and B. From other experiments, I find that the effect of the compensation on plates opposed to each other at the distance of one-fortieth part of an inch is such that they require, to produce a given intensity, at least a hundred times the quantity of electricity that would have produced it in either singly and apart. The redundant electricities in the masses under consideration will therefore be unequally distributed; the plate A will have about ninety-nine parts, and the plate C one; and for the same reason the revolving plate B will have ninety-nine parts of the opposite electricity, and the ball D one. The rotation, by destroying the contacts, preserves this unequal distribution, and carries B from A to C, at the same time that the tail K connects the ball with the plate C. In this situation the electricity in B acts upon that in C, and produces the contrary state by virtue of the communication between C and the ball; which last must therefore acquire an electricity of the same kind with that of the revolving plate. But the rotation again destroys the contact, and restores B to its first situation opposite A. Here, if we attend to the effect of the whole revolution, we shall find that the electric states of the respective masses have been greatly increased; for the ninety-nine parts in A and in B remain, and the one part of electricity in C has been increased so as nearly to compensate ninety-nine parts of the opposite electricity in the revolving plate B, while the communication produced an equal mutation in the electricity of the ball. A second rotation will of course produce a proportional augmentation of these increased quantities, and a continuance of turning will soon bring the intensities to their maximum, which is limited by an explosion between the plates."

Ronalds pendulum doubler. Plate CCXXVIII. fig. 18.

An ingenious instrument, called a *pendulum doubler*, has been recently constructed and described by Mr Ronalds. Having found it necessary to keep a telegraphic wire constantly electrified with a very small source of electricity, he converted the bob of a pendulum into the centre plate of a doubler, and he found the instrument thus modified not only useful for that purpose, but also for that class of experiments, such as those on vegetation and animal life, which require a constant supply of small quantities of electricity to repair the loss occasioned by unavoidable defective insulation, either in the glass which is used, or in the surrounding atmosphere. This improvement on the doubler is shown in fig. 18, where A and B are the two fixed plates, about 4 inches in diameter, supported by glass pillars; C is the bob carried by the pendulum rod D, and insulated by the piece of glass *e*. The form of the bob C is that of a plano-convex lens, with its interior filled with lead; *f* is a small cylinder connected to C with screws, which also adjust the plane of C parallel to the plane of vibration; *g* is another insulating glass rod, carrying the bent wire *h*, the left end of which lies nearly in the same vertical plane as the end of the wire *m*, the right end being nearly in the same plane as the end of the wire *n*. A wire, *i*, rises perpendicularly from C; and another, *k*, perpendicular to the plane of vibration, is fixed into the brass cup at the end of the pendulum rod. A wire,

Electrical Apparatus.

l, is screwed into the edge of the plate B, and the long wire *m* is fixed on the lower edge of B, so as to approach within a small distance of A, where it is bent at right angles, and then projects in a plane perpendicular to that of vibration. Another wire, *n*, is fixed into the edge of A, so as to bend and project similarly; but *n* projects farther than *m*, that the right side of the bow *h* may pass the end of *m* without touching it. A wire, *o*, is fixed at right angles into the base of the instrument.

When the bob C is exactly opposite A, the insulated wire *h* touches simultaneously the ends of the wires *m* and *n*, and establishes a communication between A and B, while at the same time the wire *i*, by touching *o*, forms a communication between C and the ground. Now, if a quantity of *positive* electricity, for example = 1, is given to A or B when the centres of A and C are opposite to each other, that quantity will be nearly all condensed on A, and C will acquire *negative* electricity nearly = 1.

"If C," says Mr Ronalds, "be now allowed to begin its vibrations, the connection of A and B with each other will be instantly broken, as also that of C with the earth, and they will be all insulated, and all retaining the electric states which they possessed before the connections were broken (*i.e.*, A will be positive nearly = 1, B negative nearly = 1, and C positive almost 0).

"When C has arrived opposite B, the *uninsulated* wire *k* will touch the wire L, and thus place B in connection with the earth; therefore C, by virtue of its negative charge, will induce a positive charge in it nearly = 1.

"When C arrives a second time opposite to A, all the former connections will be re-established, and the charge of B will (by means of the wire *m*) be nearly all condensed on and added to the original charge of A, making a tension nearly = 2 of positive electricity, which tension will induce a tension of nearly = 2 of negative electricity on C.

"And so the charges in A and C would go on, nearly *doubling* at each vibration of the pendulum, until their tensions would arrive at such a point as to cause a spark to pass between them.

"But P is a Leyden jar furnished with a Lane's discharging electrometer *q;* a connection is established by means of a small chain between it and A; and the distance between the two balls *r* and *s* is considerably less than that between A and C; therefore the spark will be given to the jar, and a spark will be continued to be given at the completion of almost every second vibration, until it is charged almost as highly as A is capable of being charged, or the sparks will continually supply the loss of electricity by any defect of insulation, either of the jar, or of any conducting body in connection with its interior coating within certain limits.

"The contacts of the wires do not impede the velocity of the vibrations, because they are made small enough to act as springs of a required force; but the electric attractions of the plates and bob *do* tend to do so. The pendulum is suspended by two springs, placed one at each extremity of a cross piece, to which the rod is attached, for the purpose of preventing the bob from being drawn, by their attractions, out of its assigned plane of vibration, as much as possible."

SECT. III.—*Description of Instruments for Multiplying Electricity.*

Multipliers of electricity.

The electrical multiplier invented by M. Cavallo is shown in fig. 19, on a scale about one-third of its real size, and is chiefly useful in ascertaining the presence of a considerable quantity of electricity occupying an extended space. Its principal parts are four plates of brass A, B, C, D. The plates A, C are supported by two glass rods G, H, fixed in the wooden base RSQ. A similar plate B is supported by another glass rod I, cemented into the wooden lever LK, moving round a pivot K. The fourth plate D is supported by a metallic rod. By the lever KL the plate B can be moved from its position on the figure into the dotted position KX. The plate D is screwed at P into a piece of brass FP, which slides in a groove, so that D can be pulled out to any distance from C. At the corner Q is fixed a brass rod N, and O*m* is a small bent wire fixed to the brass socket O on the back of B. When B is as near as possible to A, their distance being one-twentieth of an inch, this wire *m* touches the rod N, and forms a communication with the earth; when FP is pushed in as far as possible, the surfaces of C and D are one-twentieth of an inch distant. As the lever KL moves towards X, the end *m* of the wire *m*O quits N and insulates the plate B; and when the lever has the position KX, the wire *m* will touch the plate C, so as to put the insulated plates B into communication with each other.

Cavallo's multiplier. Plate CCXXVIII. fig. 19.

If a body weakly electrified positively is now made to touch A, when A and B are placed together as in the figure, A will acquire a greater quantity of positive electricity from the presence of the uninsulated plate B, which will be negatively electrified. When KL comes into the position KX, so that B touches C by the wire *m*O, its negative electricity will pass almost wholly to C, owing to its proximity to D, which communicates with the ground. By a number of successive oscillations of the lever between the two positions KL and KX, this operation may be repeated till an accumulated charge of negative electricity has been fixed upon C. The plate D must now be drawn away from C by means of the slider FP, and if pith balls are presented to C they will diverge with negative electricity.

Schweigger's multiplier.

In our chapter on the chemical agencies of electricity, we have already described Schweigger's multiplier or galvanometer, which was used by M. Colladon in his experiments on the chemical action of ordinary electricity; and also the multiplier of Dr Faraday with a double helix, which he employed in his researches on the identity of the electricity of the machine with that of the pile. Various improvements have been made on the multiplier by M. Nobili, Professor Oersted, and others; but we must reserve our account of them for the articles GALVANISM and MAGNETO-ELECTRICITY.

CHAP. III.—DESCRIPTION OF INSTRUMENTS FOR INDICATING THE PRESENCE OF ELECTRICITY, AND MEASURING ITS QUANTITY.

Indicators and measurers of electricity.

Instruments which are intended merely to indicate the presence of electricity are called *electroscopes*, while those which are intended for measuring the quantity of electricity are called *electrometers*. The earliest electrometer which seems to have been employed was a pair of silk threads, which indicated the presence of small quantities of electricity by their divergence; and the Abbé Nollet even attempted to measure the quantity communicated to them, by determining the inclination of the two threads, from their shadow on a board. Mr Waitz improved the instrument by suspending small weights to the threads, and Mr Canton perfected it by substituting the finest linen threads for the silk ones, and by suspending from them a pair of small balls turned out of the dry pith of the elder.

Description of Cavallo's Electroscope.

Cavallo's electroscope.

M. Cavallo made this little instrument portable by fitting it up as in fig. 1, where it is shown in a state of action at

Electrical Apparatus.

B. When it is unloosed, the end B carrying the pith balls is screwed off. and the balls are put into the glass tube at A, which serves for a handle. This glass case is three inches long and three tenths of an inch wide, and half of it is coated with sealing-wax. A cork tapering at both ends is made to fit the mouth of the tube, and to one end of the cork are fixed two linen threads carrying two small cones of elder pith. The case of the electrometer at C incloses at one end a piece of amber for giving negative electricity, and at the other end a piece of ivory insulated upon a bit of amber for giving positive electricity, to the balls, when rubbed with a piece of woollen. All these instruments may be greatly improved by substituting for the pith of elder the pith of the sola, a tree which grows in the East Indies.

Cavallo's electroscope. Plate CCXXIX., fig. 1.

Description of Bennet's Gold-Leaf Electrometer.

Bennet's gold-leaf electrometer, figs. 2, 3.

One of the most useful electrometers is that which was invented by Mr Bennet, and called the gold-leaf electrometer. This instrument, which is shown in fig. 2, and a section of it in fig. 3, consists of a cylinder, ABED, with a broad brass cap, AB. In a hole, *a*, in the centre of the cap, is fixed a wedge of wood, on each side of which is fastened by a little varnish a smooth-edged strip of gold leaf, shown at *m* and *n*, about two inches long and a quarter of an inch broad. Two pieces of tinfoil, *b*, *c*, are pasted opposite each other, and within the cylinder, so as to rise a little higher than the ends of the gold leaves, and the lower ends of these pieces of foil are in contact with the brass stand DEF which sustains the instrument. The inside of the cap AB, and the upper part of the glass cylinder, are sometimes coated with wax. A pointed wire, C, is used to collect the electricity af the atmosphere. In using this instrument, the cap AB is turned round till the surfaces of the gold leaves are parallel to those of the pieces of tinfoil. When no electricity is present the two gold leaves hang in contact in the axis of the cylinder; but if a fully electrified body is made to touch the cap AB, the gold leaves *m*, *n* will diverge as in the figure, and their lower ends will strike the pieces of tinfoil *b*, *c*, which will convey the electricity to the ground.

Mr Nicholson has proposed to substitute two flat radii of brass in place of the tinfoil, and by moving them to and from the gold leaves with a micrometer screw, to make the instrument more sensible, and at the same time obtain a kind of measure of its quantity.

Singer's Improved Electrometer.

Singer's improved electrometer. Plate CCXXIX., figs. 4, 5.

Although insulation may be procured by coating glass insulators with wax, yet, as Mr Singer observes, this affords only a temporary defence, as moisture is eventually precipitated upon them; and in removing this it is almost impossible to avoid exciting the surface of the wax, and disturbing delicate experiments by the electricity which is thus generated. To remove this evil Mr Singer proposes to inclose the insulator in a narrow channel, as the moist air in contact with it would be then limited in quantity, and little disposed to motion. In applying this principle to the improvement of Bennet's electrometer, the insulation is effected by a glass tube four inches long and one-fourth of an inch internal diameter, coated out and in with sealing-wax, and having a brass wire five inches long and one-sixteenth or one-twelfth of an inch thick to pass through its axis, so as to be perfectly free from contact with any part of the tube, in the middle of which it is fixed with a plug of silk, which keeps it concentric with the internal diameter of the tube. This arrangement is shown in figs. 4, 5, where A is a brass cap screwed upon the upper part of the wire

Figs. 4, 5.

w, which prevents the atmosphere from having free contact with the outside of the tube B, and defends at the same time its inside from dust. To the lower end of the wire the gold leaves are fastened, and the glass tube passes through the centre of the usual cap of the electrometer, and is cemented in it near the middle of its length, as may be seen by the dotted lines which represent the cap. "When this construction," says Mr Singer, "is considered, it will be evident that the insulation of the wire, and consequently of the gold leaves, will be preserved until the inside as well as the outside of the glass tube is coated with moisture; but so effectually does the arrangement preclude this, that some of those electrometers that were constructed in 1810, and have never yet (1814) been warmed or wiped, have still apparently the same insulating power as at first." The electrometer constructed upon the preceding principles is shown complete in fig. 4.

Fig. 4.

Dr Faraday's instructions for using electrometers.

Dr Faraday recommends strongly the use of this electrometer; but having found from repeated experience that its indications are not in general well understood by those who have occasion to use it, he has given a very valuable description of the kind of charge which it receives under different circumstances, and the precautions which are necessary in interpreting its indications. As this description would lose its value by any abstract or alteration, we shall make no apology for giving it in his own words, especially as it is applicable to many other analogous instruments.

"If an insulated portion of conducting matter, as a brass ball at the end of a glass handle or silken thread, be electrified, and then placed in *contact* with the cap of the electrometer, the cap and leaves will immediately partake of the electricity of the ball, and the leaves will diverge. If the charge in the ball be of considerable intensity, the leaves will be torn to pieces by their mutual repulsion, and the attraction of the sides of the glass jar; but if the intensity be small, the leaves will diverge moderately, so as not to touch the glass, and the degree of divergence will be in some proportion to the intensity of the charge communicated. The appearances will be the same whether the electricity communicated be positive or negative.

"The circumstances will be different if the body brought in contact with the electrometer is an electrified portion of what is usually called non-conducting matter; if, for instance, it be a stick of sealing-wax rubbed with flannel, instead of a metallic ball. If highly electrified, this will cause the same disturbance and appearance in the leaves during its approach as the ball; if moderately electrified, it will, when in contact with the cap, cause the usual appearance of divergence in the leaves, but upon removing it, the leaves, instead of remaining diverged, will either collapse, or remain very slightly, and frequently uncertainly, electrified. This is a consequence of the non-conducting power of the wax; and the method of transferring electricity to the electrometer in such a case is, to draw the excited parts of the wax over the edge of the cap; small portions will be communicated, and the electrometer will be left electrified similarly to the wax. Such a process is, however, very uncertain; for if the electricity of the wax be weak, the friction of the substance against the electrometer cap will sometimes generate an electricity stronger than that previously existing on the surface of the wax, and the electro meter will become charged, not by the previous electricity of the wax, but by that produced during its friction against the cap.

"This difficulty may, however, be avoided in most circumstances, simply by bringing the electrified non-conductor into contact with the cap, and retaining it there during the experiment; for the electricity which in this way is made by *induction* to exist in the leaves, and causes their divergence, is the same as that which would exist over

the whole of the cap and leaves, if the electricity of the wax could be transferred to them.

"Such are the circumstances relating to the charge of the electrometer, by bodies brought into *contact* with it, and communicating to it part of the electricity they previously possessed. As before mentioned, when highly electrified, they cannot be so applied to the instrument without tearing the leaves to pieces; but they may then, when held at a distance, be made to diverge the leaves by *induction*, and even to communicate a charge to the instrument, and thus enable it to exhibit divergencies when the inducing electrified body is removed. The effects thus produced by induction are the same in kind, and nearly in extent, whether the electrified body be a mass of conducting or non-conducting matter, so that in this respect the metallic ball and the stick of wax are equal; the only difference being in the kind of electricity produced, which, with bodies charged positively, is the reverse of that occasioned by such as are charged negatively.

"When an electrified substance is placed at such a distance from the cap of the electrometer as to occasion considerable divergence, and is retained there for a few minutes, the divergence of the leaves will generally diminish, and the more rapidly as the instrument becomes cold or the glass damp, as the leaves are ragged, or any part of the cap angular and pointed.

"On removing gradually the electrified substance to such a distance that it can no longer affect the instrument, it will be found that the leaves will collapse at first, and afterwards expand again more or less, according as they had lost more or less of their first divergence.

"This ultimate divergence of the leaves will be due to a charge of electricity in the instrument, of the *opposite kind* to that of the inducing or approximated body.

"If no effect of this kind takes place, and there be no diminution of the first divergence, nor any ultimate change, then the insulation and goodness of the electrometer is proved by a powerful test. This being ascertained, then, if whilst the electrified body is in the neighbourhood, and the leaves diverged, the cap be touched by the hand, or any other conducting substance communicating with the earth, the divergence of the leaves will instantly cease. In this state of the instrument, if the communication be broken so as to leave the cap and leaves insulated, they will still remain collapsed; but if the inducing electrified body be now removed from the situation in which it at first caused the divergence, the leaves will immediately diverge, and the electrometer become charged with electricity of the *opposite* kind to that of the inducing body. The degree of charge thus given to the instrument will be in proportion to the degree of divergence induced in the leaves *before* they were made to collapse by the touch of the finger.

"In the case in which a weakly electrified non-conducting substance was directed to be laid on the cap of the electrometer, to occasion a divergence by electricity like its own, it may be observed that, if, during the experiment, the cap be touched by the fingers, and the electrified body afterwards removed, the leaves will first collapse, and then diverge with *opposite* electricity, although at the commencement of the experiment they were diverged with the *same* electricity as that of the body to be examined. If, therefore, the electricity of an excited body is to be examined, the leaves of the electrometer are in the first place to be diverged. This may be done with the *same* electricity, by bringing the body, if *weakly electrified*, into contact with the cap, leaving it there if of non-conducting matter, or removing it after contact if of conducting matter; or, if *strongly electrified*, by approaching it so near as to cause a sufficient divergence of the leaves, and retaining it there until the conclusion of the experiment. On other occasions however with strongly excited bodies, it may be convenient, either because of their size or other circumstances, to communicate a charge of the *opposite* kind, in the manner described; then upon determining what that kind is, in the manner to be immediately described, the electricity of the originally electrified body will of course be known to be opposite to it.

"The tests of the kind of electricity by which the leaves are diverged are of the following nature. A stick of sealing-wax rubbed with warm flannel becomes *negatively* electrified; a tube of warm glass rubbed with a dry silk handkerchief, or, better still, with a piece of silk having a little amalgam upon it, becomes *positively* electrified, both these excitations being so strong as to make the leaves of an uncharged electrometer diverge whilst the wax or glass is at a considerable distance. If one of these excited substances be brought near the cap of an electrometer already diverged, it will either cause the divergence to increase or diminish. The divergence will *increase* if due to electricity of the *same* kind as that of the body approached, but will *diminish* if of the opposite kind; so that the electricity of the body approached being known, that of the electrometer will also be known, and consequently that of the excited body which had originally caused its divergence. The sealing-wax for instance is rendered *negative* by flannel; being approached to a diverged electrometer it may cause the leaves to collapse; the conclusion to be drawn is, that the electrometer leaves were in a *positive* state: being approached to another diverged electrometer it may increase the divergence, in which case it will indicate that the leaves of the electrometer were in a *negative* state. An excited rod of glass brought to these electrometers would make the first diverge still more, and would cause the second to collapse, in both cases indicating the same states as the wax.

"Some precaution is required with respect to the manner in which these excited rods are to be applied. The electrometer being diverged, the wax or glass is to be excited at such a distance as to have no influence over the instrument; the most strongly excited part of the wax or glass is then to be gradually approached to the cap, the hand and all other unnecessary conducting bodies being kept out of the way as much as possible, or at least not moved in the neighbourhood of the electrometer during the experiment. As soon as the rod begins to affect the leaves (even though the distance be two or three feet), the effect must be watched, and then their collapse or further divergence will become evident immediately on moving the rod a little way to or from the instrument.

"It is this first effect that indicates the kind of electricity in the electrometer, and not any stronger one; for although, if the repulsion be increased from the first, no approach will cause a collapse to take place except the actual discharge of the leaves against the sides of the glass, yet when collapse is the first effect, it may soon be completed, and repulsion afterwards occasioned from a too near approach of the strongly excited test-tube. It is, therefore, the first visible effect that occurs, as the test-rod is made to approach from a distance that indicates the nature of the electricity; and when this effect is observed, the rod should not be brought nearer, so as permanently to disturb the state of the electrometer, but should be removed to a distance, and again approached, for the purpose of repeating and verifying the preceding observation.

"It is to be understood, that the approach of the test-rod, though it affects the divergence, causes no permanent change of the electricity in the instrument, unless it be brought much too near, and cause considerable disturbance of the leaves. The electrometer will remain, after a good experiment, in the same state as at first.

"When the body to be examined is so strongly electri-

Electrical Apparatus.

fied that it may not be brought near to the electrometer, but has been placed at such a distance as to affect it, and left there to cause a proper divergence, then its place should not be directly over but rather on one side the cap, that the test-tube, when applied, may be brought towards the instrument on the other side; the originally electrified body, and the test-tube, being retained in directions as widely apart as they conveniently can be."

In order to protect his most sensitive gold-leaf electroscopes from the influence of electricity to which they may be exposed, Dr Faraday covers them with nets of linen or cotton with loose meshes, so that when they are placed in the neighbourhood of powerful electrical machines in action, the electricity never reaches them, being wholly taken up by the net which surrounds them.

Saussure's Electrometer.

Saussure's electrometer. Plate CCXXIX., figs. 6, 7.

The electrometer by which Saussure made the observations on the electricity of the atmosphere is shown in figs. 6, 7. It consists of a glass vessel, ACB, of a bell shape, and so wide that the balls *g*, *g*, when at their maximum divergency, cannot reach the strips of tinfoil *h*, *h*, *h*, *h* pasted within the glass. The pith balls, which are spherical, should not be above half a line in diameter, and should be suspended by the finest silver wires, moving freely in nicely-rounded holes. Four pieces of tinfoil are used, each internal piece having a corresponding one on the outside; and the bottom of the instrument is made of metal, and round it there is a graduated scale for measuring the divergency of the balls.

In order to collect much electricity from the atmosphere, the instrument has a pointed wire, one and a half or two feet long, which unscrews in three or four pieces; and in order to preserve its insulation, a small umbrella is screwed on the top of the instrument, see fig. 7. On other occasions he connected with a hook at H a fine metallic wire fifty or sixty feet long, at the end of which was a three or four ounce ball of lead, which he threw to the height of forty or fifty feet, in order to bring down the electricity of the atmosphere.

Fig. 7.

By dividing between two equal and similar bodies the electricity contained in one, and carrying on the subdivision progressively downwards, M. Saussure determined the relation between the divergency of the balls *g*, *g*, and the force of the electricity which acted upon them. The results which he thus obtained are given in the following table.

Distance of Balls in fourths of a line.	Relative Forces of Electricity.	Distance of Balls in fourths of a line.	Relative Forces of Electricity.
1	1	13	23
2	2	14	26
3	3	15	29
4	4	16	32
5	5	17	36
6	6	18	40
7	8	19	44
8	10	20	48
9	12	21	52
10	14	22	56
11	17	23	60
12	20	24	64

Method of using Saussure's electrometer.

In order to use this instrument, place it in open ground, free from trees and houses, and having screwed the conductor on the top of the electrometer, lay hold of it by its base, and place it so that the base and conductor may touch the ground at the same time; then raise it to the height of the eye, and observe on the scale the number of fourths of a line that the balls have diverged; then lower it till the balls almost touch each other, and measure the distance of the top of the conductor from the ground; this distance is the height at which the electricity of the air begins to become sensible. If the balls still diverge, the other parts of the conductor should be unscrewed, and it will then be seen at what height the electricity becomes sensible.

Hare's Single-Leaf Electrometer.

Hare's single-leaf electrometer. Plate CCXXIX., fig. 8.

As the divergency of the gold leaves is increased by the proximity of the strips of tinfoil, Dr Hare, of the university of Pennsylvania, conceives that the leaves are separated by attraction, and not by repulsion; and he was thus led to construct an electrometer with a single leaf, as shown in fig. 8. A brass ball one fourth of an inch in diameter is so situated that it may be made to touch the leaf, or retire from it to the distance of an inch, by means of a screw which supports it. It is obvious that this instrument is not only more simple than the double-leaved electrometer, but less liable to be destroyed by accident; and Dr Hare informs us that it is exceedingly sensible, and that it has enabled him to detect the electricity produced by one contact between a copper and zinc disc, each six inches in diameter.

Henley's Quadrant Electrometer.

Henley's quadrant electrometer. Plate CCXXIX., fig. 9.

This useful instrument is represented in fig. 9. It consists of a semicircle of ivory, C, fixed to the side of a stand, AB, about seven inches high, rounded and smoothed in all its parts. The lower quadrant of the semicircle is divided into 90°, and a thin piece of cane *ab* is suspended at the centre *m* of the semicircle, carrying a pith ball *b*. When the electricity to be measured is communicated to the instrument, the ball is repelled by the stem AB, and the angular elevation of the cane *ab* is a measure of the electrical force. This instrument may be screwed from its base B, and fixed on the end of the prime conductor, or on the summit of a Leyden phial. Mr Achard states from experiment that the quadrant should be divided according to a scale of arcs whose tangents are in arithmetical progression. It is most frequently used as an appendage to the prime conductor, for the purpose of measuring the state of action of the electrical machine.

In employing this instrument to show the progress of the charge of any jar or battery, Dr Faraday justly observes that it should be so placed that the moving index does not approach to any ball, wire, or surface charged similarly to itself, but on the contrary should recede from it. If it is therefore placed on the end of the conductor, the index should move outwards and away from the conductor, and not in a direction over it towards its more central parts; for the latter would interfere with the free indications of the electrometer, and in some cases would make it quite useless.

Brooke's Steelyard Electrometer.

Brooke's steelyard electrometer. Fig. 10.

This electrometer, which is represented in fig. 10, is calculated to measure the number of grains which the repulsive force of the accumulated electricity is capable of raising. Its base AB, about nine inches and a quarter in diameter, adjusted horizontally by screws A, B, sustains an insulating pillar DD, upon which the electrometer rests. To the brass rod H are attached two tubes of copper, G, *g*, which have a motion round the rod, so as to be turned to a proper distance from the body whose electricity is to be measured. The tube G is screwed into a solid piece within the ball F, and moves in a vertical plane about an axis close to F. The balls I K are of copper, and hollow. The arm E, which moves round an axis in a vertical plane behind the dial-plate R, carries a ball C, which touches the ball L fixed on the top of the glass rod DD. If the arm E rises from a vertical to a horizontal position, or through 90°, the index

Electrical Apparatus.

R on the dial is made to move through a whole circle, or 360°. The apparatus NPH forms the communication between the electrometer and the body whose electricity is to be measured.

Let the body be electrified positively, then the electrometer will be similarly electrified. The balls I, K will repel each other, G will rise in a vertical plane, L will repel C, and EC will also rise in a vertical plane.

The apparatus F, G, *g*, I, K, is chiefly used for graduating the inner circle of the dial-plate. For this purpose a weight *m* moves along the rod G, till it forms an exact counterpoise to the weight of F. One end of the weight *m* will consequently be the *zero* of the scale. Let *m* be now shifted to *n*, near to the ball I, and determine by a pair of good scales the weight of the ball I, or rather the weight produced by shifting *m* to *n*. Divide the space *mn* into as many divisions as the grains now found, and subdivide it into halves and quarters. These divisions are now to be transferred to the inner circle of the dial-plate, by observing the position of the upper or shorter half of the index R when *m* stands at any number of grains in the scale *mn*. When the inner scale on the dial-plate is thus graduated, the arms G, *g* and balls I, K may be removed.

Cuthbertson's Balance Electrometer.

Cuthbertson's balance electrometer. Plate CCXXIX., fig. 11.

This electrometer, which is particularly useful for jars and batteries, is shown in fig. 11. It consists of a metallic rod CD, about thirteen inches long, terminated by balls C, D, and balanced on a knife edge, the ball *b* being constructed in such a manner as to permit the rod CD to move in a vertical plane. A bent tube of brass FG, supports a similar ball G; and four inches below D is placed another insulated ball E, which communicates with a wire and chain with the *outside* of the jar or battery. If the rod AB be now connected with the prime conductor, or the *inside* of the jar, and this last be electrified, the ball E will attract D, because they are oppositely electrified, from being connected with opposite surfaces of the jar; and when this attractive force exceeds the weight at *a* with which the opposite arm is loaded, the arm *b*D will descend and give out its electricity to the ball E. In order to obtain a measure of the attractive force between D and E, and consequently of the intensity of the charge, the arm C*b* is divided experimentally into sixty parts or grains, which are indicated by one side of the moveable index *a*. A Henley's quadrant electrometer is placed at A, to indicate the progress of the charge, which is not shown by the balance electrometer.

Sir W. Snow Harris's Electroscope.

Sir W. Snow Harris's electroscope. Fig. 12.

This very ingenious and beautiful instrument, invented and used by Sir W. Snow Harris, is represented in fig. 12. The following description of it we owe to the kindness of the inventor:—

Fig. 12 represents an electroscope, which acts on the principle of electrical divergence. A small elliptical ring of metal, *a*, is attached obliquely to a small brass rod, *ab*, by the intervention of a short tube of brass at *a*; the rod *ab* terminates in a brass ball, *b*, and is insulated through the substance of the wooden ball *m*. Two arms of brass, *r*, *r*, are fixed vertically in opposite directions on the extremities of the long diameter of the ring, and terminate in small balls; and in the direction of the shorter diameter within the ring there is a delicate axis at *a*, set on extremely fine points. This axis carries, by means of short vertical arms, two light reeds of straw, *an*, *an'*, terminating in balls of pith, and constituting a long index, corresponding in length to the fixed arms above mentioned. The index thus circumstanced is susceptible of an extremely minute force. Its tendency to the vertical position is regulated by small sliders of straw, *s*, *s*, moveable with sufficient friction on either side of the axis. To mark the angular position of the index in any given case, there is a narrow graduated ring of card, board, or ivory, *ef*, placed behind it, the divisions being distinctly legible through sights cut in the reeds. This graduated circle is supported on a transverse rod of glass, *cd*, by the intervention of wooden caps, and is sustained by means of the brass ball *a*, in which the glass rod is fixed. The whole is supported on a long insulator of glass, A, by means of wooden caps terminating in spherical ends.

In the above arrangement, as is evident, the index will diverge from the fixed arms whenever an electrical charge is communicated to the ball *b*.

This instrument is occasionally placed out of the vertical position, at any required angle, by means of a joint at *m*; and all the insulating portions are carefully varnished with a solution of shell-lac in alcohol.

Sir W. Snow Harris's Electrometer.

Sir W. Snow Harris's electrometer. Plate CCXXIX., fig. 13.

The object of this electrometer, an account of which has been kindly communicated to us by its inventor, is to measure directly the attractive force of an electrified body, in terms of a known standard of weight, estimated in degrees on a graduated arch, *xy*, fig. 13. An insulated conductor, *f*, is fixed on a varnished rod of glass, *fg*, resting, by the intervention of a wooden ball on the extremity of a micrometer screw, S, by the aid of which the conductor may be raised or depressed through given intervals to within the hundredth of an inch of any required point. A moveable and similar conductor, *m*, made of light wood, hollowed and gilded, is suspended immediately over the former from the periphery of a small brass wheel W, figs. 13 and 14, by means of a fine silver thread attached near its vertical arm, and passing from thence over its grooved circumference, as shown. This conductor, *m*, is counterpoised by a short cylinder of wood, *pn*, figs. 13, 14, suspended in a similar manner from the opposite side of the wheel by means of a silk thread, and resting partly in water contained in the glass vessel N, fig. 13. Figs. 13, 14.

The extremities of the axis of the wheel W, figs. 13, 14, are turned to extremely fine pivots, and rest on two large friction wheels, after the manner represented in the figures,[1] by which great freedom of motion is obtained.

There is a fine index of light straw, W*c*, attached to the extremity of a small steel needle, inserted diametrically through the circumference, which indicates on the graduated arc *xy* the force exerted between the conductors *m*, *f*. The weight of this index is accurately poised by a small globule of brass, *n*, fig. 14, moveable on a screw, cut in the opposite arm of the steel needle carrying the index.

The centre of the wheel W is accurately placed in the centre of the arc *xy*, which, with its radii of support, is made of varnished wood; the graduated scale being of card, board, or ivory. This arc is the sixth part of a circle, divided into 120 equal parts, 60 in the direction *cx*, and 60 in the direction *cy*; the centre *c* being marked zero.

Fig. 14.

Fig. 14 represents the wheel W, with the suspended conductor and counterpoise, the index and its balance-weight, together with the lines of suspension, passing freely over the circumference, and fixed at the point *ii*.

---

[1] Sir W. Snow Harris resorted to this method of employing friction rollers, as being more efficient than that in which the axis is allowed to rest in the angle formed between the peripheries of four smaller wheels. In this case it rolls fairly on a large circumference, and is prevented from passing off it on either side by the check-wheels, either of which, when acted on, opposes little or no resistance to motion.

The various wheels above mentioned, with the graduated arc, are sustained on a projecting metallic rod, passing through a glass column B. The column is secured by means of the rod to a sort of double stand *pp*, fig. 13, supported on three levelling screws. The interval between the plates of this stand contains the glass vessel N and the micrometer screw S. The upper plate has a circular hole, *p*, through which the cylindrical counterpoise passes into the water *n*. The levelling screws serve to regulate the position of the counterpoise through the hole; so that when it hangs in it centrally, the whole is accurately adjusted.

The gravity of the suspended conductor *m* being in the above arrangement opposed by that of the counterpoise, it may be so far considered as existing in free space devoid of weight, and will therefore become very readily moved by any new force applied to it. It may consequently be caused to approach to or recede from the fixed conductor *f*, by the operation of forces acting in either of these directions; the motion, will, however, be speedily arrested by the cylindrical counterpoise *n*, which becoming either further immersed in, or otherwise raised in the water, furnishes, in the greater or less quantity of water displaced, a measure of the force. In this way the force may be estimated either in degrees or grains of actual weight; since the number of grains requisite to add to either side, in order to advance the index in either direction a given number of divisions, may be immediately found by experiment; and which, as the sections of the cylinder are all similar, will be found to increase or decrease with the degrees of the arc. Thus, if one grain advances the index in either direction five degrees, then two grains will advance it ten degrees, and so on.[1]

In the application of this instrument to electrical inquiries, the force to be measured is first communicated to the fixed conductor *f*, a free communication being established between the suspended conductor *m* and the ground, or otherwise with the negative side of the jar or battery, should the attractive force be derived from this species of accumulation; this is readily effected through the brass work of the apparatus, in connection with the rod passing through the interior of the glass column B.

For the repulsive force we connect the conductor *f* as before, and suspend *m* by a silk thread; in which case it will, after being electrified similarly to *f*, recede from it; but this method of experiment is evidently more complicated than the former, and liable to fallacy. The distance between the conductors *m f* corresponding to a given force is easily ascertained by means of the degrees indicated on the arc *x y*. In the instrument above described, each degree corresponds to a variation of distance between the conductors equal to the ·01 of an inch. If, therefore, at the commencement of any given experiment, we first bring the nearest points of the conductors *m*, *f* in contact, the index being in zero, and then depress the inferior conductor *f* a given distance, known by means of the micrometer screw *s*, then all subsequent distances may be readily determined between these points.

It is now only requisite to observe, that the interior of the cylindrical counterpoise is hollow, in order to weigh it accurately, and cause it to hang vertically in the water; and there is a small hemispherical cup, *p*, fixed on its stem for the reception of small adjusting weights, by which the position of the index at 0 of the scale is regulated with great nicety. With respect to the form of the conductors *m*, *f*, they are generally plain circular areas, backed by small cones, and are about two inches in diameter. Conductors of other forms, however, such as spheres and cylinders, may be occasionally used when the object is to experiment more particularly on bodies of peculiar forms.

Experiments with this instrument are remarkably clear, considering the subtile character of the principle we have to investigate. Thus, when the insulations are perfect, and the atmosphere dry, the index immediately exhibits the amount of the attractive force, and remains stationary for a much longer time than is required to note the result.

By varying the superficial dimensions of insulated conductors, and the quantity of electricity accumulated on them, we may, by the help of the above instrument, deduce many curious and important laws of electrical action. It is, however, first requisite to explain a method of charging simple conductors with comparative quantities of electricity; for without an accurate measure of quantity, little can be effected in almost any department of this branch of science.

Plate CCXXIX., fig. 15.

Simple conductors may have comparative quantities of electricity disposed on them, by abstracting small sparks from an insulated charged jar, fig. 15, either immediately on the given substance, or, otherwise, on an insulated transfer plate, *p*, fig. A. An insulated jar, charged with a given accumulation, as estimated by the unit of measure, which will be presently described, is of singular importance in researches with simple conductors; for series of sparks may be obtained from it of such slow convergence, that many successive terms may be considered as equal. Thus, an insulated metallic disc, *d*, being placed in connection with the electrometer, fig. 13, or with the electroscope, fig. 14, was electrified many times in succession to precisely the same amount, by sparks drawn on an insulated plate from the positive coating, the negative side of the jar after each contact being restored to a neutral state. When a portion of the charge was abstracted so as to sensibly decrease the quantity in the jar, then a new point was arrived at, from which another series of sparks can be obtained, differing extremely little in quantity; and this process may be continued to a low point of accumulation on the jar.

Fig. A.

The quantity given off by the positive coating is dependent on the dimensions of the abstracting conductor, and on the free state of the negative side of the jar. If it be free for each experiment, or be otherwise connected with a conductor of sufficiently large dimensions, it may be observed that a conductor of a double capacity receives a double quantity, a conductor of a treble capacity a treble quantity, and so on. The extent to which this process may be carried with a jar exposing about two square feet of coating is somewhat considerable. We only require in these experiments an extremely perfect insulation.

In disposing given quantities of electricity on simple conductors in this way, and investigating the attractive force by means of the electrometer, Sir W. Snow Harris arrived at the laws formerly explained. (See page 550.)

Lane's Discharging Electrometer.

Lane's discharging electrometer.

This admirable instrument is shown in fig. 16. To the stem AB of a Leyden jar MN, is fixed a bent piece of glass BC, for the purpose of supporting and insulating the brass rod DE, which has two equal brass balls at its extremities. This rod moves through a spring tube at C, so that the brass ball D can be placed at different distances from the equal ball A, by which the jar is charged. The insulated ball D is connected through the metallic wire DE with the outside coating of the jar, by a wire EF. If we bring the ball D near to A, a small electrical charge conveyed to the jar MN will discharge itself from A to D, and

[1] The counterpoise should be free from grease or varnish of every sort, and should, previously to being used, be kept immersed in water; the insulation of the conductor *f* also should be made extremely dry, and occasionally warmed by a stick of burning charcoal.

Electrical Apparatus.

pass off to the ground by the wire EF. If the distance AD is increased, the jar must be more highly charged before it discharges itself; so that the distance AD of the balls is a measure of the intensity of the charge at the time of its discharge. As long, therefore, as the jar has not discharged itself, we are sure that its charge is less than that which corresponds to the distance AD. The chief defect of this instrument arises from the occasional interposition of particles of dust or other light conducting materials between the balls, which occasions the charge to take place sooner than it otherwise would do. The arm of glass is sometimes fixed on the top of the charging rod, where a ball of wood is placed, and is bent downwards, so as to carry the balls D, E. In this case the jar is charged by another ball projecting from the charging rod towards D. This electrometer is sometimes fixed to the prime conductor, with and without a jar accompanying it.

Sir W. Snow Harris's Measuring Electrometer.

Sir W. Snow Harris's measuring electrometer.

This elegant instrument, which we have had the advantage of seeing in operation, is an invaluable addition to our electrical apparatus. According to the law of electrical accumulation on coated jars, 'the quantity added to one side is always proportional to the quantity given off by the other, and reciprocally. Hence the amount of the accumulation may be always estimated by insulating the jar to be charged, and observing, by means of a discharging electrometer, the explosions of a small jar connected with the negative coating. This process is, however, complicated in its general application; but Sir W. Snow Harris has modified it in the following manner:—Let a small jar, N, be furnished with a discharging electrometer, *n*, and inverted as in fig. 17, being supported by a brass rod, *pq*, inserted into the ball D of the prime conductor ABC. Then, as the electricity passes up the rod and accumulates on the inner coating, a similar quantity is given off from the outer coating, which may be made to pass from a ball at *p*. Now, when the small jar N has been charged to a given degree, an explosion or discharge takes place from *m* to *n*, and restores the equilibrium; and hence *one measure* of electricity is marked by the first explosion. When this has taken place, the jar is in the same state as at first; and hence by a repetition of the process we obtain the exact number of measures (or explosions) which pass from the unit jar N, and are finally accumulated on the jar J, or battery, into which the electricity passes from the ball *p*. This process of charging a battery from the outer coating of an exploding jar, instead of from the prime conductor, supersedes all electrometers, and is the best way of measuring quantity.

Plate CCXXIX., fig. 17.

Volta's Flame Electrometer.

Volta's flame electrometer.

It was observed by Mr Bennet, that a lighted candle placed above the cap of his electrometer, and communicating with it, greatly increased the sensibility of the instrument; and it appears, from various experiments, that flame possesses the property of carrying off from bodies the electricity with which they are charged. M. Volta ingeniously availed himself of this principle in order to bring down to his electrometer the electricity of the atmosphere, the nature and intensity of which he was desirous of examining. This effect is produced by elevating above the atmospherical conductor a lighted match or torch.

Matteucci's Phosphorus Electrometer.

Matteucci's phosphorus electrometer.

As the preceding instrument cannot be employed when there is the least wind or rain, and still less during a storm of hail or wind, M. Matteucci conceived the idea of constructing an electrometer depending on the strong conducting power of the vapour of phosphorus. He prepared rods of this substance between the twenty-fifth and the fiftieth of an inch in diameter, by melting the phosphorus under water, and by blowing it while in a state of fusion through a tube of the requisite diameter. He afterwards made the rod of phosphorus project from the fiftieth to the seventy-fifth of an inch beyond the end of the tube. He then fixed the glass tube on a wooden pole, and he insulated the pole by fixing to its extremity a glass handle. The phosphorus communicated by its base with a metallic wire which descended along the pole, and which could be kept at a distance from the pole by some tubes of glass placed at regular distances. M. Matteucci kept the rod of phosphorus perfectly insulated in the time of rain, by means of a glass hood varnished on both its surfaces, and having its convexity turned upwards. The pole was composed of three or four rods, which were adjusted into one another; and the instrument thus constructed was found extremely useful in examining the electricity of the atmosphere.

Mr Ronalds' Improvements on Electrometers.

Ronalds' improvements on electrometers.

As threads, pith or cork balls, and even straws when very dry, lose some of their conducting power, Mr Ronalds prefers fine silver wire, and hard charcoal balls from boxwood, for electrometric purposes. The following is the method which he employs in making electrometers of this kind. The instrument which he uses is represented in fig. 18, where ABCD is a bow of steel wire with a hook at each end. When the charcoal ball has been threaded on the silver wire, and rings formed at each end, it is *very* gently stretched in this bow, by passing the hooks through the rings, and shoving it forward with the thumb placed against the end of the tongue near the handle, which tongue is thus made to open wider by pressing the screw E on each side. The screw E is then turned a little farther into the piece F, in order to fix it firmly. The fine wire is now placed cautiously upon a piece of iron, a little below a red heat, which will make it perfectly straight, when it may be taken from the bow, and suspended on one of the rings of the piece of brass, fig. 19. In fig. 20 is shown Mr Ronalds' method of making gold-leaf electrometers.

Plate CCXXIX., fig. 18.

Figs. 19, 20

Melloni's Electroscope.

Melloni's electroscope.

When a conductor in a neutral state approaches an electrified conductor, it disguises[1] or dissimulates a portion of this electric state, and in restoring to the disguised fluid its positive tension in proportion as the sensible fluid passes from it by dispersion, it prolongs the duration of the electric charge. We know also that this effect takes away from the contrary electricity developed by induction in the part nearest to the body introduced, and that the electricity homologous to that of the inducting body appears on the more distant portions, where it diffuses itself in proportions inversely as the radii of curvature.

A fortunate combination of these three data led M. Melloni to conceive it possible to construct an electroscope singularly sensible, and capable of preserving its electricity a much longer time than any instrument of the same kind. The effect of the instrument is such as he expected, and he regards it as one which will become very useful in all kinds of electrical researches.

Let A (fig. 13) be a metallic cup furnished with two filiform appendages D, D soldered to the opposite points of

[1] See page 613, col. 1.

the upper margin of the cup, and communicating by a conductor which passes into the axis of a tube of glass

Fig. 14.

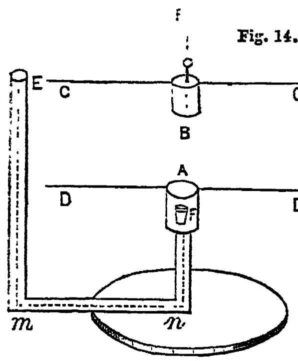


Fig. 13.

having a ball or a metallic disc at E. A second metallic cup B (fig. 14), inverted, and a little smaller and much lighter than A, is fixed below a wire or very thin lever of metal CC, suspended by a silk fibre F. The cup B is then suspended in the manner shown in fig. 15, so as to

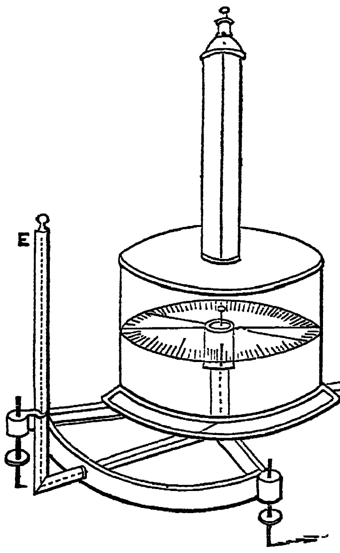


Fig. 15.

be inclosed in A without touching it. A small metallic cylinder *f* is placed in the middle of the cup A, so as not to touch the inside of the cup B.

If we now electrify positively the ball or conductor E, the electricity will pass to the cup A, will act by induction on the cup B, will repel the positive and attract the negative electricity of the natural fluid in B, which will react upon the free fluid in A, disguising a certain quantity and abandoning the rest according to the laws which regulate the distribution of electricity in insulated conductors, so that the intensity of the action will depend on the curvature of the surfaces, and will be less strong on the sides of the cup than upon its appendages. The cup A will therefore contain a certain proportion of positive electricity disguised, that is accumulated without tension and without mobility, and its appendages D, D will possess a free electricity of the same kind increasing towards their extremities. The cup B and its lever CC will possess negative electricity disguised at the central part in respect to the cup A, of free positive electricity in the rest of the moveable system, that is upon the top plate of the inverted cup B, and on the lever above it. But this last species of electricity will be more powerful at the extremities of the lever, than in the middle part or on the top of the cup; 1. Because these extremities are the most distant points of the inductive action; and, 2. Because their radius of curvature is smaller than that of any other part.

As the lever CC thus possesses the same kind of electricity as the appendages DD, it will be energetically repelled if it is not precisely in the same azimuth with them, and after a few oscillations it will rest at a certain angle of deviation. The electric charge communicated to the fixed system will then begin to diminish. This diminution will be much slower than in ordinary electrometers.

In this electrometer the moveable part is always electrified by induction, and never by communication; the difference of form between the centre and the extremities of the fixed and moveable pieces makes the distribution of the moving forces the most favourable for the rotation of the index, and the inductive action of the central surfaces, disguising a portion of the electricity to give it by degrees the free state in proportion to the losses sustained, prolongs the duration of the charge received. The following are the dimensions of the instrument:—

	Millim.
Diameter of glass cage	115
Height of do	11
Length of fibre of silk	25
Distance between dial and glass plate	3
Inner diameter of A	21
Do. do. of B	16

Sir W. Snow Harris's Bifilar Balance.

Sir W. Snow Harris's bifilar balance.

About the year 1831, Sir W. Snow Harris proposed a new method of obtaining a delicate reactive power applicable to the measurement of electrical and magnetic forces, and the movements of oscillating bars and other suspended masses.

If a magnetic or electrical needle, as $p\,n$, No. 1, fig. 16, or other body, G, No. 2, be suspended horizontally by two

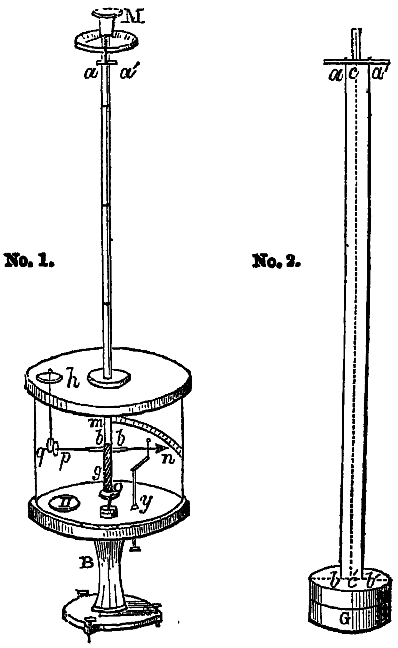


Fig. 16.

equal filaments of unspun silk $a\,b$, $a'\,b'$, fixed parallel to each other, it is evident that its position of rest will be in the vertical plane passing through the two threads. Whenever, therefore, we turn the needle from this position about the imaginary axis $c\,c'$ fig. 2, the filaments of suspension will be deflected from the vertical, so that the distance $c\,c'$ will be somewhat less than before: hence arises a reactive force derived from the weight of the suspended needle or other body, the centre of gravity of which having been raised,

Electrical Apparatus.

Harris's bifilar balance.

will endeavour to descend and rest in its previous position—it will be in a similar condition to that of a body falling down a very small arc. If therefore the needle be freely abandoned to this reactive force, a vibratory motion will arise,[1] by observing which, we may determine the laws of the reactive force imparted to the threads.

By carefully noting the rate of oscillation of a suspended cylinder of wood G, No. 2, about 2 inches high and 2 inches diameter, the following results were arrived at:—1. The time of an oscillation is as the square root of the length of the threads of suspension divided by their distance apart, without reference to the weight of the suspended mass. 2. The oscillations are isochronous at all angles. Applying the general formula $n = \frac{P\pi^2 a^2}{2gT^2}$, employed by Coulomb in his experiments on torsion; it is found that the force imparted to the threads $= n$, will vary with the squares of the distances between them divided by their lengths, and will be also as the weight of the suspended mass $=$ P, hence we have $n \propto \frac{Pd^2}{l}$; and since the oscillations are isochronous, we may conclude that n is proportional to the angle, or perhaps more nearly the sine of the angle, of deflection of the threads, results which the inventor fully verified by experiment.[2]

Upon these data the electrometer, termed by the inventor a bifilar balance, was designed. The instrument, as at first constructed, is somewhat elaborate in its form and contrivances for estimating and observing rapidly electrical forces, to which end it is remarkably available. It will be found very fully described in the *Philosophical Transactions* for 1836. A more simple form of it, however, is that similar to the torsion balance already described, fig. 1, Plate CCXXIV., substituting the bifilar suspension for the wire of Coulomb.

The two threads $a\,b$, $a'\,b'$, No. 1, fig. 16, are secured above to a small cross wire $a\,a'$, at the extremity of a vertical rod terminating in a micrometer and index M; they are about 20 inches long, and are set at a quarter of an inch apart; the electrical needle $p\,n$ is attached to the lower extremities of the threads, in a similar way, and is constructed much in the same way as the needle of Coulomb's balance of torsion, except that the repelling bodies p, q are thin discs of gilded cork of about ·5 of an inch diameter, and the extremity n of the needle balancing the insulated disc p, is formed into an index, and moves over a graduated quadrant $m\,n$ within the glass cage, thereby indicating more accurately the degrees of repulsion of the electrified bodies $p\,q$. The suspension threads are further stretched by a vertical cylinder of brass g, carrying a small stage o for receiving such small circular weights as may suit the purpose of the experimentalist. The lower portion of the cylinder g terminates in a fine needle, which plays freely in a hole drilled in a small elevated plate of brass beneath, as seen in the figure; and by which the whole is prevented from swinging out of a vertical position. The whole is mounted on a raised base of varnished wood B, supported by three levelling screws, and there is a pretty large opening in the floor at H, for the purpose of introducing any small electrified body, and communicating a repulsive force to the discs p, q. To avoid a collapse of the threads when the angle of deflection is considerable, the threads pass through one or two stays of light cork: with this precaution, the force is strictly proportional to the sine of the angle of deflection up to 360°. The angle, however, for all practical purposes need not exceed 60°. There is a small angular lever y moveable with friction through the floor of the glass cage, by which the needle is prevented from taking a violent swing when the repulsion commences, and by which it may be eased off gradually. In the instrument thus constructed, a force so small as the $\frac{1}{1000}$th part of a grain for each degree may be measured: by increasing the length of the threads, diminishing their distance apart, or changing the weights on the stage o, almost any very small fraction of a grain may be obtained and valued. This instrument may be used pretty much in the same way as Coulomb's balance of torsion before described, fig. 1, Plate CCXXIV. The inventor is of opinion, that in experiments with this, and all similar instruments, the electricity should be equal on each of the repelling bodies p, q; the force will be then, at a constant distance, always as the square of the quantity of electricity, as clearly proved by Cavendish in his manuscript papers, and as he himself has fully shown for attractive forces. If one of the repelling bodies p be in a higher state of electrical charge than the other q, then the result is very uncertain—the indications may, in some instances, be nearly as the quantity on one of the discs; but this is not always the case. It is clear, that by continually diminishing the quantity on one of the discs, we shall at length arrive at an attractive force; and to this, under every circumstance, the action of the discs on each other virtually tends, as he thinks he has fully shown.

When it is found desirable to examine the repulsive force in connection with electrified bodies placed externally to the glass cage, then the disc q is attached to a light conducting-wire, terminating above in a contact ball, and insulated through a varnished tube of glass in the hole h, after the manner of the gold-leaf electrometer.

The electroscopes of the Abbé Haüy, and the torsion electrometer of Coulomb, have been described in a preceding part of this treatise.

CHAP. IV.—ON MISCELLANEOUS ELECTRICAL INSTRUMENTS.

1. *Sir W. Snow Harris's Electrical Balance or Scale Beam Electrometer.*

Sir W. Snow Harris's electrical balance. Plate CCXXX., fig. 1.

In investigating the law of the attractive forces of electricity accumulated in jars and batteries, Sir W. Snow Harris made use of the electrical balance shown in fig. 1. The beam mn of the balance, constructed in the usual manner, is suspended from a projecting arm of brass, ea, supported by a vertical stand, abc, consisting of a brass slider and socket, ab, by which the balance can be moved up or down, and of a glass tube, bc, with a ball of varnished wood, b. A wire, pointed out by the line ef', passes through the tube abc, and connects the beam with the *negative* coating of the jar. A hollow gilt conductor of wood, f, is suspended by a metallic thread from one of the arms m, and from the opposite arm n is hung by silk lines a light brass scale, d. In this scale there is placed as much additional weight as will balance the conductor f, and put the whole in a state of equilibrium. By means of an insulated conductor f', of the same dimensions as f, and fixed directly under it, the attractive force of the electricity in the jar is made to act directly on the suspended conductor f. The conductor f', which is connected with the positive coating, is so placed that it can be depressed from contact with the conductor f, through given distances, by means of a cylindrical slide, r, attached to it, which moves in the socket s, and indicates its depression on an engraven scale, divided into twentieths of an inch. The socket s is supported on a glass pillar by means of a var-

[1] *Edin. Trans. for* 1834, Oscillations of the Horizontal Needle, sec. 29.

[2] *Phil. Trans. for* 1836, p. 419.

Electrical Apparatus.

nished ball of baked wood, on which the socket is fixed, and through which the conductor *f'* is connected with the positive coating. The whole balance can be raised or depressed through a small distance by the micrometer screw at *e*.

From this description it is obvious that the attractive force acts directly between the conductors *f* and *f'*, and can therefore be measured by weights placed in the scale *d*. The scale rests on a small circular stand *q*, which can be raised or depressed by the sliding brass rod and tube *vt*, to accommodate itself to the horizontal position of the beam, and to check any oscillation. The balance is fixed on an elliptical base, having three levelling screws.

The following experiment, made by Sir W. Snow Harris, will best explain the use and value of this balance.

Having connected the inside coating of a single jar containing five square feet with the conductor *f*, and the outside coating with the wire *ac*, the conductor *f* was depressed through half an inch, and a weight of sixteen grains was placed in the scale; then, when five turns of the plate were completed (or, if the measuring electrometer is used, when *n* explosions were conveyed to the jar), the attractive force between *f* and *f'* was sufficient to tip the beam. The accumulated electricity being discharged, the conductor *f'* was depressed through a *second interval of half an inch*, making the whole distance *one inch;* and *four grains* or one-fourth of the former weight being placed in the balance, the beam was again depressed with *five* turns of the plate, or *n* explosions of the measuring electrometer. The accumulation being again discharged, and the conductor *f* depressed through a third interval of half an inch, and one-ninth part of the first weight placed in the scale, the beam was again depressed with five turns of the plate, or *n* explosions. Hence, as the distances in the first experiment were as two to one, and the weights four to one, and as in the second experiment the distances were three to one and the weights nine to one, we may infer *that the attractive force between the conductors varied in the inverse ratio of the square of their distance.*

2. *Dr Ure's Detonating Eudiometer.*

Dr Ure's detonating eudiometer. CCXXX., fig. 2.

The electrical eudiometer is a simple instrument, for detonating or exploding gases by means of an electrical spark or shock. The common eudiometer is merely a short tube of glass closed at the upper end, and having two pieces of platina wire passing through the glass near its upper end, so as nearly to meet at the axis of the tube. These wires communicate, the one with the inner and the other with the outer coating of a charged jar, so that when the discharge passes between the platina points, it inflames the gas in the tube. As the gas subjected to the action of the spark is transferred to the tube over water or mercury, the lower or open extremity of the eudiometer must be kept in the water or mercury, in order to confine the gas. With the common eudiometer two persons are required, the one to manage the instrument and the other to manage the electrical machine; but Dr Ure has given it such a form that a single individual can perform all the operations with the greatest facility.

CCXXX., fig. 2.

Dr Ure's instrument, shown in fig. 2, consists of a glass syphon, ABC, with a bore of from two-tenths to four-tenths of an inch. Its legs AB, CB are from six to nine inches long, and from one-fourth to half an inch apart. The open end A is slightly funnel-shaped, and the other, C, which is hermetically sealed, has two platina wires, *a*, *b*, inserted near it by the blowpipe. The outer end of the one wire is bent vertically upwards, and then horizontally so as nearly to touch the edge of the aperture A. The end of the other wire is formed into a little hook, to allow a small spherical button, *d*, to be attached to it when the electrical spark is to be transmitted. The sealed leg CB is graduated by introducing in succession equal weights of mercury from a measure glass tube. Seven ounces troy and sixty-six grains occupy the space of a cubic inch, and thirty-four and a half grains represent a hundredth part of that volume.

The method of using this apparatus is shown in fig 3. Fig. 3.
The whole syphon being filled with mercury or water, a convenient quantity of the gas to be examined, not exceeding one-sixth of the capacity of the tube, must then be introduced in the ordinary manner. The tube is then held upright by the hand, and the gas being transferred into the sealed leg CB, the mercury is brought to a level in both legs, either by the addition of a few drops, or by displacing a portion by pushing down a glass or wooden rod. The tube being grasped as in the figure, the thumb must be placed tightly over the aperture, so as to close it, and at the same time touch the wire next it. A spark from the conductor of the electrical machine is then made to enter the button *d*, and after inflaming the gas, is conducted away by the thumb and hand of the operator, the tip of the finger feeling only a slight push or pressure. When two or more inches of air are left beneath the thumb, it acts as a recoil spring to restrain the violence of the explosion. When condensation of volume takes place, the finger feels pressed down to the orifice. On sliding it gradually to one side and admitting the air, the mercurial column in CB will rise above that in AB. More mercury must then be poured in till the equilibrium is restored, when without any reduction we may read off the resulting volume of gas. If the charge of a jar is to be transmitted through the wires, the thumb must not touch the wire when it closes the aperture. In this case the wire from the outside coating must be hooked on the eudiometer wire nearest the thumb, and then the knob or ball on the charging rod of the jar must be brought in contact with the button on the other wire, when the gas will be exploded.

3. *Volta's Electrical Lamp.*

Volta's electrical lamp.

As hydrogen gas is readily inflamed by a very small electrical spark, Volta conceived the idea of constructing a lamp for temporary purposes, such as that of obtaining a light at night, or in summer for the purpose of sealing letters, by employing the electrophorus to light the hydrogen. With this view a quantity of gas is put into a reservoir, and when subjected to the pressure of a column of water, it escapes from a small aperture by turning a stop-cock. Beneath this reservoir is placed an electrophorus in a box, and from the upper part of the box a wire passes through a glass tube to the small aperture. When the handle of the stop-cock is opened to let out the gas, the cover of the electrophorus is raised by means of a silk cord connected with the handle of the stop-cock, and the spark from this cover is conveyed by this insulated wire to the stream of gas, which is instantly kindled, so as to allow a candle to be immediately lighted. From the smallness of the quantity of gas consumed, a light may be procured an hundred times from the same reservoir of gas. When the hydrogen gas is expended, it is troublesome to persons unaccustomed to chemical manipulations to replenish the reservoir with fresh gas. M. Gay Lussac removed this defect by suspending a bar of zinc on the apparatus, so as to reproduce, by the action of diluted sulphuric acid[1] upon it, as much gas as was exhausted.

Mr Cutbush's improvement upon it.

Although a good electrophorus, when well excited, will retain its charge for many months, yet in general its opera-

[1] The acid should be diluted in the proportion of one part of acid to seven of water.

Electrical Apparatus.

tion has been so uncertain, especially in damp weather, that many persons have been obliged to lay aside the instrument. Mr Cutbush of Philadelphia found that he could produce a spark in the dampest weather when he warmed the electrophorus before exciting it with a fox's tail, and kept the electrophorus box as tight as possible. As the cock is apt to become loose and allow the gas to escape, Mr Cutbush applied a mixture of tallow and finely pulverized plumbago to the cock; and, what is very curious, he found that the hydrogen gas prepared from zinc escapes much more readily than that procured from iron filings. He found that the former sometimes disappeared in twenty-four hours, while the latter often remained more than a week. The gas from iron filings is more impure than the other, from containing more or less carbon. With these precautions Mr Cutbush found that the lamp of Volta seldom disappointed him in producing flame. He ascertained that one cubic inch of gas will light the taper at least ten times if the cock is quickly turned.

Green's hydrogen lamp.

A hydrogen lamp acting by voltaic electricity in place of that of the electrophorus has been invented by Professor Jacob Green of Nassau Hall, and is quite independent of the state of the atmosphere. Its description, however, belongs to the subject of another article.

4. *Ronalds' Electrograph.*

Ronalds' electrograph. CCXXX., fig. 4.

M. Magellan had proposed to delineate the changes which take place in the electricity of the atmosphere, by a cylindrical and a plain electrograph. As our limits, however, will not permit us to describe these instruments, we shall content ourselves with giving a drawing and description of the more recent and useful electrograph invented by Mr Ronalds. This instrument is shown in fig. 4, where AA is a box with a strong time-piece placed horizontally, and moved by the weight B, and CC a disc of baked mahogany eight inches in diameter, with an aperture of $2\frac{1}{2}$ inches at D. The circumference of this disc, and also that of the perforation, are provided with edges or rims, and the outer broad rim is divided off and marked with hours and minutes like a common clock. The space between the two edges is almost filled with cement, composed of rosin, bees' wax, and lamp-black, and this part of the apparatus may be taken from the box at pleasure. A glass-tube EF, with brass caps, and covered inside and out with hard cement, screws by its lower end into the disc CC, while the upper end carries a small sheave, *g*. Within this tube EF a stem of glass is fixed by its lower end on the minute arbor of the time-piece, and a pivot attached to its upper extremity passes through F and the sheave *g*. This pivot carries the iron ball and cap *h*, into which is screwed the horizontal steel wire *i*, carrying the slider *k*, which moves with little friction along the wire. The piece *k* carries the vertical wire *l*, terminating below in a hook, upon which hook is hung a ring at one end of a short wire *m*, whose other end carries a small gold bead. A fine thread, *n*, is attached to *k* by one end, and by the other to the sheave *g*.

When the clock is going, its minute arbor carries round the arm *k*, and the effect of this is to coil the thread *n* round the fixed sheave *g*, and to make the piece *k* advance towards the ball *h*, so that the gold bead will trail upon the resinous disc CC, and describe a spiral upon it. If we now cause the little iron cap above *h* to communicate with a wire connected with any atmospherical conductor, the gold bead will electrify the resinous surface, so that when the plate is removed from the clock and powdered with pounded resin, or even dry hair powder, the spiral line will exhibit configurations varying in shape and in breadth according to the intensity and nature of the electricity which the resinous surface has received from the trailing bead. The times at which these phenomena take place will be shown by the dial-plate.

If this instrument is used for recording the phenomena of serene weather, dew, &c., the hour arbor should be used in place of the minute one; but if for those of a thunder storm, hard shower of rain, or hail, or snow, the minute arbor should be used. Mr Ronalds adds, that he has sometimes found a more rapid motion necessary, which can be obtained by the addition of a third arbor; the glass tube EF, with its appendages, being transferred to the most suitable arbor, and the disc adjusted to a new centre. Sheaves larger and smaller than *g* will be requisite for different applications of this electrograph.

5. *The Electrical Air Thermometer.*

This instrument, invented by Mr Kinnersley, is shown in fig. 5, where AB is a glass tube about ten inches long and two inches wide, having its ends closed by two air-tight brass caps, A and B. Through these caps slide two hooked wires, FG, EI, so that the small brass balls G, I, can be set at any distance, and an electrical spark passing between them may be made stronger or weaker as the occasion requires. Another small tube, HA, open at both ends, passes through a tube in the copper caps, and through this tube a sufficient quantity of mercury or water is introduced to fill the lower ends both of the wide tube AB and the narrow one HA. If an electrical charge is sent through the balls G, I when they are placed in contact, by connecting the hooks E, F with the outside and inside coating of a Leyden jar, no effect will be produced; but if the balls G, I are separated so that the charge passes in the form of a spark through the interposed air, the rarefied and displaced air will press on the surface of the mercury or water at the bottom of the tube AB, and raise it nearly to the top of the small tube HA. It will then sink after the explosion, and resume its former position.

Kinnersley's electrical air thermometer. CCXXX., fig. 5.

6. *Volta's Electrical Pistol.*

A brass vessel of a pear shape, or of an ellipsoidal form, being perforated at its two ends, a glass tube of the same diameter as the perforation is inserted in one of them, so as to extend to the centre of the ellipsoid, and to project about four inches beyond the vertex. Through this tube there passes a metallic stem, which is furnished with a brass ball at its outer end, while its other extremity reaches beyond the inner end of the glass tube. A mixture of equal parts of hydrogen gas and atmospheric air having been introduced at the second aperture, this aperture is closed tightly with a cork. The operator now grasps the ellipsoid by its equator, and when a spark is taken by its brass ball from the prime conductor, the gaseous mixture will instantly be exploded, and drive out the cork with a smart explosion. In place of a mere perforation at the extremity of the ellipsoid, a barrel may be inserted, and by using a cylinder of cork for wadding, a ball may be discharged from the pistol.

Volta's electrical pistol.

7. *Ronalds' Electrical Pistol.*

Another form of the electrical pistol is shown in fig. 9, at BCF, forming a part of Mr Ronalds' electrical telegraph. The pistol has the form of a pear, and the brass rod and ball, in place of being a continuation of its axis, is inserted on one side, as shown at D. We have given a separate section of this pistol in fig. 6, where AB is the body of the pistol, which contains the inflammable gas, C the cork which is to be discharged, D the glass tube, G the brass

Ronalds' electrical pistol.

Fig. 6.

Electrical Apparatus Electrotypie. ball with a brass rod going down through the glass tube and extended a little beyond it, and E another little ball and rod fixed in the lower end of the pistol. When the spark is communicated at G, the gas will explode and discharge the cork.

8. *Ronalds' Electric Telegraph.*

Ronalds' electric telegraph. M. Cavallo suggested the idea of conveying intelligence by passing given numbers of sparks through an insulated wire in given spaces of time; and some German and American authors have proposed to construct galvanic telegraphs by the decomposition of water. Mr Ronalds, who has devoted much time to the consideration of this form of the telegraph, proposes to employ common electricity to convey intelligence along insulated and buried wires; and he proved the practicability of such a scheme by insulating eight miles of wire on his lawn at Hammersmith. In this case the wire was insulated in the air by silk strings; but he also made the trial with 525 feet of buried wire. With this view he dug a trench four feet deep, in which he laid a trough of wood two inches square, well lined both within and without with pitch, and within this trough were placed thick glass tubes, through which the wire ran. The junction of the glass tubes was surrounded with short and wider tubes of glass, the ends of which were sealed up with soft wax.

CCXXX., fig. 7. Mr Ronalds now fixed a circular brass plate, fig. 7, upon the seconds arbor of a clock which beat dead seconds. This plate was divided into twenty equal parts, each division being worked by a figure, a letter, and a preparatory sign. The figures were divided into two series of the units, and the letters were arranged alphabetically, omitting J, Q, U, W, X, and Z. In front of this was fixed another brass Fig. 8. plate, as shown in fig. 8, which could be occasionally turned round by the hand, and which had an aperture like that shown in the figure, which would just exhibit one of the figures, letters, and preparatory signs, for example 9, V, and Ready. In front of this plate was suspended a pith Fig. 9. ball electrometer, B (see fig. 9) from a wire C, which was insulated, and which communicated on one side with a glass cylinder machine, D, and on the other side with the buried wire. At the farther end of the buried wire was an apparatus exactly the same as the one now described, and the clocks were adjusted to as perfect synchronism as possible.

Hence it is manifest, that when the wire was *charged* by the machine at either end, the electrometers at both ends *diverged*, and when it was *discharged* they collapsed, at the same instant. Consequently, if it was discharged at the moment when a given letter, figure, and sign, on the lower plate, fig. 7, appeared through the aperture, fig. 8, the same figure, letter, and sign would appear also at the other clock; so that by means of such discharges at one station, and by marking down the letters, figures, and signs seen at the other, any required words could be spelt.

This is not the place to describe the method of using the telegraphic dictionary, but we may state, that the electrical pistol F, which passed through the side of the clock-case GG, had an apparatus H, by which a spark might pass through it when the sign *prepare* was made, in order that the explosion might excite the attention of the superintendent, and obviate the necessity of close watching. See Telegraph.

9. *Ronalds' Atmospherical Conductor, founded on a New Mode of Insulation.*

This conductor is shown in fig. 10. A glass pillar, A, passes through a circular piece of hard boxwood B, and also through the piece C, the sides of the perforations in these pieces being lined with thick leather. Nut bolts, D, D, pass through B and C, to secure the glass pillar in its place. Ronalds' atmospherical conductor. Fig. 10. The dotted part of the support is hollow. The glass is about one-fourth of an inch thick at the opening, and the upper part of it is coated with sealing-wax. A small spirit-lamp, E, with a single thread of cotton wick, and having a glass chimney, is placed beneath the open mouth of the glass pillar. The pillar terminates above with a strong brass socket carrying the ball F, which is perforated to admit the lowest joint of a long bamboo fishing-rod G G, gilt and inclined at an angle of about 45°. The strong bent wire H carries the upper part of a Volta's straw electrometer I, which rests upon the table M. The piece which supports the straws is entirely detached from the glass bottle I, being fixed to the arm H when the instrument is in use. The same piece carries a cone or funnel K. From the bent wire N, similar to H, a pair of wood charcoal balls are suspended, or instead of them the quadrant electrometer O, which serves to mark the higher electrical intensities, such as those of rain, hail, snow, and heavy clouds, which are too strong to be measured by more delicate instruments.

When this instrument is screwed upon a table in an upper room, and the fishing-rod thrust out of the window, it will be found highly useful for examining the usual atmospherical electricity of serene weather. If it is to be used in the open air the ball F is unnecessary, and the rod can be placed vertically in the brass socket. Two insulators of this kind may be used to sustain a wire if required.

(D. B.)

ELECTRIC TELEGRAPH. See Telegraph.

ELECTROTYPIE, Electro-Metallurgy, Electro-Plating, the art of taking exact copies of any object in copper, silver, gold, or other metal, or of covering objects with metallic surfaces, through the energy of voltaic electricity. This beautiful process now so extensively used in the arts for gilding, plating, multiplying plates for engraving, and forming solid articles in gold, silver, and other metals, appears to have been first put in operation by Mr Bessemer of Camden Town, London, to deposit copper on lead castings so as to produce antique heads in relief for mantel-piece ornaments. Mr Jordan, however, in this country, and Professor Jacobi simultaneously on the continent, appear to have been the first to have made the details of the process known to the public. The process itself is a very simple one. The cast, piece of plate, or other object wished to be covered with a metallic coating, after being properly prepared, is immersed in a solution of the metal we wish to be deposited on it, and is connected with the positive or zinc pole of the galvanic battery; the other pole of the battery terminating in a plate of the metal which is in solution, and also immersed in the metallic solution. The galvanic action decomposes the metallic solution; the metal is deposited in an equal layer all over the prepared cast or object, and the acid or agent which held the metal in solution being thus set free, reacts on the plate of metal at the negative pole, dissolving it, and thus keeping up the strength of the solution. Cyanide of potassium has been found by the Messrs Elkington to be the best agent for producing solution of the oxides of silver and of gold.

When the object to be plated or gilded is of metal it requires only to be extremely clean, which is done by boiling it in caustic potash, and then dipping it in aquafortis solution. If, however, it consist of a cast of plaster of Paris, or wood, of wax, &c., its surface must be rendered a conductor of electricity to render it susceptible of the deposition of the metal on it. It is therefore carefully but completely blackened by means of plumbago; but it has been found that dipping the object in a solution of phosphorus has the same effect. For further information see Voltaic Electricity.

ELEMI, a concrete resinous matter yielded by several different plants, chiefly of the natural order *Burseraceæ*, and imported from a variety of sources. The whole commercial and botanical history of elemi is very confused, but the following varieties of the drug are more or less met with in commerce:—

1. Elemi in flag leaves. This is a yellowish-white resin, with a pervading tinge of green. It comes in masses weighing from one to three pounds, wrapped up in the leaf of a palm or of some species of *canna*. Dr Pereira found that this is imported from Holland, and therefore concluded that it is the produce of some Dutch settlement. It may perhaps be brought to Holland from the Moluccas. The plant yielding it is not known, but it seems not improbable that it may be the produce of *Canarium balsamiferum*, Will., a species found in many parts of the East, including the Moluccas and Ceylon. The resin of the species as brought from Ceylon was found by Dr Christison and others to resemble elemi in its physical characters.

2. East India Elemi. This is a soft yellow resin, imported in bamboos; and, though called East India, does not appear to be produced in any part of Hindustan. This has been ascribed to *Canarium commune*, L., a widely distributed Eastern species.

3. Manilla Elemi. This does not seem to differ essentially from the last, except that it is imported in masses and not in bamboos. It is probably the produce of *Canarium commune*. In the Philippine Isles there is obtained from a tree which M. Baup believed to be *Canarium album*, and which is known as *Arbol a brea*, or pitch tree, a resin resembling elemi, which is got in such quantity as to be used for pitching ships. It is possible that this may form part of the Manilla elemi of commerce.

4. Brazilian Elemi. This is described by M. Guibourt as being of a yellowish-white, mixed with greenish points, and comes in cases containing two or three hundred pounds. It is almost certain that if any elemi comes from Brazil, it is the produce of *Icica Icicæriba*, DC., which exudes a balsamic resin like elemi; but Brazilian elemi is not now known in British commerce, though this at one time seems to have been the most common variety in trade.

5. Mexican Elemi. This kind has been imported of late years into this country. It is pale greenish-white; and, from the shape of some of the masses, seems to have been collected in a large reed or other hollow stem. Dr Royle received specimens of the plant known to yield this variety, and determined it to be a new species of *Elaphrium*, which he named *E. elemiferum*.

6. Common Lump Elemi. This is a dark yellow resin, with a strong turpentine odour, frequently containing pieces of dissimilar appearance. It comes from Hamburg and Holland, and is evidently a factitious substance, probably made up of portions of true elemi mixed with *thus* or common yellow resin, and flavoured with some volatile oil.

Elemi varies much in colour, consistence, and odour, according to its age and state of preservation. All the true varieties have more or less of an odour like that of fennel, sometimes mixed with that of lemons. Elemi softens with a gentle heat, and becomes adhesive. Boiling alcohol dissolves the whole of it except the impurities; the solution as it cools depositing an insipid crystalline white resin which has been called *elemine*. Bonastre obtained from elemi 60 per cent. of transparent resin, 12·5 of volatile oil, 24 of elemine, 2 of bitter extractive, and 1·5 of impurities. It is not known, however, which variety he examined.

Elemi was at one time much in use as a constituent of unguents, but is now little employed. The elemi ointment of the pharmacopœias is intended to represent the once famed Liniment of Arcæus; it is occasionally used to keep up the discharge from setons. The principal consumption of elemi is to make varnishes for coach painters. (D. M.)

ELEPHANT. See index to MAMMALIA.

The Order of the ELEPHANT in Denmark is an order of knighthood of the first distinction. Its origin has been referred to the time of Canute IV., who is said to have instituted the order in commemoration of one of the Danish crusaders having killed an elephant during an expedition against the Saracens in 1189. That the elephant was adopted at that remote period as an heraldic emblem seems probable; but it would appear that properly this order does not date further back than the year 1478, when it was instituted by Christian I. on the marriage of his son with a princess of Saxony. The decoration—which is attached either to a collar of gold, or to a watered blue riband—consists of a white enamelled elephant bearing a black tower. The chevaliers of this order have also a silver star of eight rays embroidered on a mantle of crimson velvet.

ELEPHANTA ISLE, called by the natives Gharipoor, a small island between Bombay and the mainland, about 5½ miles from Bombay. It is nearly 5 miles in circumference, and contains about 100 inhabitants, employed in the cultivation of rice, and in rearing sheep and poultry for the Bombay market. The island is nearly overgrown with wood, and contains several springs of good water. But it owes its chief celebrity to the mythological excavations and sculptures of Hindu superstition which it contains. Opposite to the landing place is a colossal statue of an elephant, cracked and mutilated, from which the island received from the Portuguese the name it still bears. At a short distance from this is a cave, the entrance to which is nearly 60 feet wide and 18 high, supported by pillars cut out of the rock: the sides are sculptured into numerous compartments containing various representations of the Hindu deities, but many of the figures have been defaced by the blind zeal of the Mohammedans and Portuguese. In the centre of the excavations there is a remarkable bust of the Hindu Triad, or three-formed god, namely, Brahma the Creator, Vishnu the Preserver, and Seva or Mahadeva the Destroyer. The heads are 6 feet in length, well cut, and the countenances, with the exception of the under lip, are handsome. The head-dresses are curiously ornamented; and one of the figures, that of the destroyer, holds in its hand a cobra de capella snake, whilst on the cap are, amongst other symbols, a human skull and a young infant. On each side of the Trimurti is a pilaster, the front of which is filled up by a human figure leaning on a dwarf, both much defaced. There is a large compartment to the right, hollowed a little, and covered with a great variety of figures, the largest of which is 16 feet high, representing the double figure of Seva and Parvati, named Viraj, half male and half female. On the right is Brahma, four-faced, on a lotus; and on the left is Vishnu. On the other side of the Trimurti is another compartment with various figures of Seva and Parvati, the most remarkable of which is Seva in his vindictive character, eight-handed, with a collet of skulls round his neck. On the right of the entrance to the cave is a square apartment, supported by eight colossal figures, containing a gigantic symbol of Mahadeva or Seva cut out of the rock. There is a similar chamber in a smaller cavern, with its walls covered with sculptures, which, however, can hardly be seen, owing to the rubbish with which the place is filled. This singular seat of Hindu superstition is said to have been dedicated to Seva, but it contains numerous representations of all the Hindu deities. It has, however, from time immemorial been forsaken by its priests or Brahmins; and it is not even the resort of pilgrims. Its only devotees are married women, who offer up their prayers here for an increase of their family. This place is a most wonderful monument of antiquity and superstition. The work must have been one of incredible labour; and there is not the least trace or tradition to indicate the time when this temple flourished, much less the period of its formation; yet it is a proof that the Brahmi-

nical religion must have flourished in India at a very remote period of antiquity. E. Long. 73.; N. Lat. 18. 57. (E. T.)

ELEPHANTIASIS, a chronic disease, chiefly affecting the legs and feet, which sometimes swell to an enormous size. It is characterized by the skin becoming thick, rough, and scaly; the eyes fierce and staring; and the perspiration highly offensive.

ELEPHANTINE, a small island of the Nile, opposite Syene. See EGYPT.

ELEPHANTINE, in *Antiquity*, an appellation given to the books in which the Romans registered the transactions of the senate, magistrates, emperors, generals, &c.: probably so called as being made of ivory.

ELEUSINIA, in *Grecian Antiquity*, a festival observed in honour of Ceres, by some states every fourth year, but by others every fifth. The Athenians celebrated it at Eleusis, a town of Attica; and hence arose the name.

Ceres, says Isocrates, wandering in quest of her daughter Proserpine, arrived in Attica, where some good offices were rendered her, which it is unlawful for those who are not initiated to hear. In return she conferred two unparalleled benefits, namely, the knowledge of agriculture, by which the human race is raised above the brute creation; and the mysteries, from which the partakers derive sweeter hopes than other men enjoy, both as to the present life and a future state of existence. It was the popular opinion that the Eleusinian goddesses suggested prudent counsel to their votaries, and influenced their conduct; and that the latter were respected in the infernal regions, and had precedence in the assemblies of the blessed, whilst the unhallowed were left in utter darkness, wallowing in mire, or labouring to fill a leaky vessel. The Athenians were solicitous to secure these advantages to their children, by having them initiated as soon as possible in the Eleusinian mysteries.

Ceres was supposed to be particularly attached to Eleusis and its vicinity, which contained various memorials of her presence and of her bounty; as, the well named *Callichorus*, by which she had rested, in the reign of Erechtheus; the stone on which she sat, named the *sorrowful;* the Rharian plain, where barley was first sown; and the thrashing floor and altar of Triptolemus, a herdsman whom she instructed in the culture of that grain, the use of which succeeded that of acorns. Her mysteries continued to possess a pre-eminence in holiness, and to be accounted as much superior to all other religious festivals as the gods were to the deified heroes. Even the garments worn at the solemnity were supposed to partake of the efficacy of the mysteries, and to be possessed of signal virtues. It was customary to retain them until they began to decay, and then to dedicate them in the temple, or to use them as swaddling clothes.

The mystic temple as it was called, provided by Pericles for the solemnity, created by its sanctity an awe only equalled by the astonishment which its beauty and magnitude excited in every beholder. The profane or uninitiated were forbidden to enter it upon any pretence. Two young Acarnanians, who happened inadvertently to mix with the crowd at the season of the mysteries, and to go in, were discovered and put to death. The chief priest, hierophant, or mystagogue, was taken from the Eumolpidæ, a sacred family which flourished at Athens, and derived its descent from Eumolpus, a shepherd and favourite of Ceres. He was enjoined to observe celibacy, and he wore a stole or long garment, and on his head a wreath of myrtle. The grand requisites in this priest were a full and sonorous voice, solemnity of deportment, magnificence, and strict decorum. Under him, besides many of inferior station, was the daduchus or torch-bearer, whose hair was likewise adorned with a fillet; the priest, who officiated at the altar; and the hiero-ceryx, or sacred herald. All these were very important personages. The latter was of a family which claimed the god Mercury, and Aglauros, the daughter of Cecrops, for its ancestors.

The secrecy in which the mysteries were enveloped served to enhance the idea of their importance, and to increase the desire of participation. It was so strict that no person was allowed even to name the hierophant by whom he had been initiated; whilst public abhorrence and detestation awaited the babbler, and the law decreed that he should die.

The Athenians suffered none to be initiated into these mysteries excepting such as were members of their city. This regulation, which compelled Hercules, Castor, and Pollux to become citizens of Athens, was strictly observed in the first ages of the institution; but after a time all persons, barbarians excepted, were freely admitted.

The festivals were divided into greater and lesser mysteries. The institution of the latter arose out of the following circumstance. Hercules, having passed near Eleusis while the Athenians were celebrating the mysteries, desired to be initiated. As this request could not be complied with, he being a stranger, and as Eumolpus was unwilling to displease him on account of his great power and the services which he had rendered to the Athenians, another festival was instituted without violating the laws; it was denominated *μίκρα*, and Hercules was solemnly admitted to the celebration and initiated. These lesser mysteries were observed at Agræ, near the Ilissus. The greater were celebrated at Eleusis, from which place Ceres has been called *Eleusinia.* In later times the lesser festivals were preparatory to the greater, and no person could be initiated at Eleusis without a previous purification at Agræ. This purification they performed by keeping themselves pure, chaste, and unpolluted during nine days; after which they came and offered sacrifices and prayers, wearing garlands of flowers called *ἱμερὰ*, and having under their feet *Δίος κωδίον*, *Jupiter's skin*, which was the skin of a victim offered to that god. The person who assisted was called *ὑδρανός*, from *ὑδώρ*, *water*, which was used at the purification; and those purified were called *μύσται*, *the initiated.* A year after the initiation into the lesser mysteries they sacrificed a sow to Ceres, and were admitted into the greater, and the secrets of the festivals were solemnly revealed to them.

This festival was observed in the month Boedromion or September, and continued nine days, from the 15th till the 23d. During that time it was unlawful to arrest any man, or present any petition, on pain of forfeiting a thousand drachmas, or, according to others, on pain of death. It was also unlawful for those who were initiated to sit upon the cover of a well, or to eat beans, mullets, or weazels. If any woman rode to Eleusis in a chariot, she was obliged by an edict of Lycurgus to pay six thousand drachmas. The design of this law was to destroy all distinction between the richer and poorer citizens. When the season approached, the mystæ, or persons who had been initiated only in the lesser mysteries, repaired to Eleusis to be instructed in the ceremonial. The service for the opening of the temple, with morning sacrifice, was performed, and the ritual was then produced from the sanctuary. It was enveloped in symbolical figures of animals, which suggested words compendiously, in letters with ligatures, the tops being huddled together, or disposed circularly like a wheel, and the whole utterly inexplicable to the profane. The case, which was called *petroma*, consisted of two stones exactly fitted; and the mysterious record, after being read, was closed up and replaced until a future festival. The principal rite was nocturnal, and confined to the temple and its environs. The mystæ waited without with impatience and apprehension. Lamentations and strange sounds were heard. Thunder pealed above these noises, and flashes of light and fire irradiated the gloom, rendering the darkness which followed more awful and sublime. The candidates for initiation were beaten by some invisible hand, whilst frightful apparitions, and monsters of a canine form, were presented to them,

Eleusinia. which filled them with apprehension and terror, and paralysed their energies. The scene then suddenly changed to one of a brilliant and agreeable character. The propylæa or vestibules of the temple were opened, the curtains withdrawn, and the hidden things displayed. They were introduced by the hierophant and daduchus, the former of whom revealed to them the mysteries. The splendour of illumination, the glory of the temple and of the images, and the singing and dancing which accompanied the exhibition, all contributed to soothe the mind after its recent agitation, and to render the wondering devotee tranquil and satisfied. After this inspection, or, as it was called, the *autopsia*, they retired, and others advanced. The succeeding days were employed in purification, in sacrifice, in pompous processions, and in spectacles, at which they assisted, wearing myrtle crowns. The second day was called ἅλαδε μύσται, *to the sea, ye initiated;* because they were commanded to purify themselves by ablution in the sea. On the third day sacrifices were offered, as also a mullet, and barley from a field of Eleusis. These oblations were called θύα, and were held so sacred that the priests themselves dared not, as in other sacrifices, partake of them. On the fourth day the votaries made a solemn procession, in which the καλαθίον, or *holy basket of Ceres*, was paraded in a consecrated cart, while on every side the people shouted χαίρε Δήμητερ, *Hail, Ceres.* After these followed women, called κιστοφόροι, who *carried baskets*, in which was sesamin, carded wool, grains of salt, a serpent, pomegranates, reeds, ivy boughs, and so on. The fifth was called ἡ τῶν λαμπάδων ἡμέρα, *the torch day*, because on the following night the people ran about with torches in their hands. It was usual to dedicate torches to Ceres, and contend who should offer the largest, in commemoration of the travels of the goddess, and of her lighting a torch in the flames of Mount Ætna. The sixth day was called Ἴακχος, from Iacchus, the son of Jupiter and Ceres, who accompanied his mother in her search after Proserpine, with a torch in his hand. From this circumstance the hand of his statue was furnished with a torch, and it was carried in solemn procession from the Ceramicus to Eleusis. The statue, with those who accompanied it, called Ιακχαγωγόν, was crowned with myrtle. In the way nothing was heard but singing and the noise of brazen kettles as the votaries danced along. The way through which they issued from the city was called ἱερὰ ὁδός, or *the sacred way*, the resting place ἱερὰ συκῆ, from a *sacred fig-tree* in the neighbourhood. They also stopped on a bridge over the Cephisus, where they derided those who passed by. After they had crossed this bridge, they entered Eleusis by a place called μυστικὴ εἴσοδος, or *the mystical entrance.* The seventh day was devoted to sports, in which the victors were rewarded with a measure of barley, that grain having been first sown in Eleusis. The eighth day was called Επιδαυρίων ἡμέρα, because Æsculapius on his return from Epidaurus to Athens was initiated by the repetition of the lesser mysteries. It became customary therefore to celebrate them a second time upon this occasion, in order that those who had not hitherto obtained the privilege might be lawfully initiated. The ninth and last day of the festival was called πλημοχόαι, or *earthen vessels*, because it was customary to fill two such vessels with wine, one placed towards the east, and the other towards the west; which, after the repetition of some mystical words, were both thrown down, and the wine spilt on the ground was offered as a libation.

The story of Ceres and Proserpine, the foundation of the Eleusinian mysteries, was both verbally narrated and represented in allegorical show. Proserpine was gathering flowers when she was stolen by Pluto; and hence the procession of the holy basket, which was placed on a car dragged along by oxen and followed by a train of females, some carrying the mystic chests, shouting *Hail, Ceres.* At night a procession was made with lighted torches, in order to commemorate the goddess searching for her daughter. A measure of barley, the grain which it was believed she had bestowed, was the reward of the victors in the gymnic exercises; and the proceedings at the temple had a reference to the legend. A knowledge of these things, from which the profane were excluded, formed the amount of what was communicated to the initiated; and the mode in which it was performed was skilfully adapted to the reigning superstitions. The operation was forcible, and the effect in proportion. The priesthood flourished as piety increased; and although the dispensation was corrupt, its tendency was not malignant. It produced sanctity of manners, an attention to the social duties, and a desire to be distinguished for what was then deemed virtue. (See Warburton, *Divine Legation of Moses demonstrated;* Gibbon, in his *Miscellaneous Works*, on Virgil's account of Æneas's Descent into the Shades; and Heyne's *Excursus*, in reference to the same subject.) Further details respecting the Eleusinia are given under the head MYSTERIES.

Eleusis. ELEUSIS, a city of Attica, four leagues from Athens, and close to the shore opposite the island of Salamis. Like most of the other cities of Greece, its origin is ascribed to various fabulous characters, and, among these, to Ogyges; a circumstance which at least proves it to be of the highest antiquity. In the earlier period of its history it seems to have been an independent state, and was even so powerful as to contest with Athens itself the palm of superiority. A considerable portion of its small territory was occupied by the plains of Thria, remarkable for their fertility, though the hopes of the husbandmen were not unfrequently disappointed from the blight of the south wind. To the west was the Campus Rharius, where Ceres is said to have sown the first seeds of corn; and on its confines was the field called Orgas, planted with trees consecrated to Ceres and Proserpine. The temple of Eleusis, sacred to Ceres and her daughter, was considered as one of the most beautiful productions of the genius of Greece. It is said to have been founded by Pandion II., and Clemens Alexandrinus places it even 120 years earlier, in the reign of Lynceus. Its position and riches naturally exposed it to the attacks of the enemies of Attica, and though defended by a strong fortress, it was seldom able to make any lengthened resistance. Cleomenes, king of Sparta, dared to violate its sacred precincts; but if we may believe the statements of the Athenians, he was soon overtaken by the just vengeance of the gods, and seized with a sudden fit of madness. The Persians burnt it to the ground after the battle of Platæa; but scarcely had they evacuated the confines of Greece, when the Athenians determined to rebuild it with even more than its original magnificence. Ictinus, the architect of the Parthenon, was ordered to draw up the plan of the new edifice. He adopted the Doric order of architecture, without the erection of pillars in front of the building. We know not whether he lived long enough to carry his plan into execution; but it was during the splendid administration of Pericles, and under the cultivated taste of Phidias, that the temple of Eleusis was completed in all its magnificence. The mystic cell was begun by Corœbus, but he lived only to finish the lower row of columns, with their architraves. Metagenes, of the district of Xypete, added the rest of the entablature and the upper row of columns. Xenocles of Cholargus built the dome on the top. A portico was long afterwards added by Demetrius Phalereus, who employed for that purpose the architect Philo. This magnificent structure continued to exist for many centuries, till the destructive hordes of Alaric completed its overthrow in the year 396. The city immediately disappeared on the destruction of the temple, which had been its ornament and principal support; and upon the site nothing is now found but a miserable village called *Lepsina*, amidst the ruins of the sacred edifice. But the coins of Eleusis are still com-

mon, and represent Ceres drawn by dragons or serpents. The inscription is ΕΛΕΥΣΙ, or ΕΛΕΥ, within a wreath of ears of corn.

ELEUTHERIA, in *Grecian Antiquity*, a festival celebrated at Platæa, in honour of Jupiter *Eleutherius*, or "the assertor of liberty," by delegates from almost all the cities of Greece. Its institution originated thus: After the victory which the Grecians under Pausanias obtained at Platæa, B.C. 479, over Mardonius the Persian general, an altar and statue were erected to Jupiter Eleutherius, who had freed the Greeks from the tyranny of the barbarians. It was further decreed in a general assembly of the Greeks, by the advice of Aristides the Athenian, that delegates from all the Greek states should assemble annually at Platæa to celebrate the Eleutheria, or festival of liberty. Every fifth year the solemnities were celebrated with contests in which chaplets were awarded to the victors. The annual festival at Platæa still existed in the time of Plutarch, and was celebrated thus:—At break of day the procession set out through the middle of the town, headed by a trumpeter who sounded a signal for battle; and it was followed by waggons loaded with myrtle boughs and garlands, by a black bull, and a number of free youths (slaves being excluded from the ceremony) who carried libations of wine and milk in large-eared vessels, with jars of oil and precious unguents; and the rear was brought up by the archon or chief magistrate of the city, who, though not permitted at any other time to touch a weapon or to wear a garment that was not white, appeared on this occasion with a sword in his hand and clad in a purple tunic, and also bearing an urn preserved for this solemnity in the city archive. When the procession arrived at the sepulchres of those who had fallen at Platæa, the archon, having drawn water from a neighbouring spring, first washed and anointed the monuments, and then sacrificed the bull on a pyre of wood; at the same time invoking Jupiter and Mercury, and inviting the souls of the heroes who had perished on the plains of Platæa to partake of the entertainment prepared for them. He then filled a bowl with wine, and pledged those who lost their lives in the defence of the liberties of Greece. (Plut. *Aristid.*; *Strabo*, ix.; *Paus.* ix.)

A festival of the same name was observed by the Samians in honour of the god of love. Slaves, also, on their emancipation, kept a holiday which they called *Eleutheria*.

ELEUTHEROPOLIS, an ancient episcopal city, situated in the south-western plain of Judæa, between Hebron and Askelon. It has been identified by Dr Robinson with the modern Beit-Jibrin, the Betogabra of Ptolemy and the Peutingerian Tables.

ELEVATION *of the Host*, in the Romish Church, that part of the mass in which the priest raises the consecrated wafer above his head for the people to adore.

ELEVATOR, in *Anatomy*, the name of several muscles, which serve to raise a part of the body, as the lip or the eye.

ELEVATORY, an instrument used in trepanning, for raising a depressed or fractured part of the skull.

ELEVE, a term purely French, denoting literally a disciple or scholar—from an Italian word signifying an apprentice. It was first applied by French writers to the pupils of painters; and afterwards to such as studied any other art under a master. In the Royal Academy of Sciences there were 20 élèves; and in that of Inscriptions, 10 élèves.

ELF, a fairy or hobgoblin; an imaginary being which our superstitious ancestors supposed to inhabit unfrequented places.

Elf-Arrows, the name given by the ignorant to the ancient arrow-heads formed of flint which are still found in Scotland, America, and several other parts of the world, under the belief that they were shot by fairies, and that cattle were thus sometimes killed.

ELGIN, a royal and parliamentary burgh of Scotland, and county town of Elgin or Morayshire, 64 miles north-west from Aberdeen. Pop. (1851) 6337. It stands about five miles from the sea, in a valley sheltered on the north and east by the wooded eminences of Quarrywood and Barnett Hill, and watered by the Lossie, a small river which winds round the town. The elegant villas in its outskirts, and round the village of Bishopmill, which may be almost called a suburb of the town, give it a fine appearance when approached from the south or east. The town, which is about a mile in length, is well paved and lighted, and plentifully supplied with water. It contains many handsome buildings, which, being built of the beautiful light-coloured sandstone of the district, have a fine appearance. The parish church is a handsome structure in the Corinthian style, with an elegant spire. Near it, in the centre of the street, is a fountain, which marks the site of the old jail. The other principal buildings of the town are Gray's Hospital, Anderson's Institution, museum, New Market Buildings, court-house, jail, Free Church, South Free Church, Catholic Chapel, Commercial Bank, Caledonian Bank, Trinity Lodge Rooms, &c.

The academy, which stands on the south side of the town, is one of the best in the north of Scotland. It is conducted by a rector who presides over the classical department, and several assistants who teach the subsidiary branches. Elgin likewise possesses an infant and several other schools. Gray's Hospital stands on an eminence at the west end of the town, and is a handsome edifice surmounted by a dome. The sum of L.20,000 was left for its endowment by Dr Gray. It was opened in 1819 for the reception of patients from the town and county, and the average number of patients in the house at one time is 35. Adjoining the hospital is the Lunatic Asylum, built and supported by voluntary contributions, and generally containing 20 or 30 patients. Anderson's Institution, for the support of the aged and the education of youth, is at the east end of the town. Its founder, General Anderson, H.E.I.C.S., who was a native of Elgin, bequeathed the bulk of his fortune, amounting to L.70,000, for the building and support of this splendid institution. It was opened in 1833. Above the northern front of the building is a group of statuary representing the founder in an attitude corresponding to his character. There are generally from 40 to 50 children, and about 10 aged people, in the institution. Attached to it is a free school with an average attendance of 200 scholars. The museum belongs to the Morayshire Scientific Association, which holds its meetings monthly in the building. The new market is a long range of building, with an entrance from the High Street, and another from South Street. Attached to it is a small theatre, which is open for apart of the year.

The ruins of the magnificent cathedral stand on the east of the town. It is described by Billings as "at once the most stately and the most beautifully decorated of all the ecclesiastical edifices of the country." It was founded in 1224, and destroyed by fire, according to Fordun, in 1270. The greater part of the present ruins are attributed to a date closely subsequent to this. It was again burnt, along with the canons' houses and a great part of the town, by the "Wolf of Badenoch," a natural son of King Robert II., in 1390. It was slowly rebuilt; a solemn agreement having been come to that each bishop should apply one-third of his revenue for this purpose till the completion of the building. In 1568, in the regency of the Earl of Murray, the lead was stripped from the roof by an order of privy-council, and shipped for Holland to be there sold. Being thus exposed to the weather, the interior rapidly decayed. In 1711 the great centre tower fell. The ruin is now carefully preserved by the Commissioners of Woods and Forests. Near the cathedral stands the bishop's town residence. The dean and canons' houses stood round about the cathedral, and some of them existed till very lately. The re-

mains of the monastery of the Grey Friars stands on the south side of the town. Of a similar monastery of White Friars on the north there is now no vestige. On the "Lady Hill" are the ruins of an ancient fortification, said to have been used as a hunting seat by one of the Malcolms; and also an elegant pillar erected to the memory of the last Duke of Gordon.

The trade of the town is chiefly connected with the weekly and other markets. A woollen manufactory gives employment to a number of hands, chiefly in making blankets, plaiding, shawls, and drugget. There are also large tan works, and an iron foundry. Elgin communicates by railway with the harbour at Lossiemouth, and along the line there is a considerable traffic. There are two newspapers published weekly in the town; and besides circulating libraries and book clubs, Elgin possesses also a mechanics' institute and a literary association. The places of worship are numerous. Besides the Established Church, there are two Free Churches, two United Presbyterian, one Independent, two Baptist, one Episcopalian, and a Roman Catholic. Of late years the town has extended considerably, and several new streets have been erected. Its municipal corporation consists of a provost, 4 bailies, and 12 councillors; and along with Banff, Cullen, Inverury, Kintore, and Peterhead, it returns one member to the imperial parliament.

By some historians the name of the town is said to have been derived from Helgy, a Norwegian chief, who in the ninth century overran Morayshire. Others derive the name from the Saxon *Hely*, holy, and *Dun*, a hill. It was the favourite residence of William the Lion and the two Alexanders.

ELGINSHIRE, or MORAYSHIRE. See MORAYSHIRE.

ELGIN MARBLES, the name applied to that matchless collection of ancient sculpture which was acquired by the British Museum from Lord Elgin. They are mostly basso-relievos and fragments of statuary which had adorned the Parthenon at Athens. The history of this collection may be thus shortly stated. It was in 1799 that the idea of such a collection first occurred to Lord Elgin, when he was appointed ambassador at Constantinople. Mr Harrison, an architect, suggested to him in the course of conversation, that though the public possessed everything requisite to give them a general knowledge of the remains of Athens, yet to artists nothing but the actual representation by cast could be of essential service. Lord Elgin accordingly entered into communication with government on the subject; but the important transactions in which the nation was then engaged prevented the government from embarking in the undertaking. When Lord Elgin met Sir William Hamilton in Sicily, he entered with him into a more minute examination of the feasibility of the scheme; and it appeared to them most advisable that his lordship should be accompanied by artists from Italy. He accordingly obtained permission from the king of the Two Sicilies to take with him Signor Lusieri, a painter of great reputation, then in the service of that monarch; and from Rome he obtained two architects, two modellers, and a figure-painter. In the summer of 1800 these persons reached Athens. At this period the French were in possession of Egypt, and the Turks felt little inclined to afford any facilities towards furthering the object which Lord Elgin had in view. They in fact did everything to thwart him; and his artists could only obtain admission to the Acropolis, for the purpose of taking drawings, on the payment of a large daily fee. When, however, our arms proved victorious in Egypt, a favourable change took place. The Sublime Porte showed an inclination to grant whatever our nation might think proper to ask; and Lord Elgin, availing himself of this opportunity, obtained, in the summer of 1801, firmans or warrants to the chief authorities of Athens, in which it was stated "that he might view, draw, and model the ancient temples of the idols, and the sculptures upon them, and make excavations, and *take away any stones* that might appear interesting to him." There was little difficulty after this permission had been granted; and as the Turks showed a perfect apathy in respect to the preservation of these remains, and indeed often wantonly destroyed them, Lord Elgin determined to remove as many as he could. In this way these noble remains of antiquity came into the possession of a British subject.

In 1811 an offer was made by Mr Perceval to purchase the whole collection for the nation, and the sum of L.30,000 was named as the price which the government was willing to give; but Lord Elgin considered this an inadequate compensation for the outlay occasioned in procuring the collection, and declined the proposal. In 1812 eighty more cases of architecture and sculpture were added, and also a collection of medals.

In 1815, however, Lord Elgin presented a petition to the House of Commons, in which he offered to make over the collection to the nation, on such conditions as it might seem just and reasonable to that assembly to recommend. Accordingly a select committee was appointed to examine into the affair, and after due consideration, and the examination of many witnesses, the committee came to the resolution of recommending the house to offer L.35,000 as a reasonable and sufficient price for this collection.

Thus were these noblest models which the genius of man has ever produced secured to the nation;—an acquisition invaluable in itself, and the more to be appreciated when we consider that the cultivation of the fine arts has contributed to the reputation, character, and dignity of every government by which they have been encouraged, and that they are intimately connected with the advancement of everything that is valuable in science, in literature, and in philosophy. No country certainly is better adapted than our own to afford an honourable asylum to these monuments of the school of Phidias, and of the wise administration of Pericles.

Further particulars are contained in the *Report from the Select Committee on Lord Elgin's Collection of Sculptured Marble, &c.;* and in the *Memorandum of the Earl of Elgin's Pursuits in Greece*, 4to, 1810.

ELI, the high priest of the Jews when the ark was in Shiloh. He was the first high priest of the line of Ithamar, Aaron's youngest son. Eli also acted as regent or civil judge of Israel after the death of Samson; this function devolving on the high priest in the absence of any person specially appointed to deliver and govern Israel. He is said to have judged Israel forty years; the Septuagint makes it twenty. The longer period probably comprehends the whole period of his administration both as high priest and judge.

Eli seems to have been a religious man, but having failed to repress the conduct of his sons, Hophni and Phinehas, the judgment of God was at length denounced upon his house, through the young Samuel. During an inroad of the Philistines the ark of God was captured, and Eli when he heard the news fell heavily from his seat and died. The ultimate doom upon Eli's house was accomplished when Solomon removed Abiathar (the last high priest of this line) from his office, and restored the line of Eleazar in the person of Zadok.

ELIAS LEVITA, a celebrated Jewish grammarian, was born in 1472, at Neustadt in Franconia. He was professor of Hebrew at Padua, Venice, and Rome, and died at Venice in 1549. His principal works are the *Masorah*, or *Traditio Doctrinæ*, Ven. 1538, and a *Chaldaic, Rabbinical*, and *Talmudic Lexicon*, January 1541. His merits are summed up by Simon when he says, "*Solus Elias Levita inter Judæos desiit nugari.*"

ELIJAH (*i. e. God-Jehovah*) is introduced to our notice like another Melchizedek, without any mention of his father or mother; and from this silence of Scripture much vain speculation has arisen. Some of the Rabbins supposed that he was *Phineas*, the grandson of Aaron; whilst others thought that he was an angel in human form. He is called a Tishbite, either from Tishbeh, a city beyond the Jordan; or from a Hebrew root signifying to convert or reform. He is first introduced as denouncing a drought for three years and a half, on account of the sins of Ahab and his people. As the denunciation took effect, the king sought to wreak his vengeance upon him as the cause of their sufferings. At the command of God, he hid himself by the brook Cherith, where he was miraculously fed by ravens, or, according to some commentators, although with needless scrupulosity, by merchants or Arabians, as the word may possibly be translated. For one year God miraculously provided for his bodily wants at Cherith; but the brook dried up. Again, at the command of God he withdrew to Zarephath, where, at the house of a widow woman who did not hesitate to divide her last meal with him, he and the household were preserved by the miraculous multiplication of their remaining food. During his stay in her house the prophet raised the widow's son to life. For three years and six months (James v. 17) the destructive famine had spread its deadly influence over the whole nation of Israel. Ahab was yet alive and unreformed, and Jezebel, his impious consort, was still mad upon her idols. At the command of God Elijah once again stood before Ahab. Wishing not to tempt God by going unnecessarily into danger, he first presented himself to good Obadiah, and afterwards to Ahab as he came forth to meet him. At the interview Elijah flung back upon the king the charge of troubling Israel, and offered to decide the controversy between God and Baal by a miracle from heaven. As fire was the element over which Baal was supposed to preside, the sending of fire to consume a sacrifice was chosen as the criterion of divinity. For the trial the people assembled at Mount Carmel; and Elijah, at his altar, confronted the priests of Baal. At the time of the evening sacrifice the controversy was settled; and seizing the opportunity, Elijah demands the execution of the priests of Baal. Ahab too lends his magisterial authority to the sentence, and it is willingly carried into effect by the people, who regard these false priests as the authors of their calamities. At the prayer of the prophet a cloud rises out of the Mediterranean, and rain descends upon the whole land. Impressed with the hope that God's miraculous actings at Carmel might penetrate and soften the heart of Jezebel, Elijah, strengthened from on high, accompanied Ahab to Jezreel on foot. Learning, however, that she was infuriated against him and sought to take his life, he fled from her presence. In the wilderness and at Mount Horeb his heart is touched and his petulancy corrected by the ministration of the angel of God, and by a fearful exhibition of His Divine power. Revealing Himself in the gentle accents of a still voice, Jehovah announces to him that he must go and anoint Hazael king over Syria, Jehu king over Israel, and Elisha prophet in his own place, ere death can put a period to his labours. Leaving the cave of Horeb (B.C. 906), Elijah now proceeded to the field where he found Elisha in the act of ploughing, and cast his prophet's mantle over him.

For about six years from this calling of Elisha, Elijah remained in privacy, probably labouring in the schools of the prophets, till God sent him again to pronounce judgments upon Ahab and Jezebel for the murder of Naboth. When Ahab seemed to be triumphing in the possession of his ill-obtained gain, Elijah stood before him, and threatened him in the name of the Lord, that God would retaliate blood for blood, that his seventy sons shall die, and Jezebel shall become meat for dogs. Elijah again retires from the history till an act of blasphemy on the part of Ahaziah, the son and successor of Ahab, causes God to call him forth. Ahaziah having met with an injury, sent to consult Baalzebub, the idol-god of Ekron, in regard to the issue of his sickness; but the angel of the Lord tells Elijah to go forth and meet the messengers of the king, and assure them that he shall not recover.

After twice consuming the bands of fifty whom Ahaziah sent out for his apprehension, he at length appeared before the king and repeated the denunciation. This was his last public effort to reform Israel. After a brief sojourn with the schools of the prophets, and having made a circuit from Gilgal to Bethel and thence to Jericho, while standing on the other side Jordan he was carried into heaven in the sight of Elisha and fifty of the sons of the prophets.

ELIOT, JOHN, the apostle of the North American Indians, was born in England in 1604. At Cambridge he distinguished himself in theology and languages; but having quitted the Established church he emigrated to America in 1631, and became pastor of an Independent church at Boston. He was finally established at Roxbury, and from this point he carried on his missionary labours. Before eight years had elapsed upwards of 500 Indians abandoned their savage life and settled peaceably on the lands allotted to them by the provincial government. Eliot also translated the Bible and several religious treatises into the Indian tongue, and wrote a number of English works. In addition to all his other labours, he held the pastoral charge at Roxbury till within two years of his death, which took place in 1690.

ELIQUATION (*eliquare, to melt*), in *Chemistry*, the operation of separating a more fusible substance from one that is less so, by means of heat sufficient to melt the one but not the other; as an alloy of copper and lead.

ELIS, or ELEA, in *Ancient Geography*, a country of the Peloponnesus, bounded N. and N.E. by Achaia, E. by Arcadia, S. by Arcadia, and W. by the Ionian Sea. In its extreme length, Elis included all the country lying between the small river Larissus which separated it from Achaia, and the Neda which divided it from Messenia.

Elis was originally divided into three districts, the largest of which, ἡ κοίλη Ἦλις, or Hollow Elis, comprised the country between the promontories Araxus and Ichthys; the second, called Pisatis, extended from Cape Ichthys to the Alpheus; and the third, known as Triphylia, lay between the rivers Alpheus and Neda. Hollow Elis, by far the largest and most valuable part of the country, was again subdivided into two parts; the Acroreia or mountain country lying on the southern slopes of Mount Erymanthus, and champaign country through which the Peneus flows. In its physical distribution Elis was regarded by some of the ancient geographers as forming part of Arcadia. The great mountain range which separates the two countries throws off numerous low spurs into Elis, which slope down gradually to the sea. These ridges form the basins of the rivers which drain the country and inclose the great plains that constituted the most fertile land of ancient Greece. The shore of the country is low and sandy; and as the rivers have no fall towards the latter part of their courses, they lose themselves in the flat country, forming thus fens and marshes, which during the heats of summer are peculiarly unhealthy. Sand-dunes have, in course of time, been thrown up by the action of the waves, over which the sea sometimes breaks, and in this way some extensive lagunes have come to be formed. The fish off the coast of Elis are extremely numerous during the summer months. At that time canals are cut between the lagunes and the sea, and the fish run into these canals, and are caught in vast numbers by the inhabitants. But these advantages are more than compensated by the countless swarms of gnats which are engendered in the marshes, and which render it almost impossi-

ble to live near the sea, especially in summer. Though Elis possesses no great natural barriers against invasion, it nevertheless suffered less by war than any other of the Greek states. This is to be attributed chiefly to the sacred character which attached to the country as the seat of the Olympic games. Secure in their exemption from the attacks of enemies, the inhabitants devoted themselves to commerce and the arts of peace; and thus when other parts of Greece were poor and depopulated, Elis continued rich and well-peopled.

Hollow Elis is a broad and fertile plain, watered by the Peneus and its tributary the Ladon, whose united stream forms the modern Gastuni. It is still as fertile as in the days of ancient Greece, and grows largely corn, cotton, and flax. One variety of the last called *byssus*, believed to have been introduced by the Phœnicians, was inferior only to that of Palestine. The wine of Elis was excellent, and Bacchus was held in high honour in the country. The rich pastures on the river banks were peculiarly favourable for the rearing of cattle and horses, the latter of which are celebrated in the *Odyssey*.

Pisatis is traversed by the Alpheus, and is separated from Hollow Elis by Mount Pholoë, a spur of Erymanthus. Its level lands are equally fertile with those of that district. By far the larger portion of Triphylia is occupied with offshoots from the mountains of Arcadia. It is separated from Pisatis by the river Alpheus, on whose banks were the temple of Olympic Jove, and the plain which witnessed the celebration of the Olympic games.

The original inhabitants of Elis were called Caucones, and seem to have sprung from a Pelasgic source. From traces of the worship of Venus in the city of Elis, it is believed that the Phœnicians had settlements in this country at a very remote period. The inhabitants of Elis first appear in history as setting out for the Trojan war under the title of Epæans. They are described by Homer as living at this time in a state of constant hostility with their neighbours the Pylians. At the close of the eleventh century B.C., the Dorians invaded the Peloponnese, and Elis fell to the share of Oxylus and the Ætolians. These people, amalgamating with the Epæans, formed a powerful kingdom in the north of Elis. After this many changes took place in the political distribution of the country, and from time to time individual cities such as Pisa rose into temporary importance. The result of all these vicissitudes was, that the country came at length to acknowledge only three tribes, each independent of the other. These tribes were the Epæans, Minyæ, and Eleans. Before the end of the eighth century B.C., however, the Eleans had vanquished both their rivals, and established an undisputed supremacy over the whole country. Among the other advantages which they thus gained was the right of celebrating the Olympic games, which had formerly been the prerogative of the Pisans. The attempts which this people made to recover their lost privilege, during a period of nearly two hundred years, ended at length in the total destruction of their city by the Eleans. So complete was its annihilation, that the very existence of Pisa was doubted even by some of the ancient geographers. From the time of this event, B.C. 572, till the Peloponnesian war, the peace of Elis remained undisturbed. In that great contest Elis sided at first with Sparta; but that power, jealous of the increasing prosperity of Elis, availed itself of the first pretext to pick a quarrel with it. At the battle of Mantinea the Eleans sided with the allies against the Spartans, who, as soon as the war came to a close, took vengeance upon them by depriving them of Triphylia and the towns of the Acroreia. The Eleans made no attempt to re-establish their authority over these places, till the star of Thebes rose in the ascendent after the battle of Leuctra. It is not unlikely that they would have effected their purpose had not the Arcadian confederacy come to the assistance of the Triphylians. In 366 B.C. hostilities broke out between them, and the Eleans were at first successful, but were soon overpowered, and their capital very nearly fell into the hands of the enemy. Unable without assistance to make head against their opponents, they applied for assistance to the Spartans, who invaded Arcadia, and forced the Arcadians to recall their troops from Elis. The general result of this war was the restoration of their territory to the Eleans, who were also again invested with the right of holding the Olympic games, of which they had been deprived. During the Macedonian supremacy in Greece Elis sided with the victors, but refused to fight against their countrymen. After the death of Alexander they renounced the Macedonian alliance. At a subsequent period they joined the Ætolian League, but persistently refused to identify themselves with the Achæans. When the whole of Greece fell under the Roman yoke, the sanctity of Olympia secured for the Eleans a certain amount of indulgence. The games still continued to attract to the country large numbers of strangers, until they were finally put down by Theodosius in 394, two years previous to the utter destruction of the country by the Gothic invasion under Alaric. In later times Elis fell successively into the hands of the French and the Venetians, under whose rule it recovered to some extent its ancient prosperity. By the latter people the province of Belvedere on the Peneus was called, in consequence of its fertility, "the milk cow of the Morea." The country has of late greatly declined from its former prosperity. The sea-coast is now almost uninhabitable from malaria.

ELIS, now *Kaloscopi*, the capital of the foregoing country, was situated on a hill overhanging the river Peneus, where it issues from the mountain passes that inclose the upper part of its course into the champaign country beyond. Elis was remarkable as being the only fortified town in the country of which it is the capital; the other towns and villages, as has been already remarked, being unwalled. The history of the town is so closely identified with that of its country, that a recapitulation is here unnecessary. It long maintained its place as one of the most splendid and populous cities of Greece, though no remains of its ancient magnificence are now visible. One of the most sumptuous of its public buildings was the gymnasium, in which it was necessary that all the athletes who intended to take part in the Olympic should undergo a month's training before they were allowed to compete. The history and topography of Elis will be found very fully discussed in Leake's *Morea* and Curtius's *Peloponnesos.*

ELISABETGRAD, or JELIZABETGRAD, a fortified town of South Russia, government of Kherson, on the Ingal, 140 miles N. of Kherson. It was founded in 1754, is regularly built, and has a large arsenal, hospital, and several churches. Including its four suburbs, it has a population of 12,496.

ELISABETPOL, JELIZABETPOL, or GANSHAW, a fortified town of Georgia, province of Tiflis, and 90 miles S.E. of the town of that name. It was formerly a place of considerable importance, but is now in a rather dilapidated condition; having still, however, several elegant mosques and other public buildings. Pop. (1848) 12,966.

ELISHA (*i. e. God the Deliverer*), the successor of Elijah, whose mantle he received at his translation. At the opening of his ministry he vindicated his claim to a divine mission by the division of the Jordan, and the destruction of the children who taunted him with the translation of his master. He next predicted the miraculous supply of water to the hosts of Jehoram and Jehoshaphat, which proved the destruction of the Moabites. His miracles, unlike those of Elijah, were generally miracles of mercy, as, for example, multiplying the widow's oil, raising the Shunamite's son, and healing the leprosy of Naaman. Having defeated the schemes of

the Syrian king, he escaped from the band sent to apprehend him, by smiting them with blindness, and leading them into the heart of Samaria (B.C. 892). After predicting the liberation of Samaria from siege, he next appears as predicting the death of Benhadad. Having anointed Jehu, he disappears from the sacred narrative, and at the advanced age of ninety, he is called to his rest. Jehu mourned at his funeral; and a dead body touched by his bones immediately started into life.

ELISION, in *Grammar* and *Prosody*, the cutting off or suppressing a vowel at the end of a word, for the sake of sound or measure, when the next word begins with a vowel.

ELIXATION, in *Pharmacy*, the extracting of the virtues of ingredients by boiling or stewing.

ELIXIR (Lat. *elixare, to boil, to seethe*), in *Medicine*, a tincture composed of several ingredients. In modern pharmacy elixirs are called compound tinctures. Elixir was also the name given by the alchymists to a liquor for transmuting base metals into gold, as also to a cordial which was reputed to possess rejuvenescent qualities.

ELIZABETH, queen of England, one of the most fortunate and illustrious of modern sovereigns, was born in the palace of Greenwich on the 7th of September 1533. She was the only surviving issue of the ill-starred union between Henry VIII. and Anne Boleyn, which barely extended over a space of three years. Anne was crowned at Westminster June 15, 1533, and was beheaded within the Tower of London May 19, 1536. The girlish beauty and vivacity of Anne Boleyn, with her brief career of royal splendour and her violent death, invest her story with a portion of romantic interest; but she does not seem to have possessed any solid virtues or intellectual superiority. The name of Elizabeth cannot be added to the list of eminent persons who are said to have inherited their peculiar talents and dispositions from the side of the mother. On the contrary, she closely resembled her father in many respects,—in his stout heart and haughty temper, his strong self-will and energy, and his love of courtly pomp and magnificence. Combined with these, however, there was in Elizabeth a degree of politic caution and wisdom, with no small dissimulation and artifice, which certainly does not appear in the character of "bluff King Harry." Early hardships and dangers had taught Elizabeth prudence and suspicion, as well as afforded opportunity in her forced retirement for the pursuit of learning and for private accomplishments. The period of her youth was an interesting and memorable one in English history. The doctrines of the Reformation had spread from Germany to this country; and the passions and interests of Henry led him to adopt in part the new faith, or at least to abjure the grand tenet of the papal supremacy. Anne Boleyn, by her charms and influence, facilitated this great change; and there is historical truth as well as poetical beauty in the couplet of Gray:

> "That Love could teach a monarch to be wise,
> And gospel light first dawn'd from Boleyn's eyes."

The Protestantism of England was henceforth linked to Elizabeth's title to the crown. She was in her fourteenth year when her father King Henry died. Her education had been carefully attended to, latterly under the superintendence of good Catherine Parr, the last of Henry's queens. The young princess was instructed in Greek and Latin, first by William Grindal, and afterwards by Roger Ascham, who has described his pupil in glowing terms as "exempt from female weakness," and endued with a masculine power of application, quick apprehension, and retentive memory. She spoke French and Italian with fluency, was elegant in her penmanship, whether in the Greek or Roman character, and was skilful in music, though she did not delight in it. "With respect to personal decoration," adds Ascham, "she greatly prefers a simple elegance to show and splendour." This last characteristic, if it ever existed, did not abide with Elizabeth. Her love of rich dresses, jewels, and other ornaments, was excessive; and at her death she is said to have had about 2000 costly suits of all countries in her wardrobe. Nor can it be said that even at the tender age of sixteen, when Roger Ascham drew her flattering portrait, Elizabeth was exempt from female weakness. After the death of Henry, the queen-dowager married the Lord Admiral Seymour, whose gallantries and ambition embittered her latter days. Seymour paid court to the Princess Elizabeth, and with the connivance of her governess, Mrs Ashley, obtained frequent interviews, in which much boisterous and indelicate familiarity passed. The graver court ladies found fault with "my lady Elizabeth's going in a night in a barge upon Thames, and for other light parts;" and the scandal proceeded so far as to become matter of examination by the council. Mrs Ashley and Thomas Parry, cofferer of the princess's household (afterwards patronized by Elizabeth), were committed for a time to the Tower, and Elizabeth underwent an examination by Sir Thomas Tyrwhit, but would confess nothing. "She hath a very good wit," said Tyrwhit, "and nothing is gotten of her but by great policy." The subsequent disgrace and death of Seymour closed this first of Elizabeth's love passages; she applied herself diligently to her studies under Ascham, and maintained that "policy" and caution which events rendered more than ever necessary.

The premature death of Edward VI. called forth a display of Elizabeth's sagacity and courage. Edward had been prevailed upon by the Duke of Northumberland to dispose of the crown by will to his cousin Lady Jane Grey. The two sisters, Mary and Elizabeth, on whom the succession had been settled by the testamentary provisions of Henry VIII., as well as by statute, were thus excluded. Mary's friends immediately took up arms; Elizabeth was asked to resign her title in consideration of a sum of money, and certain lands which should be assigned to her; but she rejected the proposal, adding that her elder sister should be treated with first, as during Mary's lifetime she herself had no right to the throne. Elizabeth then rallied her friends and followers, and when Mary approached London, successful and triumphant, she was met by Elizabeth at the head of 1000 horse—knights, squires, and ladies, with their attendants. Such a congratulation merited a different acknowledgment from that which Elizabeth was fated to experience. But the temper of Mary, never frank or amiable, had been soured by neglect, persecution, and ill-health; and her fanatical devotion to the ancient religion had become the absorbing and ruling passion of her mind. She was not devoid of private virtues,—certainly excelling Elizabeth in sincerity and depth of feeling; but her virtues "walked a narrow round;" and whenever the Romish Church was in question, all feelings of private tenderness, and all considerations of public expediency or justice, were with Mary as flax in the fire. The five years of her reign are perhaps the most un-English epoch in our annals.[1]

[1] Miss Lucy Aikin, in her *Memoirs of the Court of Elizabeth*, praises the magnanimity of Elizabeth in allowing Shakspeare's drama of *Henry VIII.*, in which the wrongs and sufferings of Katharine of Arragon are embalmed, to be publicly offered to the compassion of her people. We wish that this instance of magnanimity could be justly ascribed to the queen; but it seems certain that Shakspeare's Henry VIII. was not produced till after Elizabeth's death. No poet would have dared to hint at the death of the queen while she lived; and Cranmer's prophecy in the fifth act speaks of the death of Elizabeth and of her successor James. We have Ben Jonson's testimony as to Shakspeare's favour with Elizabeth,—

> ——— "Those flights upon the banks of Thames,
> That so did take Eliza and our James."

To escape from indignities and persecution at court, Elizabeth was suffered to retire, though carefully watched, to her house of Ashridge, in Buckinghamshire. Wyat's insurrection, prompted by the rumoured marriage of Mary with Philip of Spain, made her still more an object of suspicion and distrust, as the hopes of the Protestant party were on all occasions turned to Elizabeth. The young princess was taken from Ashridge and privately committed to the Tower. Her death was demanded by some of the bigoted adherents of the court, but Mary dared not and probably did not desire to proceed to this extremity; Philip, when allied to the English crown, interceded on behalf of the fair captive, and Elizabeth was removed to Woodstock, under care of a fierce Catholic, Sir Henry Bedingfield. Her extreme wariness and circumspection baffled every effort to entrap her. She conformed outwardly to the Catholic Church, opening a chapel in her house at Woodstock, and keeping a large crucifix in her chamber. This conformity was not unnaturally ascribed to dissimulation, but part was probably real. To the end of her life, Elizabeth retained a portion of the old belief. She had always a crucifix with lighted tapers before it in her private chapel; she put up prayers to the Virgin (being, she said, a virgin herself, she saw no sin in this), she disliked all preaching and controversy on the subject of the real presence, and she was zealous almost to slaying against the marriage of the clergy. She was anxious to retain as much as possible of the Catholic ceremonial and the splendid celebrations of the church festivals, which the ardent reformers would gladly have swept away, as had been done in Scotland. The Anglican Church was a compromise.

The wretched and inglorious reign of Mary terminated on the 17th of November 1558. Elizabeth heard the news of her accession at Hatfield, and she fell down on her knees exclaiming in Latin, "It is the Lord's doing, and marvellous in our eyes," words which she afterwards caused to be stamped on a gold coin, impressing on her silver coin another pious motto, "I have chosen God for my helper." All her perils were now passed. The nation received her with umbounded enthusiasm. Church bells were rung, bonfires blazed, tables were spread on the streets, the Protestants exulted with a holy joy.

Elizabeth was in her 25th year when she ascended the throne. She had been better disciplined and trained for her high trust than most princes, yet the difficulties that surrounded the English crown at this time might well have appalled her. The nation was struggling in a war with France, trade was much decayed, Calais had been lost, and England was distracted by religious divisions and animosities. All Catholic Europe might be expected to be arrayed against the Protestant Queen of England. Elizabeth, however, at once chose the better part for herself and the nation. Without waiting for the assembling of her first parliament, she ordered the church service to be read in English, and the elevation of the host to be discontinued. But before this could be known abroad, she had instructed the English ambassador at Rome to notify her accession to the pope. Paul IV., then pontiff, arrogantly replied, that England was a fief of the Holy See, that Elizabeth was illegitimate, and could not inherit the crown, and that she should renounce all her pretensions and submit to his decision. If Elizabeth had ever wavered as to the course she should pursue, this papal fulmination must have fixed her determination. Twelve years afterwards, a subsequent pope, Pius V., issued a bull releasing English Catholics from their allegiance to the queen, and formally depriving her of her title to the throne. But the thunders of the Vatican, like the threats of the Escurial, fell harmless on the English shores. The nation, under its firm monarch and her wise counsellors, Cecil, Bacon, Walsingham, Sadler, and others, pursued its triumphant course, while its naval and military glories were augmented beyond all former precedent. The government of Elizabeth and the public events of her reign will fall to be recorded in another part of this work, under the head of ENGLAND. Her first parliament passed the famous Acts of Supremacy and Uniformity, which struck directly at the papal power. All clergymen and public functionaries were obliged to renounce the temporal and spiritual jurisdiction of every foreign prince and prelate; and all ministers, whether beneficed or not, were prohibited from using any but the established liturgy. These statutes were carried out with considerable severity; many Catholics suffered death; but all might have saved themselves, if they had explicitly denied the right of the Pope to depose the queen. The Puritans and Nonconformists, on the other hand, were content to bear some portion of the burden of intolerance and oppression, from the consideration that Elizabeth was the bulwark of Protestantism. If they lost her firm hand they lost all; and the numerous plots and machinations of the Catholics against the queen's life showed how highly it was valued, and how precious it was to Protestant Europe. In the latter part of the queen's reign, her domestic and fiscal regulations were justly open to censure. The abuse of monopolies had grown to be a great evil; grants of exclusive right to deal in almost all commodities had been given to the royal favourites, who were exorbitant in their demands, and oppressed the people at pleasure. Elizabeth wisely yielded to the growing strength of the Commons, and the monopolies complained of were cancelled. The monarchy, though as yet arbitrary, and in some respects undefined, was still, in essential points, limited by law.

One great object of the Protestants was to secure a successor to the throne by the marriage of Elizabeth. The nearest heir was Mary Queen of Scots, a zealous Catholic, supported by all the Catholic states, and who had ostentatiously quartered the royal arms of England with her own, thus deeply offending the proud and jealous Elizabeth. The hand of the English queen was eagerly solicited by numerous suitors—by Philip of Spain, who was ambitious of continuing his connection with England, by the Archduke Charles of Austria, by Eric king of Sweden, the Duke of Anjou, and others. With some of these Elizabeth negotiated and coquetted for years; to Anjou she seems to have been attached; but her affections were more deeply touched, as Mr Hallam has remarked, by her favourite Dudley, Earl of Leicester. Her early resolution, and that which ultimately prevailed over her weakness or vanity, was, that she should remain single and hold undivided power. To a deputation from the Commons on this delicate subject, she emphatically said she had resolved to live and die a virgin queen: "and for me it shall be sufficient that a marble stone declare that a queen, having reigned such a time, lived and died a virgin." She appears often to have wavered in her resolution; and in her partiality for handsome courtiers and admirers, to have forgotten her prudence and dignity. Her partiality for Essex was undisguised—it was unhappy for both; and making Hatton chancellor because he could dance gracefully, was a bold but not unsuccessful achievement. Elizabeth's fits of rage were as violent as her fits of love. Her maids of honour sometimes felt the weight of the royal hand; and when Essex once turned his back on her, she appropriately dealt him a box on the ear. As a pendant to these *nugæ*, we may add, that Elizabeth swore strongly, decided and masculine oaths.

The feminine weakness and egregious vanity of Elizabeth, in the midst of so many masculine qualities of heart

And the tradition that the poet wrote his *Merry Wives of Windsor* by request of the queen, *who wished to see Falstaff in love*, is at least highly probable.

and intellect, have afforded matter for many chapters of garrulous chroniclers. Five years after she ascended the throne, she issued a proclamation against portrait painters and engravers, who had erred in expressing "that natural representation of her majesty's person, favour, or grace," that was desired by her loving subjects, and who were ordered to desist until some "special cunning painter" might be permitted to have access to the royal presence. The works of the unskilful and common painters were, as Raleigh relates, by the queen's commandment, "knocked in pieces and cast into the fire." A long account is given by the Scottish ambassador Melville, of certain interviews he had with Elizabeth when in her most gracious and pleasant mood. She shewed him "my lord's picture,"—a portrait of the unworthy favourite Dudley; she changed her dress every day, "one day the English weed, another the French, and another the Italian, and so forth," asking Melville which became her best; her hair, he says, was rather reddish than yellow, and curled naturally; she inquired whether the queen of Scotland or herself was of highest stature, and Melville answering that Mary was tallest, "then," saith she, "she is too high, for I myself am neither too high nor too low." Melville praised Mary's accomplishments as a musician and dancer, and Elizabeth contrived, as if by accident, that he should hear her play upon the virginals: "she inquired whether my queen or she played best; in that I found myself obliged to give her the praise." In the matter of the dancing, Melville was also able to answer, that Mary did not dance "*so high and disposedly*" as Elizabeth. Determined to show all her accomplishments, Elizabeth addressed the wary ambassador in Italian, which she spoke "reasonably well," and in German, which he says, was "not so good." These glimpses of the *woman* Elizabeth, contrast strangely with the *sovereign*, who, at Tilbury camp, rode from rank to rank of her army, bareheaded, with a general's truncheon in her hand, declaring to her soldiers that she was resolved to live and die amongst them in the midst and heat of the battle; and that she thought it "foul scorn that Parma or Spain, or any prince of Europe, should dare to invade the borders of her realms." Language and sentiments like these must have insured the destruction of the troops of Parma or Spain, even if the vaunted Armada had not been sunk by the English fire or scattered by tempests.

The darkest stain on the memory of Elizabeth is her treatment of Mary Queen of Scots. To have cut off Mary from the crown, settling it on her son, would have secured the Protestant succession. Her execution, though clamoured for by the English nation, was an act of cruelty peculiarly revolting, as well as indefensible in law, on the part of a female sovereign and kinswoman. And Elizabeth's affected reluctance to sign the death-warrant, her promptings to Sir Amias Paulet that he should make away with the captive queen (which the "dainty precise fellow," as Elizabeth termed him, refused to do), and her feigned grief and indignation after the event had taken place, constitute altogether a tissue of disgusting hypocrisy, as injurious to the reputation of Elizabeth as the deed itself.[1]

To the end of her life, Elizabeth affected all the airs of a coy beauty and coquette. Even her statesmen addressed her in a strain of fulsome adulation and semi-gallantry. She was the Gloriana of Spenser, the "fair vestal throned in the West," of Shakspeare, and the idol of all the lesser poets, as well as courtiers and politicians. She continued her gorgeous finery and rigorous state ceremonial, and was waited upon by applauding crowds whenever she went abroad. We have a graphic picture of her in her sixty-fifth year by a German, Paul Hentzner, who saw the queen on a Sunday as she proceeded to chapel. She appeared stately and majestic; her face oblong, fair but wrinkled; her eyes small, yet black and pleasant; her nose a little hooked, her lips narrow, and her teeth black. She had pearls with rich drops in her ears, wore false red hair, had a small crown on her head, her bosom uncovered, her dress white silk, bordered with pearls of the size of beans, a collar of gold and jewels; and thus arrayed, Elizabeth passed along smiling graciously on the spectators, who fell down on their knees as she approached, while a marchioness bore up her train; a bevy of ladies followed her dressed in white, and she was guarded on each side by fifty gentlemen pensioners, carrying gilt battle-axes. A few years afterwards we see the eclipse of this Eastern splendour and servility. Towards the end of March 1603, Elizabeth was seized with her mortal illness. She became restless and melancholy, refused medicine, and sat for days and nights on cushions, silent, her finger pressed on her mouth. When asked by Cecil who should succeed her on the throne, she characteristically answered, "My seat has been the seat of kings; I will have no *rascal* to succeed me." She afterwards, when speechless, joined her hands together above her head, "in manner of a crown," to signify, in answer to another interrogatory from Cecil, that she wished the king of Scots to be her successor. She expired on the 24th of March 1603. And thus calmly passed away the last of the Tudors, the lion-hearted Elizabeth. She was in the seventieth year of her age and forty-fifth of her reign—a period of brilliant prosperity and advancement, during which England had put forth her brightest genius and soundest philosophy, and attained to the highest distinction and glory among the states of Europe.

Horace Walpole has assigned to Elizabeth a place in his *Catalogue of Royal and Noble Authors*, and a list of thirteen productions, exclusive of letters and speeches, is attached to the queen's name. They consist chiefly of translations from the Greek, Latin, and French, with a sonnet printed during her own lifetime, and some prayers and meditations. The learning of Elizabeth is undoubted: it was considerable even in that age of learned ladies; but her style is stiff, involved, quaint, and full of conceits—the whole evincing rather a predilection for literary and scholastic studies than literary taste or power. (R. C—S.)

ELIZABETHAN Style, in *Architecture*, the name given to the impure architecture of the time of Queen Elizabeth and James I. It may be called a mixture of the worst forms of the Gothic and the Italian styles; but it nevertheless is capable of wonderful picturesqueness in general effect. Deeply embayed windows, long galleries, and fantastic gables, are its principal characteristics.

ELK, in *Zoology*. See index to Mammalia.

ELL (Lat. *ulna*), a measure used chiefly for cloth, and varying in length in different countries. The English and the Flemish ells were those most in use in Great Britain. The English ell is 45 inches, while the Flemish ell is only 27 inches, or $\frac{3}{4}$ths of a yard. In Scotland the ell is $37\frac{1}{5}$ English inches.

ELLESMERE, a market-town of Shropshire, hundred of Pimhill, 16 miles N.N.W. of Shrewsbury. It is so called from the beautiful lake or *mere* near which it stands; and consists of four main streets, with a handsome church. Pop. (1851) 2087, chiefly engaged in tanning and the making of malt, the barley grown in the vicinity being of excellent quality. The site of the ancient castle, of which

[1] There was something like personal vindictiveness in the feeling entertained by Elizabeth towards Mary. She hated her for her personal charms and graces, for her having presumed to quarter the royal arms of England, for her having a "fair son," and for her complicity in the Catholic conspiracies. But more than all perhaps must she have been provoked by the malicious letter written by Mary to Elizabeth, in which she reported certain alleged speeches of the Countess of Shrewsbury, charging the queen with licentious amours, physical defects, absurd vanity, folly, avarice, &c. (See Hume, note to chap. xlii.) The original letter in Mary's handwriting was seen a few years since by Prince Labanoff in the repositories at Hatfield House. It is such a letter as no woman (royalty apart) could have forgiven.

there are now no remains, is now used as a bowling green, and commands a rich and varied prospect. Market-day Tuesday. Ellesmere is connected with the Mersey by a canal which greatly facilitates its trade.

ELLICHPOOR, a town of Hindustan, in the territory of Hyderabad, or the dominions of the Nizam, and the principal place of a jaghire, or feudal possession of the same name. A stone wall sixty feet in height surmounted by battlements surrounds the town, which is of considerable size, and contains several bazaars and houses built of brick. The khan of Ellichpoor held his jaghire from the Nizam on military tenure, furnishing a brigade of two battalions of infantry, two thousand horse, and four guns; but a few years since the relations between the feudatory and his superior were seriously disturbed, and several actions took place between the troops of the two chiefs, which were attended with varied success. Tranquillity was at length restored by the sequestration of the district and its transfer to the British, with other possessions of the Nizam, as a provision for the support of the military contingent which that prince is bound by treaty to maintain. The town of Ellichpoor is distant 40 miles N.E. of Argaum, where the Duke of Wellington gained a brilliant victory over the Mahrattas in 1803. Lat. 21. 10., Long. 77. 36. (E. T.)

ELLIOT, *the Right Honourable* George Augustus, Lord Heathfield, was the youngest son of Sir Gilbert Elliot, Bart. of Stobbs, in Roxburghshire, and was born about 1718. He received the rudiments of his education under a private tutor, and at an early period of life was sent to the university of Leyden. Being designed for a military life, he was sent from thence to the celebrated *Ecole Royale du Génie Militaire,* conducted by Vauban, at La Fère in Picardy, where he laid the foundation of that scientific knowledge which he so conspicuously exhibited at the defence of Gibraltar. He completed his military course on the Continent by a tour, undertaken for the purpose of seeing in practice what he had studied in theory; and as Prussia was then the best model for discipline, he continued some time as a volunteer in the service of that state.

Mr Elliot returned in the seventeenth year of his age to Scotland; and was in the same year, 1735, entered as a volunteer in the 23d regiment of foot, in which he continued for upwards of a year. From the 23d regiment he went into the engineer corps at Woolwich, and made great progress in study, until through his uncle Colonel Elliot he was appointed adjutant of the second troop of horse grenadiers. With these troops he went upon service to Germany, and was present with them in a variety of actions. At the battle of Dettingen he was wounded. In this regiment he obtained the rank of captain and major, and afterwards purchased the lieutenant-colonelcy. On arriving at this grade he resigned his commission as engineer, which he had enjoyed along with his regimental rank, and quitted a branch of the service in which he had been actively employed very much to the advantage of his country. He received the instructions of the famous engineer Bellidor, and made himself completely master of the science of gunnery; and had he not so disinterestedly resigned his rank in the engineer department, he would long before his death have, by regular progression, reached the head of that corps. Soon after this he was appointed aid-de-camp to George II., and was distinguished for his military skill and discipline. In 1759 he quitted the second troop of horse grenadier guards, being selected to raise, form, and discipline the first regiment of light horse, which was called after him *Elliot's.* As soon as they were raised and formed, he was appointed to the command of the cavalry in the expedition on the coasts of France, with the rank of brigadier-general. After this he passed into Germany, where he was employed on the staff, and greatly distinguished himself.

During the peace he was not idle. His great talents in the various branches of the military art procured him ample employment. In 1775 he was appointed to succeed General A'Court as commander-in-chief of the forces in Ireland; but he did not continue long on this station, not even long enough to unpack all his trunks; for finding that interferences were made by petty authority derogatory to his own, he resisted the practice with becoming spirit; and not choosing to disturb the government of the sister kingdom on a matter personal to himself, he solicited to be recalled. The government acceded to his request, and, in a fortunate hour for the safety of Gibraltar, he was appointed to the command of that important fortress. The system of his life, as well as his education, peculiarly qualified him for this trust. He was perhaps the most abstemious man of the age, indulging himself neither in animal food nor in wine. He never slept more than four hours at a time, so that he was up later and earlier than most other men. He so inured himself to habits of hardiness, that the things which prove difficult and painful to other men were to him his daily practice, and rendered pleasant by use. It could not be easy to starve such a man into a surrender, nor possible to surprise him. The example of the commander-in-chief in a besieged garrison has the most persuasive efficacy in forming the manners of a soldiery. Like him, his brave followers came to regulate their lives by the most strict rules of discipline before there arose a necessity for so doing; and severe exercise, with short diet, became habitual to them from their own choice. The military system of discipline which he introduced, and the preparations which he made for his defence, were contrived with so much judgment, and executed with so much address, that he was able with a handful of men to preserve his post against an attack, the constancy of which, even apart from the vigour with which it was made, would have been sufficient to exhaust any common set of men. With perfect calmness he desisted from any premature attempts to destroy the works which it cost the enemy time, patience, and expense to complete; he deliberately observed their approaches, and, with the greatest discernment, seized on the proper moment at which to make his attack with success. He never spent his ammunition in useless parade or in unimportant efforts. He never relaxed his discipline from the appearance of security, nor hazarded the lives of his garrison by wild experiments. By a cool and temperate demeanour, he maintained his station for three years of constant investment, in which the whole powers of Spain were employed against him. All the eyes of Europe were on this garrison; and his conduct has justly exalted him to the most elevated rank in the military annals of his time. On his return to England, the gratitude of the British senate was as forward as the public voice in awarding him that distinguished honour which his merit deserved. Both houses of parliament voted a unanimous address of thanks to the general; the king conferred on him the honour of knight of the bath, with a pension during his own and a second life of his own appointment; and on the 14th June 1787, His Majesty advanced him to the peerage by the title of Lord Heathfield, Baron Gibraltar, permitting him to take, in addition to his family arms, the arms of the fortress which he had so bravely defended.

His lordship died on the 9th July 1790 at Aix-la-Chapelle, of a second stroke of the palsy, after having for some weeks preceding enjoyed tolerable good health and an unusual flow of spirits. His death happened two days before he was to have set out for Leghorn on his way to Gibraltar, of which place he had been once more appointed governor, in the prospect of an approaching war. He married Anne, daughter of Sir Francis Drake of Devonshire, and had by her Francis Augustus, by whom he was succeeded in his title.

ELLIOTT, Ebenezer, the *Corn-Law Rhymer,* was

born March 17, 1781, at Masborough, in the parish of Rotherham, where his father was employed in an iron-foundry. At school his education was thwarted by a constitutional nervousness, which prevented him from doing little more than merely learning to write, and which kept him aloof from his boyish companions. From his sixteenth to his twenty-third year he wrought with his father, who had become nominal proprietor of the foundry. He afterwards engaged in business in Sheffield on his own account, and after a failure in his first attempt he succeeded in realizing a competence. The last years of his life were spent at Argilt Hill, near Barnsley, where he died December 1, 1849. His principal works are, *Corn-Law Rhymes; Love, a Poem; The Village Patriarch; Poetical Works;* and *More Prose and Verse by the Corn-Law Rhymer*, 2 vols. His political poems are generally characterized by an athletic energy, and an almost morbid sense of wrong; but his domestic verses will always hold a distinguished place in the popular poetry of England.

ELLIPSIS, or Ellipse, in *Geometry*, an oval figure produced from the section of a cone by a plane which cuts both sides of it in an oblique direction. See Conic Sections.

Ellipsis, in *Grammar*, defect, omission; a figure of syntax by which one or more words are omitted; as,—the landscape I admire, for the landscape *which* I admire.

ELLIPTIC, pertaining to an ellipse.

Elliptic Turning. Wood and other substances are turned into an elliptic form by means of a chuck, which is applied on the common turning-lathe. This chuck is on the principle of the trammel, Plate XXIX. fig. 1. The grooves in the chuck are much wider than in the trammel, and the points of the chuck that correspond to C, D, of the trammel, fig. 1, remain fixed, and in one horizontal line; whereas in the trammel these are the points which are put in motion.

Illustration of the principle. If two straight lines, crossing each other, be drawn on a piece of transparent paper; if this transparent paper be laid upon a sheet of white paper, with two points marked on it; if the transparent paper be moved round, so that the cross lines shall travel over the two points, in like manner as the two points C, D, in the trammel, fig. 1, travel over the cross grooves of the trammel; and if the point of a pencil be held fixed, and touching the transparent paper, so as to leave a trace on the transparent paper when the paper is moved; then after the transparent paper has made a revolution, the trace left on it by the point of the pencil will be an ellipse. This method of describing an ellipse represents the action which takes place in the chuck for turning ellipses: the point of the pencil which remains unmoved is in the same situation as the turner's gouge; the transparent paper which receives the trace of the ellipse from the fixed pencil is analogous to the wood which is to be turned into the form of an ellipse by the fixed cutting gouge.

Description of the chuck. In fig. 2 the chuck is represented as fitted on a common turning lathe, of which A is the pulley of the mandrel, B and C are the sides of the frame supporting the pulley, P the rest, D the frame in which the rest slides, E, F the feet of that frame, I the nut and screw which serve to fix the rest, G, H are the continuation of the sides B, C. K is the elliptic chuck, with two grooves, through which the knobs of the slider pass. These knobs are connected by a strong bar of iron screwed into their ends; and on this bar of iron is seen the screw for fastening the board, to which is fixed the wood or other substance which is to be turned elliptically.

Fig. 3. shows the other side of the chuck, which in fig. 2 is turned towards the side of the frame C. N, in fig 3, is the board with the grooves which contain the slider O. In the middle of N is seen the end of the screw, which is fixed to the mandrel. The board N has a circular motion, being fixed on the axis of the mandrel, whilst the slider O, at the same time that it is carried round by the circular motion of N, is constrained to perform other motions by the grooves in N and by the groove in O, fig. 3, which slides on the ring M, fig. 4.

In fig. 4, L is a part of the side C of the mandrel frame, with the ring M fastened to it. On this ring the broad groove in the slider O, fig. 3, moves when the lathe is set agoing; and this groove is at right angles to the grooves in N, fig. 3, in which the knobs of O move. In fig. 4 it is seen that the centre of the ring M may be made to coincide with the centre of the spindle of the mandrel, in which case a circle is described. If the ring is fixed, so that the centre of the ring does not coincide with the centre of the mandrel, an ellipse is described by the wood screwed upon the bar of O in fig. 2; and the most eccentric ellipse that the machine describes is obtained when the mandrel is at the circumference of the ring. The centre of the spindle of the mandrel, and the centre of the ring M, are always in one immoveable horizontal line, and are analogous to the points C, D, of the trammel, fig. 1. In fig. 3 it is seen that the sides of the grooves may be brought nearer together by means of screws; so that the sliders and the cylindric ring may fit exactly to the grooves. The best elliptic chucks are made of brass. (See *Mechanical Exercises*, by Peter Nicholson, London, 1812.) (W. A. C.)

ELLIPTOGRAPH, an instrument for drawing ellipses. The trammel is an instrument which has long been known and used for describing ellipses. On the principle of the trammel Mr Farey constructed his elliptograph in a form much more commodious for drawing. Mr Farey's elliptograph is represented at Plate CCXXXI., fig. 5. The circle A slides between the two parallel rulers D, E. The circle B slides between two parallel rulers F, G, at right angles to the former. In this way, if a line joining the centres of the circles is made to revolve, M, the extremity of that line, will describe an ellipse in the same manner as the extremity E of the line CDE, fig. 1, does in the trammel. The elliptograph may be considered as a trammel, in which the pins C and D, fig. 1, are enlarged into the circles A and B, fig. 5. The pinion at K, fixed to one of the arms of the lower circle, acting on a rack screwed to the upper circle, serves to alter the distance of the centres of the circles A and B; and, by so doing, this pinion serves to vary the eccentricity of the ellipses which the instrument describes. When the centres of the circles A, B, coincide, the describing pen M draws a circle. When the centres are removed from each other, and on the circles being turned round, an ellipse is described by the pen; and when the distance of the centres is increased, the eccentricity of the ellipse is increased. When the pen is at the centre it describes a straight line, continually moving to and fro on that line when the circles are turned round. The two circles are fixed together by screws, and can only be made to slide the upper circle over the lower by the action of the pinion K. The pinion at L moves a rack, by which the describing pen M, which draws the ellipse, is brought nearer to the centre for the purpose of drawing a small ellipse, and removed farther from the centre of the ellipse when a large one is to be drawn. The size of the ellipse may be increased as far as the size of the instrument will admit. The pair of rulers D, E, are placed below the pair F, G, as is seen in fig. 6. The instrument, when used, is held upon the paper with the thumb and a finger of the left hand at the nuts N, O; and the circles are moved by applying the right hand to the pins *f*; the pen M, pressing by its weight on the paper, then describes the ellipse.

Fig. 7 shows H, the socket for the compasses, with the centre pin on which the socket moves; and the pinion L and rack *h*, for moving along the frame *g* between the bars; and the other pinion K, for separating the circles.

The ruler P has two points, to fix the instrument to the paper. The ruler is united to the frame by screws, which serve to adjust the position of the instrument after the ruler has been fixed to the paper.

By means of the elliptograph any ellipse can be described, of which the long and short axes are given, provided it does not exceed the size of the instrument. When an ellipse is to be described, draw on the paper the longer and shorter axes, bisecting each other; place the instrument on the paper, so that the centre of the four rulers appears to coincide with the centre or the intersection of the two axes of the ellipse; and fix the instrument in this situation by the points that go into the paper. By the pinion L move the pen to one extremity of the short axis of the ellipse; turn the circles half round, to see if the pen comes to the other end of the short axis; if it does not, adjust the error one half, by moving the pen by the pinion L, the other half by moving the frame on the paper; continue this adjustment till the pen, setting out from the one end of the short axis, arrives in a half revolution at the other end. Next, by means of the pinion K, bring the pen to one end of the long axis of the ellipse; turn the circles half round, and if the pen reaches the other extremity of the long axis of the ellipse, the instrument is rectified; if not, one half of the error is to be corrected by moving the circles by means of the pinion K, and the other half by moving the instrument to a side on the paper, by means of the nuts N, O. The instrument is now adjusted; and the pen, resting on the paper, traces the ellipse required when the circles are turned round by the handles.

Mode of using the instrument.

Elliptograph for engraving.

An instrument similar to the elliptograph has been employed for engraving ellipses on copper plates, and for dividing these ellipses accurately, so as to give the perspective representation of a circle divided into equal parts, both in the case where the distance of the eye is limited, and in the orthographic projection. The Society for Encouraging Arts rewarded Mr Farey with their gold medal for his invention, and a description of the elliptograph is contained in the thirty-first volume of the Transactions of that society. (W. A. C.)

ELLORE, in Hindustan, in the British district of Masulipatam, presidency of Madras, a town with a military station, situated on the Jummalair, a torrent which about 3 miles below falls into the Colair Lake. The town is populous and well built; and the sides of the streets are planted with rows of trees affording grateful shade in a place where the heat is oppressive, the thermometer having been known to rise to 110° in the house, and to upwards of 120° in officers' tents. Lat. 16. 42., Long. 81. 10.

ELLRICH, a town in the Prussian province of Saxony, government of Erfurt and circle of Nordhausen, on the river Zorge, 45 miles N.N.W. of Erfurt. It has some paper and oil mills, and manufactures of linen and woollen goods. Pop. (1849) 2942. In the vicinity is the calcareous grotto of Kelle, 290 feet long, 260 broad, and 158 high.

ELM. See Planting, and Timber.

ELMACINUS, Elmacin, or Elmakyn, George, author of a *History of the Saracens*, and known in the East by the name of Ibn-Amid, was a Christian of Egypt, where he was born in the year of the Hegira 620, and of our era 1225. He occupied the place of ketib or secretary at the court of the sultans of Egypt, an office which was usually filled by Christians. His history consists of annals which extend from the time of Mohammed till the year of the Hegira 512 (A.D. 1117). It is principally occupied with the affairs of the Saracen empire, but contains some passages relating to the eastern Christians. In 1238 he succeeded his father Yaser Al Amid, who had held the office of secretary to the council of war under the sultans of Egypt for forty-five years. Elmacinus died at Damascus in the year of the Hegira 675 (A.D. 1273). His History of the Saracens was translated from Arabic into Latin by Erpenius, and printed in both languages at Leyden, 1625, in folio. Erpenius, however, died before the publication was completed; and the issuing of the volume was left to Golius, who wrote a preface to the work. The title is, *Historia Saracenica, quâ res gestæ Muslimorum, inde a Muhammede primo imperii et religionis Muslimicæ auctore, usque ad initium imperii Atabecæi, per XLIX. imperatorum successionem fidelissime explicantur, insertis etiam passim Christianorum rebus in Orientis potissimum ecclesiis eodem tempore gestis.* Arabice olim exarata a G. Elmacino et Latine reddita. Leyden, 1625, 8vo. The Latin text was printed separately in quarto; and there also exists an edition which only contains the Arabic text, and appears to have been designed for the Christians of the Levant. The work has been translated in whole or in part into several modern languages.

ELMINA, a town and fort on the Guinea Coast of Africa, capital of the Dutch possessions in that part. The fort is the strongest on the coast, being surrounded with double walls and deep ditches. Pop. about 10,000.

ELMSLEY, Peter, a distinguished philologist and editor, was born in 1773, and educated at Westminster and Oxford. After quitting the university he was appointed to a small chapelry at Horksley in Essex; but on the death of his uncle, from whom he inherited a competent fortune, he devoted himself to the study of Greek philology. He resided for some time at Edinburgh, where he lived in intimacy with the projectors of the *Edinburgh Review.* To this periodical he contributed the articles on Heyne's *Homer*, Schweighauser's *Athenæus*, Blomfield's *Prometheus*, and Porson's *Hecuba.* To the *Quarterly Review* he also contributed several classical articles. In 1819 he was commissioned along with Sir Humphry Davy to superintend the deciphering of the papyri at Herculaneum; and on his return after a short illness he was appointed principal of St Alban's Hall and Camden Professor of History at Oxford. He died of disease of the heart, March 8, 1825.

ELOGY, or Eulogy, (Lat. *elogium;* Fr. *éloge;*) eulogium, or the praise bestowed on a person or thing; panegyric. Among the French particularly it is a very general practice to pronounce *éloges* on illustrious deceased persons. To this custom the public has been indebted for many interesting biographical sketches.

ELOHIM, in Scripture, is the abstract expression for absolute *Deity*, apart from the special notions of unity, holiness, substance, &c. It is more a philosophical than a devotional term, and corresponds to our term *deity*, in the same way as *state* or *government* is abstractedly expressive of a king or monarch. Elohim is the plural form of *eloach;* and thus appears to be used as the *pluralis excellentiæ*—indicating the abundance and super-richness contained in the Divine Being.

The word Elohim was also sometimes applied to angels, princes, judges, &c., as indicating delegated authority.

ELOIGNED, or Eloined, (Fr. *esloigner*, q. d. *elongare, procul habere;*) removed to a distance; separated from;—a term used chiefly in law. Thus Blackstone—"If the person be conveyed out of the sheriff's jurisdiction, the sheriff may return that he is *eloigned, elongatus.*"

ELONGATION, in *Astronomy*, the digression or recess of a planet from the sun, as it appears to the eye of the spectator on our earth: the apparent recession of a planet from the sun in its orbit, as the *elongation* of Venus or Mercury.

ELORA, a town of Hindustan, in the native state of Hyderabad, near the city of Dowlatabad. In a mountain near this town there are some remarkable excavations, containing mythological symbols of the Hindu worship, and temples ornamented with representations and statues of many of the deities worshipped by the Hindus. The principal figures are those of Indra the god of the firmament, and his consort Indranee. Besides these, there are some figures of the deities adored by the sectaries of Boodh and

Parisinath; but all of them have been forsaken by the priests. The temples here are said to have been executed by the rajah Edoo of Ellichpoor, who was cured of some cutaneous disorders by a spring near the place, and in gratitude gave orders for the construction of the temple. It measures 138 feet in front, and in the interior extends 247 feet in length by 150 feet in breadth, and is in some places 100 feet high. A minute account of these curious antiquities is contained in the sixth volume of the *Asiatic Researches*. Elora was ceded in 1818 by Holcar, under the treaty of Mondesoor, to the British, who transferred it to the Nizam in 1822 by the treaty of Hyderabad. Lat. 20. 2., Long. 75. 13. (E. T.)

ELPHIN, a market-town and bishop's see of Ireland, county of Roscommon, and 14 miles N. of the town of that name. The cathedral is a plain building with an ancient tower. Pop. (1851) 1225.

ELPHINSTONE, WILLIAM, a Scottish prelate and statesman of considerable eminence, was born at Glasgow in 1431. He received his education at the university of that city, and in the learning which distinguished the period he made extraordinary proficiency. He afterwards studied civil and canon law in the university of Paris, where in due time he became professor, and for six years discharged the duties of his office with great reputation. On his return to Scotland he entered into holy orders, and was successively appointed official of Glasgow, St Andrews, and Lothian. He was also admitted a member of the privy-council; and on the occasion of a misunderstanding between James III. of Scotland and Louis XI. of France, his powerful mediation at the latter court, in conjunction with the Bishop of Dunkeld and the Earl of Buchan, effected an amicable reconciliation. For the diplomatic ability which Elphinstone on this occasion displayed, the king rewarded him with the see of Ross, from which he was translated to that of Aberdeen about 1484. He subsequently held the office of chancellor of the kingdom; and besides carrying on negotiations with the English king, he acted as mediator between James and the discontented nobility. During his residence at Aberdeen, Elphinstone appears to have declined all interference with public affairs of a political nature, and to have confined himself to the discharge of his episcopal duties. But when James IV. ascended the throne, his abilities as a statesman were again called forth, and he was chosen ambassador to the Emperor Maximilian, in order to negotiate a marriage between his royal master and the emperor's daughter. The bishop's mission, although it failed in the object for which it was set on foot, was not without its salutary effects, and was the means of terminating an enmity which had long existed between the Dutch and Scots. The masterly manner in which he conducted this affair raised him in the estimation of James, who undertook nothing of importance without first procuring his sanction. Elphinstone was also the zealous patron of learning; and it is generally believed that the establishment of a university at Aberdeen was entirely owing to his influence with the pope, from whom he obtained a bull for that purpose; and it was almost entirely by his exertions that King's College was undertaken and completed. At his death, which took place in 1514, he bequeathed a sum of 10,000 pounds Scots for its erection and endowment, as well as for the maintenance of a bridge over the Dee. Although at his death he had attained the age of about eighty-three, his constitutional vigour was very little impaired, and all the faculties of his mind were in full force; but the calamity which the nation sustained at Flodden Field had broken his heart. Besides a history of Scotland now preserved among the Fairfax MSS. in the Bodleian Library, Elphinstone wrote a book of canons and some lives of Scottish saints.

ELSINORE or ELSINEUR (Danish *Helsingör*), a sea-port-town of Denmark Proper, on the east coast of the island of Seeland. It stands at the narrowest part of the Sound, opposite the Swedish town of Helsingborg, from which it is three miles distant. The town is well-built, and contains some good buildings, among which are two churches, the town-hall, high school, hospital, theatre, and a quarantine establishment. Pop. (1850) 8111. On a tongue of land east of the town stands the castle and fortress of Kronborg (Crown Castle), the guns of which command the Sound in all directions. It was built by Frederick II. towards the end of the sixteenth century, and is a magnificent, solid, and venerable Gothic structure. The great tower, and the lighthouse which rises at the N.W. angle of the courtyard, command fine views of the strait and the neighbouring countries. The principal object of interest within the castle is the apartment in which the unfortunate Queen Matilda, sister of George III. was confined. All merchant vessels are obliged, under certain reservations depending on the weather, to salute the castle by lowering their top-sails in passing. In the vicinity is Marienlyst (Mary's delight), till lately a royal chateau, now the property of the corporation, and let to a private family. The pleasure-grounds are open to the public, and command fine views. Elsinore is 26 miles from Copenhagen, with which in summer it has steamboat communication twice a-day. All merchant ships passing the Sound have to clear out at Elsinore. The Sound duties had their origin in an agreement between the king of Denmark and the Hanse towns, by which the former undertook to construct lighthouses, landmarks, &c., along the Cattegat, and the latter to pay duty for the same. The annual amount of the Sound dues may be computed in round numbers at L.230,000. The average number of vessels that passed the Sound in the ten years from 1843 to 1852 was 18,088, and of British 4900; the greatest number of vessels in one year was in 1847, 21,526, and of British, in 1849, 6846. Ships of war are exempt from duty. Most maritime nations have consuls here. Elsinore is well known as the scene of Shakspeare's tragedy of Hamlet. It was the birthplace of Saxo-Grammaticus, the celebrated Danish historian of the twelfth century, from which Shakspeare derived the materials of his drama.

ELTHAM, a parish, formerly a market-town of England, county of Kent, 8 miles E. by S. of London. Pop. (1851) 1207. Of the royal palace which formerly existed here, only the great hall now remains. The parish church is a neat structure, and contains some interesting monuments.

ELVAS, a fortified frontier city of Portugal, province of Alemtejo, 12 miles west of Badajos. Pop. 16,460. It is picturesquely situated on a hill between two others on which stand the fortresses of Santa Lucia and La Lippe. The town is generally ill-built and dirty, while the number of Moorish buildings give it an antique and venerable appearance. The chief edifices are the cathedral, arsenal, bomb-proof barracks for 6000 or 7000 men, theatre, prison, public hospital, college, seminary, and a singularly formed tower. The town is supplied with water by means of a large Moorish aqueduct. Manufactures—hardware and jewellery; but many of the inhabitants depend on the contraband trade carried on with Spain. This was a place of great importance during the Peninsular war. It was taken by Marshal Junot in March 1808, and held by the French till the August following, when it was given up in terms of the convention at Cintra.

ELUTRIATION (*elutriare, to purify by washing*), the operation of diffusing an insoluble pulverulent substance in a large quantity of water, and, after the coarser particles have subsided, drawing off the supernatant liquid with a siphon, or by careful decantation. This liquor will be found to contain an impalpable powder, which is to be allowed to subside, and then taken out and dried.

ELY, a city of Cambridgeshire, capital of that division

of the county called the Isle of Ely. See CAMBRIDGESHIRE. The city stands on a considerable eminence near the Ouse, 16 miles N.N.E. of Cambridge. It consists chiefly of one long street, and the houses are mostly old. A monastery was founded here about 670; but in 870 it was pillaged and destroyed by the Danes, and was not rebuilt till about a century later. In 1107 Ely was erected into a bishopric by Henry I. After the dissolution of the monasteries Henry VIII. converted the conventual church into a cathedral. This edifice displays a singular mixture of various styles of architecture; but taken as a whole, it is a noble structure. The interior is exceedingly beautiful, and contains many interesting monuments. It has recently been almost entirely restored. The length of the building is 517 feet, and the western tower is 270 feet high. St Mary's church is a handsome building, partly in the Norman, and partly in the early English style of architecture. The church of the Holy Trinity, which is attached to the cathedral, was commenced in the reign of Edward II., and is one of the most perfect buildings of that age. Ely has also places of worship for Independents, Baptists, Methodists, &c.; a grammar-school founded by Henry VIII.; national, charity, and other schools; mechanics' institute, savings-bank, a house of correction, and infirmary. There is a considerable manufactory of earthenware and tobacco pipes, and there are several mills in the isle for the preparation of oil from flax, hemp, and cole-seed. Market-day Thursday. Pop. (1851) 6176. The soil in the vicinity is very fertile, and cultivated chiefly by market gardeners, who send large quantities of fruit and vegetables to the London market.

ELYSIUM, the place which, according to the ancient poets, the souls of the blessed inhabited. By Homer it was placed in the vicinity of Oceanus, and on the extreme confines of the earth. Here Nature produced her most delicious fruits without assistance from the hand of man. No winter storm ever obscured the brilliancy of the atmosphere; but cooling zephyrs refreshed the air, and wafted on their wings the most delightful perfumes. Admission into this realm of pleasure and repose was a favour which could only be purchased by an irreproachable life, or by brilliant exploits. The souls of the dead had to appear before the awful tribunal of the infernal judges, Æacus, Minos, and Rhadamanthus, who decided without appeal upon their claims, and either allowed them to pass into Elysium or condemned them to the torments of Tartarus. This part of the myth has evidently allusion to an Egyptian custom, according to which one could only obtain the right of burial in certain privileged cemeteries after undergoing a severe scrutiny of his life and conduct. It is curious to observe the various changes of position in respect to the Elysian Fields, as a more intimate acquaintance with geography successively dispelled the erroneous impressions derived from the foolish statements of travellers. The Greeks in the earlier ages placed them in the district of Thesprotia, where they also found the Acheron, Cocytus, and Avernus; and it was to this elysium that Homer tells us Mercury conducted the souls of the suitors of Penelope, after they had been slain by Ulysses. But they afterwards transported the Elysian Fields and Avernus to the vicinity of Baiæ in Campania.

> Largior hic campos æther et lumine vestit
> Purpureo; solemque suum, sua sidera norunt.

It was not till later times that these imaginary abodes were fixed at the extremity of Iberia, where they found the Lethe, "that slow and silent stream, the river of oblivion," now called *Guadalete*, as well as another of the same name in Lusitania.

ELYTRA (ἔλυτρον), in *Entomology*, the wing-sheaths or thick upper membranes which form the superior wings of the beetle tribe. They serve to protect the true membranous wing.

ELZEVIRS, celebrated printers at Amsterdam and Leyden, who produced many beautiful editions of the ancient classics. Their names were Louis, Bonaventure, Abraham, Lewis, and Daniel. Louis began to be famous at Leyden in 1595, and was remarkable for being the first who observed the distinction between the *v* consonant and *u* vowel, which had been recommended by Ramus and other writers long before, but never regarded. Daniel died in 1680, and though he left children who carried on the business, he is considered as the last of the family who excelled in printing.

EMANATION (*e* and *manare*, to *flow*), the act of flowing or proceeding from some source or origin. Also that which issues, flows, or proceeds from any source, substance, or body. Thus, light is an emanation from the sun; wisdom from God, &c.

EMANCIPATION (Lat. *emancipatio*), the act of setting free from slavery, servitude, subjection, or dependence; liberation from bondage or dependence, &c.

Emancipatio, in the *Roman Law*, was used in a special sense to denote an act by which the *patris potestas*, or the power of a father over his son, was dissolved in the lifetime of the parent. This end was effected by a certain formality in the manner of a *sale*—whence the term was derived. In some cases, according to the law of the Twelve Tables, this ceremony was performed three times; but in others once was sufficient, as it also was in the case of a daughter or a grandchild.

By emancipation the son was put in a capacity of managing his own affairs, and of marrying without his father's consent, although a minor. Emancipation differed from manumission, as the latter was the act of a master in favour of a slave, whereas the former was that of a father in favour of his son.

There were two kinds of emancipation; the one tacit, which was by the son's being promoted to some dignity, by his coming of age, or by his marrying—in all which cases he became his own master of course; the other express, where the father declared before a magistrate that he emancipated his son. In performing this act, the father executed an imaginary sale of his son to another person, who was called *pater fiduciarius*, or father in trust; from whom the son was immediately purchased by the natural father, who thereafter manumitted him before the magistrate by a verbal declaration. (For further details, see Smith's *Dict. of Greek and Roman Antiquities*.)

EMATHIA, in *Ancient Geography*, a central division of Macedonia, encircled on the north by the rivers Erigon and Axius, and on the south by the Haliacmon. It formed naturally a distinct and isolated country, comprising within its own limits all the elements of independence. The rivers and mountain ranges which begirt it on every side secured it against all attack from without, while its fertile plains, adorned with every variety of wood and water, formed the most important of its internal resources. Some of the strongest natural fortresses in Greece belonged to Emathia, such as Edessa and Berœa. It was in this country that the Macedonian dynasty, which ultimately subdued the whole of Greece, first began to develop itself.

Under the Romans Emathia formed part of the third region of Macedonia. Its principal cities at this time were Almopia, Atalanta, Berœa, Citium, Cyrrhus, Edessa, Europus, Gortynia, and Idomene. (See Leake's *Northern Greece*, vol. iii.)

EMAUM GHUR, in Scinde, was lately a strong fortress in the Thur or Great Sandy Desert, separating that province from the rajpoot state of Jessulmere. As scarcely a drop of fresh water can be had on the route from Scinde after leaving Choonkee, distant about fifty miles from Emaum

Phenomena and Laws.

appeared that electricity of exalted intensity passed through it, while it completely stopped voltaic electricity, confirms the observations of M. Delarive on the relation between the conducting power and the quantity of electricity which traverses the conductor; and the phenomena seem to indicate that the electric fluid or matter may consist, like solar light, of different parts possessing different powers of conductibility and other properties, which may facilitate or obstruct their passage through solid, fluid, or gaseous bodies. An electric current, composed of different currents, may have some of its component currents entirely stopped by some bodies, while other currents are transmitted with the greatest facility, in the same way as certain rays both of light and heat are entirely absorbed by coloured bodies, while other rays are copiously transmitted. Non-conductors, like black bodies, stop every electrical current. Perfect conductors, like colourless transparent bodies, may transmit every electrical current, or absorb a small portion of all of them in an equal degree; while there may be imperfect conductors, which, like coloured bodies, stop some currents and transmit others. If this should prove correct, two bodies which, when used separately, conduct electricity, would be insulators when joined so as to transmit the electricity in succession, in the same manner as two transparent coloured bodies which separately transmit light copiously are opaque when combined, the light which each transmits being absorbed by the other.

Absorption of electricity.

Distance to which electricity has been conducted;

We have already seen that electricity was conveyed through a distance of four miles. On the ground that these experiments were made imperfectly, and that an electric charge will prefer a short passage through air to a passage of twenty or thirty feet through thin wire, Mr Singers has expressed his conviction that the results of the experiments referred to are incorrect. We are unable, we confess, to appreciate the reasons on which this opinion is founded; but, even if they have any force, the original fact has been more than confirmed by Mr F. Ronalds, who erected at Hammersmith an electrical telegraph on which the inflections of the wire composed *one continuous length of more than* EIGHT *miles*. "When a Canton's pith-ball electrometer was connected with each extremity of this wire, and it was charged by a Leyden jar, both electrometers appeared to diverge suddenly at the same moment; and when the wire was discharged by being touched with the hand, both electrometers appeared to collapse as suddenly. When any person took a shock through the whole length of wire, and the shock was compelled to pass also through two insulated inflammable air pistols, one connected with each extremity of the wire, *the shock and the explosion seemed to occur simultaneously*. But when the shock was compelled to pass through the gas pistols, and any one closed his eyes, it was *impossible* to distinguish more than one explosion, although both pistols were discharged. When people did not look at the pistols, and when I sometimes charged only one highly, and sometimes both lowly, they could never guess, except by mere chance, whether one or both were fired. *Thus, then, three of the senses, namely, sight, feeling, and hearing, seemed to receive absolute conviction of the instantaneous transmission of electrical signs through my pistols, my* EIGHT *miles of wire, and my own proper person*."[1]

through telegraphic wires and submarine cable.

These results, interesting as they were some years ago, sink into insignificance compared with the extraordinary facts with which the operations of the electric telegraph have made us acquainted. The transmission of electricity through hundreds of miles of wire passing through the atmosphere, and through 300 miles of submarine wires stretching from Dover to Ostend, are facts familiar to everybody. Experiments have not yet been made to ascertain the distance to which a given electric force will pass through wires of different lengths and diameters, when insulated and uninsulated; but from the opportunities which we now possess from the extension of the telegraphic system, we may expect that very interesting results will ere long be obtained. The completion of the electric current, too, through immense distances in the ground and in water—as first noticed through distances of a few miles by Sir William Watson—is a remarkable fact which requires farther investigation in reference to Mr Lindsay's proposal of a transmarine telegraph.[2]

Velocity of electricity.

Various attempts have been made to measure or rather to estimate the velocity of electricity in passing along a conducting wire. Sir William Watson considered it to be less than any measurable portion of time in passing through a distance of 12,276 feet or 2⅓ miles, or as he expressed it, that it passed instantaneously through such a length of wire. The first attempt to measure the velocity of electricity by any accurate method, was made by Mr Wheatstone, who, by an ingenious apparatus, concluded that it moved along a copper wire at the rate of 288,000 miles in a second. According to the experiments of MM. Fizeau and Gonelli, it moves through a similar wire at the rate of 112,680 miles per second, and through an iron wire at the rate of only 62,000 miles. Professor Mitchell of Cincinnati found its velocity to be only 28,500 miles in a second; and Professor Walker of the United States only 16,000 miles through an iron wire. Along the copper wire between Greenwich and Edinburgh, its velocity was only about 6500 miles per second; and along the copper wire (a great part of which was plunged in water), between Greenwich and Brussels, only 2300 miles in a second. Dr Faraday ascribes the enormous differences in these measures, to a certain extent, to the influence of the conducting bodies in contact with the wire; and he is of opinion that the velocity may vary more than the hundredth of its velocity according as the electricity passes through a wire immersed in water, or through one suspended at a great distance from the ground, or one carried along a solid conducting wall. These experiments on the electric telegraph wires confirm, in a remarkable degree, the sagacious anticipation of Dr Faraday, who announced, at the time of the publication of Wheatstone's experiments, that *the velocity of electricity in the same metallic* would vary much "with the tension or intensity of the first urging force, which tension is charge and induction. So if the two ends of the wire in Professor Wheatstone's experiment were immediately connected with two large insulated metallic surfaces exposed to the air, so that the primary act of induction, after making the contact for discharge, might be in part removed from the internal portion of the wire at the first instant, and disposed for the moment on its surface, jointly with the air and the surrounding conductors, then I venture to anticipate that the middle part would be more retarded than before; and if these two plates were the inner and the outer coating of a large jar or a Leyden battery, then the retardation of that spark would be still greater."[3]

Experiments of Faraday.

These interesting anticipations have been proved by a series of fine experiments made by Dr Faraday with the telegraphic lines of wire between London and Manchester. This wire, which is 1400 miles long, is buried in the ground, and consists of four wires, each 350 miles long. At the Manchester station the extremities of the first and second wire were united, and also the extremities of the third and fourth. At the London station a galvanometer was attached to the end of the first wire, the ends of the second and third wire were united by a second galvanometer, and at the end of the fourth wire was attached a third galvanometer commu-

[1] *Description of an Electrical Telegraph, &c.*, p. 4. Lond. 1823.

[2] See *North British Review*, No. xliv., p. 547.

[3] *Experimental Researches, &c.*, vol. i., No. 1, 1833.

Embankment.

Previously to entering on the detail of the different descriptions of banks for the purpose of embanking, we shall here observe, that the pressure of still water against the sides of the vessel containing it being as its depth, it follows that a bank of any material whatever, impervious to water, whose section is a right-angled triangle, and the height of whose perpendicular side is equal to that of the water it is to dam out, will balance or resist this water, whatever may be the breadth of the surface of the latter; and therefore, that as far as width or extent is concerned, it is just as easy to exclude the Atlantic Ocean as a lake or a river of a few yards in width.

The earthen wall.

1. The Earthen Wall (Plate CCXXXI., fig. 1) is the simplest description of embankment, and is frequently erected by temporary occupiers of lands, on the general principle of inclosing and subdividing, which is sometimes made a condition of tenure between the landlord and tenant. This wall applies to lands occasionally but rarely overflowed or inundated, and is set out in a direction generally parallel to the river or shore. Its base is commenced on the surface from two to five feet wide, regularly built of turf on the outsides, with the grassy sides underneath. The middle of the wall is filled up with loose earth. The wall is carried up with the sides bevelled towards the centre, so as to finish in a width of one foot or eighteen inches at five or six feet in height. In the inside of such walls, and at the distance of three or four feet, a small open drain is formed, as well to collect the surface-water of the grounds within, as that which in time of floods will necessarily oose through a wall of this construction. The water so collected is let through the wall by tubes, or tunnels of boards, with a valve opening outwards on their exterior extremity. Such a tube and valve is represented by fig. 2. When the flow of water from without approaches, it shuts the valve, which remains in this state till the flood subsides, when, the height of the water within being greater than that without, it presses open the valve and escapes. Walls and valves of this kind were erected about the year 1800, on the estate of the Earl of Galloway near Wigton, by Mr Hannah, tenant for life of Cue farm, and by Mr Hutchinson, tenant for thirty years of Mersehead farm, on the Solway Frith. (*Farmer's Magazine.*) They are common enough in the drier parts of the fenny districts of Lincolnshire and Cambridgeshire; and in Caernarvonshire 1800 acres were in 1804 completely protected in this way on the estate of Tre Madoc, by the proprietor, who has since made greater efforts in embanking, to be afterwards described.

The earthen mound.

2. The Earthen Mound (fig. 3) is the most general description of embankment, and, as it is executed at considerable expense, is only undertaken by such as have a permanent interest in the soil. This barrier applies to sea lands overflowed by every spring tide, and to alluvial plains inundated by every flood. It is set out in a direction parallel to the shore and to the general turns of the river, but not to its minute windings; and it is placed farther from or nearer to the latter, according to the quantity of water in time of floods, the rapidity of the current from the declivity of the bed, the straight course of the stream, and the intended height of the bank. The two sides of such a mound are generally formed in different slopes. That towards the land is always the most abrupt, but can never be secure if more so than 45°; that towards the water varies from 45° to 15°; the power of the bank to resist the weight of the water, as well as to break its force when in motion, being inversely as its steepness. The power of water to lessen the gravity of bodies, or, in other words, to loosen the surfaces over which they flow or stand, is also lessened in a ratio somewhat similar.

The formation of such a mound consists merely in taking earth from the general surface of the ground to be protected, or from a collateral excavation, distant at least the width of the mound from its base line, and heaping it up in the desired form. The surface is then in general cases covered with turf, well rolled in order to bind it to the loose earth. The earth of such mounds is generally wheeled by barrows; but sometimes it is led by carts placed on a wooden roller instead of wheels, which, with the treading of the horses, serves in some degree to consolidate the bank.

The excavation within serves the same purpose as the open drain in the *earthen wall*, and similarly constructed sluices or valves are introduced on a larger scale. Sometimes also the interior water is drawn off by windmills, and thrown over the mound into the river. This is very common in Huntingdonshire, and might be greatly improved on by employing steam-engines for entire districts, one of which, of a ten-horse power, would do the work of twenty mills, and this in calm weather, when the latter cannot move.

Embankments of this description are the most universal of any, and their sections vary from a scalene triangle of ten feet in base and three feet in height, as on the Forth near Stirling, and the Thames at Fulham, to a base of 100 feet and a height of ten feet, as on the great bank of the Ouse, near Wisbeach. The great rivers of Germany and Holland are embanked in this way when so far from the sea as to be out of the reach of the tide; as the Vistula at Marienwerder, the banks of which, near Dantzic, are above fifteen feet in height; the Oder, the Elbe, &c. All these banks are closely covered in every part with a grassy surface, and sometimes ornamented with rows of trees.

But near the sea, where such banks are washed by every tide when the course of the wind is towards the shore, and by all land floods and spring tides, grass is only to be found on and near their summits. The rest of the bank is bare, and to preserve it from the action of waves, currents, and the stones, pieces of wood, and other foreign matters which they carry with them, the surface is covered with gravel, reeds, or straw, kept down by pieces of wood, faggots, wicker hurdles, nets of straw-ropes, or any other contrivance, according to the situation, to prevent the washing away of the bank. It is common to attribute to these coverings the power of breaking the force of the waves; but this power depends, as we have already stated, on the slope of the bank and its smoothness; and the use of the surface covering, and of the constant attention required to remove all obstacles which may be left on it by floods and tides, is to prevent the loosening power of the water from wearing it into holes. For this purpose, a sheet of canvass or straw-netting is as good whilst it lasts as a covering of plate-iron or stone pavement.

All banks whatever require to be constantly watched in time of floods or spring-tides, in order to remove every object, excepting sand or mud, which may be left by the water. Such objects, put in motion by the water, in a short time wear out large holes. These holes, presenting abrupt points to the stream, act as obstructions, soon become much larger, and, if not immediately filled up, turfed over, and the turfs pinned down, or the new turfs rendered by some other means not easily softened and raised up by the water, will end in a breach of the bank. A similar effect is produced by a surface formed of unequal degrees of hardness and durability. The banks of this description in Holland, at Cuxhaven, and along the coast of Lincolnshire, are regularly watched throughout the year; the surface protection is renewed whenever it goes out of repair, as is the body of the bank in the summer season.

Varieties of the mound.

Mound with puddle-wall.—It generally happens that the earth of such banks is alluvial, and their foundation of the same description; but there are some cases where the basis is sand, silt, or gravel, or a mud or black earth, as in some parts of Cambridgeshire and Lincolnshire, which does not easily become so compact. Here it is common, before beginning the bank, to bring up what is called a puddle-ditch, or section of clay, in the centre of the highest part of the mound in the direction of its length, and of three or five feet wide, according to the depth of the silt and the intended height of the bank. When the clay of this puddle-ditch is well worked, either by men's feet or clay rammers, the bank will be perfectly impervious to water, and, if against a mild stream or shore, need not contain such an accumulation of earth as where the imperviousness of the bank to water depends chiefly on the mass of materials. An important point to attend to in this variety of mound is, to found the section or wall of clay so deep as to be in contact with a stratum, either by induration or its argillaceous nature impervious to water.

Mounds with reversed slopes (fig. 4).—In some cases of embanking rivers, as where they pass through parks, it is desirable to conceal as much as possible the appearance of a bank from the protected grounds, less able to break the force of waves. Here the mound is simply reversed, the steepest side being placed next the water. It is proper to observe, that such banks are not so strong by the difference of the weight of the triangle of water which would rest on the prolonged slope were it placed next the river, and are more liable to be deranged in surface in proportion to the difference of the slopes.

Mound faced with stones.—This is the same species of mound, with a slope next the water of forty-five or fifty degrees, paved or causewayed with stones or timber. In Holland this pavement or causeway is often formed of planking or bricks; but in England generally with stones, and the mortar used is either some cement which will set under water, or, what is better, plants of moss firmly rammed between them. The objections to such banks are their expense, and their liability to be undermined invisibly by the admission of the water through crevices. They are, therefore, chiefly used where there is little room, or where it is desirable to narrow and deepen the course of a river.

Mound protected by a wicker hedge.—This is a Dutch practice, and, where appearance is no object, has the advantage of not requiring watching. Wicker-work, however, subjected to the strain of waves, will be obviously less durable than where it lies flat on the ground, and can only decay chemically. This wicker hedge is sometimes a series of hurdles supported by posts and struts; but generally in Britain it is a dead hedge or row of stalks wattled or wrought with bushes presenting their spray to the sea or river. Besides placing such a hedge before a bank, others are sometimes placed in parallel rows on its surface; the object of which is to entrap sand, shells, and sea-weeds, to increase the mass of mound, or to collect shells for the purpose of carrying away as manure.

The sea wall (fig. 5) is an embankment formed to protect abrupt and earthy shores or banks of rivers, and consists of a wall, varying in thickness, and in the inclination of its surface, according to the required height and other circumstances. Belidor, in his *Traité de Hydraulique*, has given the exact curve which the section of such a wall ought to have in order to resist loose earth, and which is somewhat greater than what we have given in the figure referred to, where the earth behind the wall is supposed to be chiefly firm. Some fine examples of such walls, for other purposes, occur in the CALEDONIAN CANAL; and perhaps the finest in the world are the granite walls which embank the Neva at Petersburg, the construction of which may serve as an example of a river case with a foundation of soft bog earth. A space of the river, say 100 feet long, and twenty wide along shore, being inclosed by a double row of piles, and filled in with loam in the usual way, the water is pumped out, and the ground excavated about ten feet deeper than the margin of the bed of the river. Poles are then inserted nearly as close as they can be put in, and driven to their full length. When finished, this foundation occupies a breadth of from twelve to eighteen feet, generally fifteen. The tops of the piles are now cut level, and covered with planks, and on this is raised a mass of brick-work for five or six feet, sloping on both sides as it ascends towards the centre line of the wall. In the course of rising six or seven feet, it is narrowed to five feet, and is within five feet of the bed of the margin of the river. Here the granite facing begins in immense blocks, and is continued at a slope of fifteen degrees from the perpendicular, till it reaches the surface of the intended pathway. Here the wall from three feet is narrowed to an upright parapet eighteen inches wide; and at four feet of height it is finished in a projecting coping of Finnish granite. The voids on each side of the wall are now filled with earth, the pavement on the land side (generally narrow) completed, and the piles removed, and another length taken in to repeat the operation.

There is another mode, adopted in Petersburg, of building under water by driving the piles and cutting them over level with a machine, and then sinking caissons of brick-work. This mode, however, is unsuitable for sea walls in general, which ought to be founded as deep as possible, and at all events under the bed of the water. The motion of the Neva is so slow as hardly to render this worth attending to.

In Britain, such walls are fortunately rare; for in proportion as it is agreeable and flattering to self-love to protect or gain lands never before cultivated, it must be mortifying to be obliged to protect such as have long been subjected to agriculture, and where success can only be said to have a negative advantage.

Embankments for fixing drifting-sands, shells, or mud.—In several tracts of coast, the sea at ordinary tides barely covers a surface of sand, and these sands in dry weather, during high winds, are drifted and blown about in all directions. Great part of the north shores of the Solway Frith, of Lancaster Bay, and of the coast of Norfolk, is of this description. Mr Young, in his *Farmer's Letters*, informs us, that a considerable part of the county of Norfolk was drift-sand, even as far inland as Brandon in Suffolk, before the introduction of the turnip culture; and Harte (*Essay I.*) states, that some of what is now the richest land in Holland was, about the middle of the sixteenth century, of this description. The suggestion of any mode, therefore, by which, at a moderate expense, such tracts could be fixed and covered with vegetation, must be deemed worthy of a place in this article.

The mode which nature herself employs is as follows: After the tides and wind have raised a marginal strip of sand as high as high-water mark, it becomes by degrees covered with vegetation, and chiefly by the *elymus arenarius*, *triticum junceum*, various species of *Juncus*, and sometimes by the *galium verum*. With the exception of the first of these plants (the leaves and stalks of which are made into mats and ropes in Anglesea and the Orkneys, and the grain of which is used as meal in Ireland), they are of no other use than fixing the sands, which, being composed in great part of the debris of shells, expand as they decay, and contribute to raise the surface still higher, when the fibrous roots of good grasses soon destroy the others.

To assist nature in fixing drift-sands, it is only neces-

sary to transplant the *elymus*, which is to be had in abundance in almost every sandy coast in Britain; and as it would be liable to be blown away with the sands if merely inserted in the common way, it seems advisable to tie the plants to the upper ends of *willow* or *elder* rods, of two or three feet in length, and to insert these in the sand, by which means there is the double chance of the grass growing, and the truncheon taking root. The elder will grow exposed to the sea breeze, and no plant throws out so many and such vigorous roots in proportion to its shoots.

The mode by which sands were fixed in Holland was by the formation of wicker work embankments, and by sticking in the sands branches of trees, bushes, furze, &c. in all directions. These obstructed the motion of the sands, and collected masses of sand, shells or mud, and sea-weeds around them, which were immediately planted with some description of creeping grass; or, what was more frequent, covered with a thin coating of clay, or alluvial earth, and sown with clover.

Though the most certain and least expensive mode of gaining such lands be undoubtedly that of seconding the efforts of nature, by inserting bushes, and planting the *elymus* in this way, yet it may sometimes be desirable to make a grand effort to protect an extensive surface, by forming a bank of branches, which might in a single or in several tides be filled with sand and shells. It is evident that such a bank might be constructed in various ways; but that which would be most certain of remaining firm, and effecting the purpose, would be one regularly constructed of framed timber, the section of which would resemble a trussed roof; each truss being joined in the direction of the bank by rafters, and the whole inside and surface stuck full of branches. To retain it firm, piles would require to be driven into the sand, to the upper parts of which would be attached the trusses. The height of such a barrier would require to be several feet above that of the highest spring-tides; and the more its width at base exceeded the proportion of that of an equilateral triangle the better.

A more economical mode, and one, therefore, suited to a less extensive scale of operation, is to intersect a sandy shore in all directions with common dead or wicker-work hedges, formed by first driving a row of stakes six or eight feet into the ground, leaving their tops three or four feet above it, and then weaving among these stakes branches of trees or the tops of hedges. The Dutch are said to weave straw ropes, and thereby to collect mud in the manner of *warping*. This mode being little expensive, seems to deserve a trial in favourable situations; and, in so doing, it must not be forgotten that much depends on the immediate management of the surface after it is in some degree fixed. In an extensive trial of this sort made on the west coast of Scotland, under an English gentleman, seeds and roots were kneaded in a mixture of loam and dung in the gravel, and then formed into masses, and scattered over a sandy surface. These, from their weight, will not, it is thought, be moved by the water or the wind; but becoming more or less covered with sand, the mass will be kept moist, and the seeds and roots will grow, and, fixing themselves in the soil, will in time cover the surface with verdure.

Embankments for straightening the course of rivers.—Where a river in a fertile valley is very circuitous in its course, land may be gained, and a more rapid efflux of the water produced, by straightening its course. The best plan in general for effecting this is, to find an entirely new bed or course for the river; otherwise, when it passes alternately through new soil and through a part of its old bed, its action on surfaces which are so different in regard to induration ends, if great care be not taken, in holes and gulleys in the new bank, which require to be constantly filled up with loose stones thrown in, and left to be fixed by the pressure and motion of the water.

The embankment used in straightening the course of rivers is almost always the mound with a clay wall in the centre, varying in width according to the depth of the different parts of the old bed of the river which it has to intersect. The materials for these banks are obtained from excavations for the new bed.

The pier called the *protecting pier* is to be considered as a species of embankment the object of which is to prevent the increase of partial breaches made in the banks of rivers, by accidental obstructions during floods. A tree or branch carried down by a stream, and deposited or accidentally fixed or retained in its banks, will repel that part of the stream which strikes against it, and the impulse, counteracted more or less by the general current, will direct a substream against the opposite bank. The effect of this continual action against one point of the opposite bank is to wear out a hole or breach, and the protecting pier is placed so as to receive the impulse of the substream, and reverberate it to the middle of the general stream. If this pier be not placed very obliquely to the substream, as well as to the general stream, it will prove injurious to the opposite bank, by directing a subcurrent there as great as the first; and, indeed, it is next to impossible to avoid this; so much so, that Mr Smeaton, in every instance in which he was consulted in cases of this sort, recommended removing the obstacle where that could be done, and then throwing loose stones into the breach. A perfect bed of a river would be a perfect half cylinder, and therefore we are decidedly of opinion that Mr Smeaton's mode is the best, as tending to maintain as much as possible this form. Mr Marshal (*Treatise on Landed Property*) has treated on piers of this description at considerable length; but a very little reflection will show that they are more likely to increase than to remedy the evil they are intended to cure. We have seen the injurious effects of such piers on the Tay and the Dee; and on a part of the Jed near Crailing they are so numerous that the stream is, to use a familiar phrase, bandied about like a football from one shore to the other; behind every pier an eddy is formed, and, if the stream does not strike it exactly, a breach in the bank. Many of these piers have in consequence been taken down.

The use of such piers can only be justified where the obstruction, from ill neighbourhood or some such cause, cannot be removed from the opposite bank; or where, as is sometimes the case, it arises from an island of sand or gravel thrown out by the river near its middle, and which, however absurd it may appear, the interested parties cannot agree as to who may remove it. The case of buildings also being in danger may justify such a pier for immediate protection; but if such breaches are taken in time, a few loads of loose stones will effect a remedy without the risk of incurring or occasioning a greater evil.

Such piers are frequently constructed of wicker work; either a mere wicker hedge projecting into the water, as is common where the rivers are of slow motion, as in England, and particularly on the Thames, Tame, and Severn; or a case of wicker work filled with stones, as is common where the motion is rapid, as in Scotland, and particularly on the Esk, Tweed, Tay, and Clyde.

Embankments to serve as roads are generally mounds without clay walls, carried through countries liable to be overflowed, without reference to protecting any part from water, through lakes or marshes, or across straits of the sea. The earth in such mounds is generally allowed to take its own slope on both sides, which is commonly from forty to forty-five degrees, and the width at top is

regulated by that of the intended road. The materials, when the mound is formed in a country merely liable to be overflown, as in many parts of Lincolnshire and Huntingdonshire, are excavated from ditches, or taken from the surface on each side of the mound. In Holland the roads formed on such mounds are bounded by rows of trees; a practice which it is to be regretted has not been more attended to in England, where accidents not unfrequently happen in the night, and particularly on the Boston and Wisebeach roads, both of which are formed in great part on such mounds, unprotected by hedges, rails, or trees. In passing through part of a lake, or strait, or marsh, the earth must of course be taken from the firm ground on the shores; and here the ground being generally soft below, the first operation is to lay a foundation three or four feet thick, of branches or faggots of copsewood, in order that the mound may sink in a body. The next thing, the direction of the mound being marked out by a line of poles placed along its centre, is to begin at one end, and wheel or cart on earth, throwing it down in the direction of the bank, raising it to its proper height and width, leaving the slopes at the sides to adjust themselves, either by the gravity of the material alone, or jointly with the loosening and spreading operation of the water.

The noblest attempt of this sort ever made in Britain was that of W. A. Madocks, Esq. in order to unite the counties of Merioneth and Caernarvon by a mound across an estuary and embouchure of the Glasslyn, two miles wide. Mr Madocks had, in 1802, succeeded in protecting from spring tides, by a wall or bank of the first species, 1800 acres of good alluvial soil, which he let at from 30s. to 50s. per acre; and his enterprising spirit induced him to contemplate the idea of gaining the whole bay or mouth of the stream, extending to nearly 4000 acres of alluvial and sandy earth, overflowed in great part by every tide. Besides the mere gaining of the land, this patriotic improver had another object in view; that of uniting two maritime points in two counties which at that time were separated by a day's journey; and, by effecting this, he would at the same time have rendered practicable a new line of road from Worcester along the top of this embankment, through a creation of his own, called the town of Tre Madoc, to the newly formed harbour of Porthdynlleyn, by which forty miles would have been saved to the public between Dublin and London, and fifty between Dublin and Bath.

After consulting various engineers, the first operation was begun in 1807, and consisted in forming an immense bridge of flood-gates in the solid rock of the shore, as such a bridge and gates could not be formed in any part of the mound. The use of this was to admit the exit of the river. This done, the mound was commenced from both shores, and rocky, sandy, and clayey materials thrown down in the direction of the mound, and left to take their own slope. The greater part of these materials consisted of argillaceous rock broken into small pieces, which being mixed with clay, the mound would have been of the strongest texture. As the work proceeded, an iron railroad was laid along the top of it, and extended to the quarries and excavations, by which means much labour was saved. In the course of three years the work was brought within fifty yards of meeting in the middle, but it was found extremely difficult to close it, from the rapidity of the influx and reflux of the tide. This difficulty, however, would have been overcome, and the proposed improvement effected at little more than the estimated cost, L.20,000, had not the various and extensive projects in which the proprietor was at that time engaged led him into pecuniary difficulties, which put an end to the undertaking, and, as is usual in such cases, called forth popular clamour against the plan. It is but just, however, to state, that the very plan now put in execution was contemplated about two centuries ago by Sir Hugh Middleton, who then wrote to a friend, that if he were not so deeply engaged in the scheme of bringing water to London, he should certainly engage in it. (See BEDFORD LEVEL.)

The writings of Smeaton, Young, Gregory, and others, contain the general principles on which is founded the art of embanking, and every other operation connected with water. (J. C. L.)

EMBARGO, an order issued by the government of a country to prevent the sailing of ships, either into or out of port, or both. Embargoes are usually imposed only in time of war, or under apprehension of invasion.

EMBASSY. See AMBASSADOR, and DIPLOMACY.

EMBATTLED, in *Architecture*, furnished with an indented parapet, or having the form of embrasures.

EMBDEN or EMDEN, a fortified seaport-town of Hanover, province of Aurich, and 12 miles S.W. of the town of that name. Though not the capital, it is the largest town in the province, and in 1848 contained 11,964 inhabitants. It stands on the Dollart; and although the harbour is shallow, the roadstead is capable of accommodating the largest vessels. The trade is considerable: in 1851, 435 vessels of the aggregate burden of 18,097 lasts entered, and 443 of 12,616 lasts left the port. The chief exports are corn, butter, cheese, tallow, honey, wax, wool, and hides; the imports—timber, hemp, potash, and French wine. The herring fishery, formerly considerable, has much declined, as indeed has also the town itself; for in 1652 it contained upwards of 20,000 inhabitants, and its trade was much more extensive than at present. Canals intersect the town in various directions, and also connect it with Aurich, the Ems, &c. Shipbuilding is carried on to a considerable extent, and there are also manufactories of linen and cotton goods, hosiery, hats, soap, leather, tobacco, and brandy. Among the principal public buildings are the town-house, a Roman Catholic and also a large Protestant church, the barracks, exchange, and custom-house. Embden has also a gymnasium, midwifery school, school of navigation, house of correction, deaf-mute institution, and a marine insurance society.

EMBER WEEKS are those in which the *ember* or *embring days* fall.

In the laws of King Alfred and those of Canute, these days are called *ymbren*, that is, circular days, from which the word was probably corrupted into *ember* days. By the canonists they are called *quatuor anni tempora*, the four cardinal seasons on which the circle of the year turns; and hence Henshaw takes the word to have been formed by corruption from *tempora*. The ember days are the Wednesday, Friday, and Saturday, after Quadragesima Sunday, after Whitsunday, after Holy-rood day on the 14th of September, and after St Lucia's day, 13th December; which four dates correspond generally with the four seasons of the year, spring, summer, autumn, and winter. It would appear that they were originally fasts, instituted in order to implore the blessing of the Almighty on the fruits of the earth; agreeably to which, Skinner supposes the word *ember* taken from the ashes or *embers* then strewed on the head.

EMBLAZONING. See BLAZONRY, and HERALDRY.

EMBLEM (ἔμβλημα, literally, that which is *put in* or *on*, something *inlaid*, from ἐμβάλλειν, to *cast in* or *insert*), in its ordinary acceptation, denotes a figurative representation which, by the power of association, suggests to the mind some idea not made evident to the senses; or, in other words, a figure or picture which represents one thing to the eye and another to the understanding. It has been otherwise defined as a kind of painted enigma, or a figure

representing some obvious history instructing us in some moral truth. Such is the image of Scævola holding his hand in the flames, and inscribed with the words "*Agere et pati fortiter Romanum est.*" The Greeks applied the term ἔμβλημα to inlaid or mosaic work, and also to all kinds of raised ornaments on vases, &c. The Romans too used *emblema* in the same sense. Thus Cicero, reproaching Verres with his plunder of statues and other works of art from the Sicilians, calls the ornaments upon them *emblemata*. It may be farther observed, that the Latin authors frequently compare the figures and ornaments of discourse to these *emblemata*. Thus, an ancient Latin poet, praising an orator, says, that all his words were ranged like the pieces in mosaic :—

> Quam lepide λέξεις compostæ, ut tesserulæ omnes,
> Arte pavimento, atque *emblemate* vermiculato.

The word emblem is now chiefly applied to a figure or representation intended to convey some moral or political instruction. Thus a balance is an emblem of justice; and in Scripture a white robe is an emblem of purity or righteousness. An emblem differs from a device in that the words of an emblem have a full and complete sense of themselves; while those of a device are significative only with reference to some particular person or thing. This difference will be more apparent by a comparison of the emblem above quoted with the device of a candle lighted, and the words *Juvando consumor*, "I am wasted in doing good."

EMBOLISM (ἐμβόλισμός, from ἐμβάλλειν *to insert*), intercalation; or the insertion of days, months, or years, in a cycle or period of time, in order to produce regularity. The Greeks made use of the lunar year of 354 days, and in order to adjust it to the solar year of 365 days they added a lunar month every second or third year, which additional month they called *embolimæus*, *i. e.* the inserted one. See CALENDAR.

EMBOSSING, the forming of works in relief upon any substance, whether by cutting, stamping, casting, or any other method. In sculpture particularly, according as the figures are more or less prominent, they are said to be in alto, mezzo, or basso-relievo; or high, intermediate, or low relief.

EMBRASURE, in *Architecture*, an opening in a wall splaying or spreading inwards. In fortification it is applied to the openings in the wall or parapet of a fortified place, or in the breastwork of a battery, through which the guns are fired.

EMBROCATION (ἐμβρέχειν, *to moisten*), any liquid applied externally to the body to reduce swelling or relieve pain.

EMBROIDERY (in French, *broderie*). To embroider signifies properly to surround with an edge or border, but more generally to adorn with figures of needlework. The art of embroidery was practised at a very early period. In Exodus we are told that Aholiab was "an embroiderer in blue and in purple and in scarlet and fine linen;" and long before the Trojan war the women of Sidon had acquired celebrity for their skill in this art. The Greeks ascribed the invention of it to Minerva, but it is probable that they derived their knowledge of it from the Phrygians. The Grecian women attained to such a degree of skill in this art, that their performances were said to rival the finest paintings.

Embroidery is wrought upon stuffs or muslin by means of a needle and various kinds of thread. When it is done upon stuffs, the threads are of silk, cotton, wool, gold, and silver; and the work is sometimes adorned with spangles, mock or real pearls, &c. This species of embroidery is wrought on a kind of loom or frame. In muslin embroidery the muslin is stretched on a pattern already designed, and the thread is of cotton. The modes of embroidering are extremely various, and a minute description of them would be uninteresting to the general reader.

According to the census report of 1851, the number of females so employed in England was 2521, and in Scotland 2071; while in Ireland, for which no returns have been made the number is vastly greater; one house in Glasgow alone affording employment to upwards of 3000 hands in that country. The introduction in 1834 of a machine, by means of which the most difficult patterns may be wrought with the greatest nicety by 130 needles all in motion at once, has considerably affected this art as a trade, and will doubtless in a great measure supersede it. As a description of this interesting machine could not be made intelligible without illustrations, we must refer to Ure's *Dictionary of Arts, &c.*

EMBRUN, the ancient *Ebrodunum*, a fortified town of France, capital of a cognominal arrondissement in the department of Hautes-Alpes, on a steep rock near the right bank of the Durance, 25 miles E. of Gap. Pop. (1851) 3201. Embrun was an important military station in the time of the Romans. In the time of Constantine it was the see of a bishop, and afterwards of an archbishop, which was suppressed at the Revolution. The principal building in Embrun is the cathedral, a handsome Gothic structure surmounted by a lofty tower.

EMBRYO (ἔμβρυον), in *Physiology*, the first rudiments of an animal in the uterus, before the several members are distinctly formed; after which it is termed a *fœtus*.

EMERALD, *Smaragdus, Schmaragd, Emeraude verte.* In mineralogy this includes two subspecies; the emerald properly so called, or the precious emerald—comprehending the transparent and beautiful green-coloured varieties—and the beryl, which has already been described under its appropriate head.

The emerald always occurs crystallized, its most common form being that of a regular six-sided prism, occasionally modified by truncations on the terminal edges. It is in general well characterized by that pure and lively green colour which has hence received the name of *emerald green;* its hue, however, varies somewhat, inclining at times to verdigris or grass green, and frequently becoming rather pale. This fine colour is occasioned by the presence of a minute portion of the oxide of chrome, to which indeed may be attributed the principal distinction between emerald and the beryl; the mountain-green and yellow colours of the latter being produced by an admixture of iron in different states of oxidation. The most magnificent crystals of emerald occur in veins of magnesian carbonate of lime which traverse a hornblende rock in the mine of Muso, near Santa Fé de Bogota, in Peru. A hexagonal prism from this locality, upwards of two inches in length, and measuring across its three diameters $2\frac{1}{4}$, $2\frac{1}{8}$, and $1\frac{7}{8}$ inches, is now in the possession of the Duke of Devonshire: it weighs eight ounces and eighteen dwts., and, though imperfect for the lapidary's purposes from the numerous flaws it contains, is unquestionably the finest crystallized emerald at present in Great Britain. There are some magnificent crystals of emerald in the Royal Collection at Madrid, some of them as large as those of the Duke's collection, and of the finest water. Less distinct varieties, generally of muddy emerald-green colours, occur imbedded in mica-slate in the Pinzgau valley, Saltzburg; also in mica-schiste at Mount Zabara in Upper Egypt, a locality whence the ancients are believed to have obtained their emeralds.

The Peruvian emerald, according to the analyses of Klaproth and Vauquelin, contains,

Silica	68·50	64·50
Alumina	15·75	16·00
Glucina	12·50	13·00
Oxide of iron	1·00	0·00
Oxide of chrome	0·30	3·25
Lime	0·25	1·60

Its specific gravity ranges between 2·6 and 2·8, and its hardness between 7·5 and 8·0 of the scale of Mohs; that is, it scratches quartz, and is very little inferior to topaz in hardness. It possesses a vitreous lustre more or less

Emeritus || Emerson.

shining, and a conchoidal uneven fracture. By friction it becomes electric; and before the blowpipe with borax it fuses into a transparent colourless glass. But it is as a gem, inferior only to the diamond and the ruby, that this mineral is so highly prized and esteemed. Its colour, which is perfectly distinct from that of any other gem, is very rich, and presents by daylight the most pleasing hue. Consequently this gem, when of considerable surface and free from flaws and impurities, has always been very highly prized, and, as Pliny observes (xxxvii.), in his time commanded immense sums. Haüy describes one in the tiara of the sovereign pontiff when in Paris in 1804, consisting of a cylinder about two inches long by two and a quarter broad, which is supposed to have been brought from Africa, as it bears the name of Julius II., who flourished anterior to the conquest of Peru. The most magnificent cut emerald in this country is that in the possession of Mr Hope of London. It weighs six ounces, is perfect in colour and transparency, and cost L.500. It is believed to be from Coimbetoor.

Emeralds are cut and polished with facility. The usual form given them is that of a square table with the edges replaced, the lower surface being cut into facets parallel to their sides. When fine they are always set without a foil; and, as their brilliancy is somewhat impaired by candle-light, they are generally surrounded with small diamonds or pearls, which enhance their lustre and effect. This gem has been very successfully imitated by the French manufacturers of paste stones, the colouring matter used being the oxide of chrome.

EMERITUS, a Latin word signifying one who has completed his term of service. It was the name given by the Romans to a soldier or other public functionary who was exempted from further duty, and received a retiring allowance.

EMERSION, in *Physics*, the rising of any solid above the surface of a fluid specifically heavier than itself in which it has been forcibly immerged.

EMERSION, in *Astronomy*, the gradual reappearance of the sun, moon, or other celestial body, after it has been eclipsed. It also denotes the reappearance of a star which has been hid in the effulgence of the sun's light.

EMERSON, WILLIAM, an eminent but eccentric mathematician, was born May 14, 1701, at Hurworth, near Darlington, where his father Dudley Emerson taught a school. From him young Emerson received a thorough mathematical education, and the bequest of a good mathematical library. In the earlier part of his life he followed his father's profession, but with little success; and having received a moderate competence from his parents, he soon after devoted himself entirely to studious retirement. Towards the close of 1781, he relinquished his studies and disposed of his library. His death took place soon after, May 20, 1782, at his native village, and in the eighty-first year of his age.

Emerson in person was rather short, but strong and well made, with an open countenance and ruddy complexion. In dress, manners, and appearance, he was eccentric and indeed clownish; but with all his eccentricities he possessed an uncompromising independence of character, and intellectual energy of a very high order. He invariably shut himself up in London during the publication of his works, and carefully revised them sheet by sheet himself, so that they are singularly free from errata. In mechanics, he never advanced a proposition which he had not previously tested in practice, nor published an invention without first proving its effects by a model. Emerson was married, but had no family. His wife employed her leisure in spinning on a curious wheel, of which an accurate drawing is given in his Mechanics; and his favourite recreation was fishing. He was skilled in the science of music, the theory of sounds, and the ancient and modern scales; but he never attained any excellence as a performer.

The following is a list of Emerson's works:—*The Doctrine of Fluxions*. 1748, 8vo; *The Projection of the Sphere, orthographic, stereographic, and gnomical*, 1749, 8vo; *The Elements of Trigonometry*, 1749, 8vo; *The Principles of Mechanics*, 1754, 8vo; *A Treatise of Navigation*, 1755, 12mo; *A Treatise of Algebra*, in two books, 1765, 8vo; *The Arithmetic of Infinites, and the Differential Method, illustrated by Examples*, 1767, 8vo; *Mechanics, or the Doctrine of Motion*, 1769, 8vo; *The Elements of Optics, in four books*, 1768, 8vo; *A System of Astronomy*, 1769, 8vo; *The Laws of Centripetal and Centrifugal Force*, 1769, 8vo; *The Mathematical Principles of Geography*, 1770, 8vo; *Tracts*, 1770, 8vo; *Cyclomathesis, or an easy Introduction to the several branches of the Mathematics*, 1770, in 10 vols. 8vo; *A short Comment on Sir Isaac Newton's Principia*; to which is added, *A Defence of Sir Isaac against the objections that have been made to several parts of his works*, 1770, 8vo; *A Miscellaneous Treatise, containing several Mathematical Subjects*, 1776, 8vo.

Emery || Emigration.

EMERY, a mineral substance long regarded as an ore of iron, but which appears to be a mixture of corundum and oxide of iron. Emery, reduced to a fine powder by grinding and elutriation, is very extensively used for polishing metals, glass, marble, and other hard bodies. It is imported into this country chiefly from the Isle of Naxos, where it exists in great quantities; and it also occurs in Germany, Italy, Spain, and in some other parts of the world. It is found in beds in strata of mica slate, and in colour is intermediate between grayish-black and bluish-gray. Specific gravity about 4·000. It varies considerably in quality. The constituents of good emery have been given as follows:—alumina, 80; silica, 3; iron, 4. The great hardness of emery constitutes its value as a material for polishing. Ground emery is used in various ways; as, for instance, applied with glue to paper, cloth, or wood, to be used in rubbing; or formed into paste as an artificial stone for grinding-wheels, &c.

EMETIC (ἐμέω, *to vomit*), a medicine that excites vomiting by a specific action on the stomach, independently of its taste or odour. The emetics most in use are ipecacuanha, the tartrate of antimony and potash (tartar emetic), sulphate of zinc, and sulphate of copper.

EMIGRATION is the act of leaving the country or place in which one has previously resided, in the view of residing in some other country or place. Persons so leaving the place of their residence are called emigrants; and latterly the term immigrants has been employed to designate persons arriving from a distance in some place or country with the intention of settling in it. Persons leaving a country for a while, to which they intend to return, are not reckoned emigrants. This term is appropriated to those who leave their present habitations to establish themselves permanently elsewhere. Definition

The motives which lead to emigration are various in the extreme; but, whatever its immediate cause may be, all emigrants expect either to avoid some considerable evil, or to improve or amend their situation. The natural multiplication of man and of the animals which he domesticates, and the tendency of both to increase beyond such means of subsistence as may be easily made available for their support, have been in all ages the great cause of emigrations. When the flocks and herds of the occupiers of particular districts began to be so numerous that pasture became deficient, it was an obvious resource, in the event of any unoccupied lands being in their vicinity, for a portion of the tribe to emigrate to them. The Book of Genesis affords a striking illustration of what is now stated. The herds of Abraham and Lot, it is there stated, had so greatly increased, that, there not being room for them both, contests took place between their servants. Whereupon Abraham said to Lot, "Is not the whole land before thee? Separate thyself, I pray thee, from me. If thou wilt take the left hand, then I will go to the right; or if thou depart to the right hand, then I will go to the left. Then Lot chose him all the plain of Jordan, and Lot journeyed east; and they separated themselves the one from the other." (Chap. xiii. v. 8–11.) And what happens to herdsmen hap- Motives which lead to emigration.

Emigration.

pens to agriculturists. It would be easy, indeed, to show, by entering into historical details, that this was in fact the way in which population was extended over all countries. But the thing is so very evident that this would be quite unnecessary—a mere accumulation of proof in a case where none is required.

Emigrations from Greece and Rome.

Many of the emigrants from the Greek states of antiquity consisted of citizens forced by the violence of contending factions to seek new settlements in other countries. But Greece also sent forth emigrants, impelled by the difficulty of maintaining themselves at home, or allured by the glowing descriptions of the comparative abundance they would enjoy in distant lands. Both these classes of emigrants established themselves, for the most part, either in countries with a scanty population, or whose inhabitants were in a decidedly lower state of civilization. And the greater refinement and ingenuity of the Greeks, and their industrious habits, enabled them to make a rapid progress, so that several of these colonies became, in no very lengthened period, populous and powerful states.

But few voluntary emigrants ever left Rome. The colonies which she sent forth were intended to bridle subjugated provinces, and should be regarded rather as the outposts of an immense army, the headquarters of which were at Rome, than as establishments of individuals who had bid adieu to their mother country, and who intended to maintain themselves in their new residence by their own industry.

Emigrations of the northern nations.

But in their wish to amend their condition, emigrants have not always been contented to establish themselves in unoccupied or thinly-peopled countries. Sometimes, as in the case of the irruption of the northern nations into the Roman empire, they have attacked countries that were densely peopled; and, having subdued the inhabitants, have seized upon the whole, or upon a greater or less proportion of their lands.

Pastoral nations, inasmuch as they can carry with them the flocks and herds from which they derive their subsistence, may emigrate in very large bodies; and previously to the invention of gunpowder, and other improvements in warfare, were very dangerous neighbours. The danger was further increased, or rather was perpetually kept up, by the fact that the emigration of one tribe or nation, by making more room for those that remained behind, gave a corresponding stimulus to population, so that the vacuum being soon filled up, the motive to fresh emigration became as great as ever. On this principle we are able to account satisfactorily for the successive swarms of barbarians that, issuing from the countries in the north of Europe, first attacked and ultimately overthrew the colossal fabric of Roman power. It admits of demonstration that these countries were then not nearly so populous as at present, that they had not more, perhaps, than a fifth or a sixth part of the inhabitants by which they are now occupied. But as they depended principally on pasturage, their numbers were often in excess compared with their means of support. And the pressure of want, that is, the necessity of finding additional room for their flocks and herds on the one hand, and, on the other, the prospect of vast wealth and riches of which they might hope to possess themselves, precipitated them into those expeditions in which, though often defeated, they were in the end successful. The lines of Gray, in reference to these irruptions, are as true as they are beautiful:

> The prostrate South to the destroyer yields
> Her boasted titles, and her golden fields:
> With grim delight the brood of winter view
> A brighter day, and heav'ns of azure hue;
> Scent the new fragrance of the breathing rose,
> And quaff the pendent vintage as it grows.

Thanks, however, to the progress of science and of arts, the civilized world is now secure against being again over run by barbarians. Those who overcome the armies, the fleets, and other means of defence of refined and polished nations, must themselves be to a considerable extent refined and polished. The brute force of mere barbarism can no longer contend with the tremendous energies which civilised nations can press into their service. If the sun of Europe is destined to be again obscured, it will not be by a fresh irruption of barbarians.

Emigrations to America and Australia.

In modern times America, and, more recently, Australia, have formed the favourite outlets for the emigrants from the Old World. When first discovered, these vast continents were wholly or almost wholly occupied by the scanty population of hunters, hardly more advanced than the wild animals which they made their prey. Europeans consequently had very little difficulty in subjugating and occupying the most extensive territories on the other side of the Atlantic and in the Southern Ocean, while their propitious climate and extraordinary fertility (of America at least) held out every encouragement to draw to them not only the poor and needy, but also the aspiring, the industrious, the discontented, and the rejected population of this and other old settled countries. To these America has truly been a "city of refuge." The hosts of paupers and outcasts that have fled or been driven to her hospitable shores have become citizens of free and independent communities, and have mostly attained to a state of comfort or it may be of independence. And the benefits of this emigration have not only been, but they continue to be, of a gigantic description. Besides the gain to humanity by the establishment of arts, science, and religion in the vast wildernesses of America and Australia, and the advantageous asylum they afford to all who resort to them, the endless variety and abundance of their animal, vegetable, and mineral products, supply the means of carrying on a commerce which is becoming every day more and more important, and which has already done more than anything else to stimulate the inventive and productive energies of the English and other nations of Europe.

And it is satisfactory to know, that notwithstanding the rapid progress of population in America, a long series of years will have to elapse before the temperate portions of that great continent will have accumulated anything like an average number of inhabitants. Owing to the general inferiority of its soil, Australia is not so well fitted to support a dense population as the extra-tropical regions of America. But what with its vast size, its prodigious mineral wealth, and other resources, it is not easy to anticipate to what a flourishing state it may arrive, or how long it may be a favourite resort of industrious emigrants.

Capacity of Asia Minor and the countries round the Black Sea to receive emigrants.

We are not, however, of the number of those who suppose that the field for emigration is to be restricted in all time to come to the temperate regions of America and to Australia. We believe that the events which are now in progress, whatever may be their results in other respects, will most probably assist in opening the extensive countries in south-eastern Europe and western Asia to the enterprise of Europeans. It is not possible to imagine that the great peninsula of Asia Minor, once the favoured seat of arts and industry, and of many flourishing and powerful states, should be destined to crouch indefinitely under the loathsome despotism which has so long weighed down and extinguished all its energies; and if it and the countries on the west and north shores of the Black Sea were once opened to settlers from the more civilized European States, their great extent, genial climate, and superior soil, would make them be eagerly resorted to by emigrants. At all events, it must be sufficiently obvious to any one who takes up a map of the world, that many generations may be expected to pass away before parties desirous of emigrating from the older European states will have much difficulty in finding localities in which they may advantageously establish themselves.

Emigration.

Impolicy of restrictions on emigration.

Hitherto most emigrations that have taken place have consisted of individuals who have emigrated at their own risk and expense. Sometimes, indeed, it has been attempted to hinder certain parties, such as skilled labourers, from emigrating, from an apprehension that they might, by instructing foreigners in their peculiar arts, enable them to become successful competitors in those arts with the countries which the emigrants had left. But such restrictions are at once oppressive and inefficient: oppressive because they hinder individuals from attempting to improve their condition by emigrating, and inefficient because the arts which they practise may be learned in a great many ways—by written descriptions, by foreigners sending emissaries to the countries in which they are practised, by their smuggling away a few individuals, and so forth. And we are glad to have to state that the justice of this reasoning is now generally admitted; and that, for some years past, all classes of artificers have had full liberty to leave this country.

Emigration may sometimes be advantageously assisted by government, &c.

But besides giving free leave to individuals to emigrate, there are many occasions in which it may he highly expedient for government and public bodies to come forward to assist them in leaving the country. Wherever there is a surplus population, that is, wherever the population is not wholly employed, or where, though employed, wages are so low as not to afford work-people a sufficient supply of necessaries and conveniences, emigration may be advantageously resorted to. The sum required to maintain an able-bodied labourer for twelve months or thereby in a workhouse would suffice to carry him to Upper Canada, or to some other part of America, where he would find immediate employment, and from being a pauper, would forthwith become independent. It is not easy, indeed, to see how the money of parishes could be more profitably laid out than in enabling such parties to emigrate. By doing so they relieve themselves at a trifling cost of a permanent burden; and while they greatly improve the condition of the emigrants, they also improve the condition of the labourers who are left at home, and raise up customers for our manufactures in foreign and distant countries.

Emigration from Ireland.

The late extraordinary emigration from Ireland (1846–1854) has done more perhaps to improve its condition than anything else that could have happened. In consequence of the diminution that has been effected in the population, employment is more easily obtained, and the rate of wages has increased; a considerable progress has been made in many parts of the country in the consolidation of small patches of land into something like farms of a reasonable size, and susceptible of a better system of cultivation; the towns and workhouses have been, in part at least, relieved of their pauper population; and agitation, crime, and outrage, are less prevalent. Nor is there any reason to fear, that either in Ireland or anywhere else, emigration will be, or indeed can be, carried to excess. The rise of wages and the brisker demand for labour, which it invariably occasions, are insuperable obstacles in the way of such a result. The danger, indeed, is all on the other side—that emigration will either stop or decline too much and too soon. It may yet be carried much farther with infinite advantage to Ireland. From the want of coal, Ireland is ill-fitted for manufacturing industry; and from the nature of the soil and the humidity of the climate, it is much better suited to pasturage than to tillage. And such being the case, the population is still (1854) so much in excess, that an emigration by which it would be farther reduced by one or two millions, would contribute most materially to its well-being.

Emigration cannot be carried to excess.

Emigration from the Highlands.

The emigrations from certain parts of the Scottish Highlands, in regard to which so loud a clamour was raised, have been highly advantageous to all parties directly or indirectly connected with them; to the emigrants who were carried from narrow, barren, and over-peopled districts, to countries of boundless extent, rich, and under-peopled; to the proprietors who were enabled to turn their estates to the best account; and to the public who are always interested in having lands occupied in the most beneficial manner. Unluckily the emigration has stopped far short of the point to which it ought to be carried. Many estates, both in the mainland and in the islands, continue to be overstocked with a half-employed, beggarly population.

Emigration.

Advantage of sending out female emigrants.

Owing to causes which are too obvious to need being pointed out, the greater number of emigrants, especially of those who go to new settlements, consist of males; and the want of a proper proportion of females is often productive of the worst consequences. Inasmuch, too, as the female portion of the population in old settled countries is generally that which is most in excess, it is plain that every facility and encouragement should be given to the emigration of women. Nothing, therefore, can be more consistent with sound policy than the efforts which have recently been made by government, and by private individuals, to send out well-conducted females to Australia; and it is to be hoped that they will not relax in their benevolent labours till the wide disproportion which now (1854) exists between the sexes in that continent be materially reduced.

Emigration from the United Kingdom, &c.

The application of steam to the propulsion of vessels and the other improvements that have been made in the art of navigation, have greatly diminished the cost, risk, and time spent in distant voyages, and have given a proportional extension to emigration. Notwithstanding their great distance, the emigration from Europe to America and Australia, but especially the former, has latterly attained to a magnitude which, previously to the employment of steam in navigation, would not have been conceived possible. For a lengthened period the United Kingdom has furnished the largest supply of transatlantic emigrants; but of late years the emigration from Germany has become very extensive, and promises at no distant period to equal, if it do not surpass, that which is carried on from this country. The vast majority of the German emigrants are destined for the United States, where (in Pennsylvania principally) they occupy extensive districts, and have established themselves in great numbers. The States have also become, since 1835, the principal resort of the emigrants from the United Kingdom, more particularly of those from Ireland; though large numbers of the English and Scotch emigrants, with a smaller number of Irish, continue to resort in preference to Canada. Since the discovery of the gold-fields of Australia, great numbers of emigrants have gone to that continent. But its much greater distance, and the consequent length and cost of the voyage, make it difficult for the poorer classes to find, without assistance, their way to this new El Dorado. And we may add, that to the natural difficulties in the way of emigration to Australia have been superadded those which arise from an extravagant *minimum* price of 20s. an acre having been set on all waste land in that continent, even though it should require three, four, or five acres to depasture a single sheep. But it is not to be supposed that this mischievous or rather insane regulation will be permitted much longer to disgrace our colonial legislation. It is abundantly certain, that its repeal will do more than anything else to promote the emigration to, and the settlement of, our great south-eastern colonies.

Next to the United Kingdom and Germany, China furnishes the greater number of over-sea emigrants. A Chinese population has long been settled in large numbers in many parts of the Eastern Archipelago, where they are distinguished by their industry and good order; and recently many thousands of them have found their way to California and Australia. We beg to subjoin an account of the number of emigrants from the United Kingdom in each year from 1815 to 1853, both inclusive, specifying the countries for which they sailed, and the numbers that sailed for each.

Years.	North American Colonies.	United States.	Australian Colonies and New Zealand.	All other Places.	Total.
1815	680	1,209	...	192	2,081
1816	3,370	9,022	...	118	12,510
1817	9,797	10,280	...	557	20,634
1818	15,136	12,429	...	222	27,787
1819	23,534	10,674	...	579	34,787
1820	17,921	6,745	..	1,063	25,729
1821	12,955	4,958	...	384	18,297
1822	16,013	4,137	...	279	20,429
1823	11,355	5,032	...	163	16,550
1824	8,774	5,152	...	99	14,025
1825	8,741	5,551	485	114	14,891
1826	12,818	7,063	903	116	20,900
1827	12,648	14,526	715	114	28,003
1828	12,084	12,817	1,056	135	26,092
1829	13,307	15,678	2,016	197	31,198
1830	30,574	24,887	1,242	204	56,907
1831	58,067	23,418	1,561	114	83,160
1832	66,339	32,872	3,733	196	103,140
1833	28,808	29,109	4,093	517	62,527
1834	40,060	33,074	2,800	288	76,222
1835	15,573	26,720	1,860	325	44,478
1836	34,226	37,774	3,124	293	75,417
1837	29,884	36,770	5,054	326	72,034
1838	4,577	14,332	14,021	292	33,222
1839	12,658	33,536	15,786	227	62,207
1840	32,293	40,642	15,850	1,958	90,743
1841	38,164	45,017	32,625	2,786	118,592
1842	54,123	63,852	8,534	1,835	128,344
1843	23,518	28,335	3,478	1,881	57,212
1844	22,924	43,660	2,229	1,873	70,686
1845	31,803	58,538	830	2,330	93,501
1846	43,439	82,239	2,347	1,826	129,851
1847	109,680	142,154	4,949	1,487	258,270
1848	31,065	188,233	23,904	4,887	248,089
1849	41,367 .	219,450	32,091	6,590	299,498
1850	32,961	223,078	16,037	8,773	280,849
1851	42,605	267,357	21,532	4,472	335,966
1852	32,876	244,261	87,424	4,203	368,764
1853	34,522	230,885	61,401	3,129	329,937
Total	1,071,239	2,295,466	371,680	55,144	3,793,529

Annual emigration from the United Kingdom—
From 1815 to 1853.................................. 97,269
For the five years ending 1853.................. 323,002

(J. R. M.)

EMINENCE, literally elevation or height; but usually a rising ground, or a hill of moderate elevation above the adjacent country, &c.

Eminence, as a title of honour, was first given to cardinals by a papal decree bearing date Jan. 10, 1630; previous to which time they had been addressed as *illustrissimi* and *reverendissimi.* The title of Eminence has been applied to various dignitaries at different times; as to the grand master of Malta, to the kings of France, the emperor, &c.

EMIR (*Arabic*), a title of dignity among the Turks. It signifies lord or chief, and was first given to the khalifs; but when they assumed the title of Sultan the title of Emir was given to their children, as that of Cæsar among the Romans. The title of Emir is now given, by prescriptive usage, to all who are considered to be descended from Mohammed by his daughter Fatima, and who consequently wear the green turban instead of the white. As prefixed to another word indicative of a particular command or office, it is a common title of dignity, and is borne by viziers, pachas, &c.

EMMANUEL, or Immanuel, a Hebrew word which signifies "God with us." It is applied to our Saviour as God-man, prophetically by Isaiah (vii. 14, viii. 8), and historically by Matthew (i. 23).

EMMERICH, a fortified town of Rhenish Prussia, government of Dusseldorf, situated on the right bank of the Rhine, 5 miles N.E. of Clèves. Pop. (1849) 6647. It has several churches, a gymnasium, Roman Catholic seminary; and manufactures of woollen and linen goods, leather, and soap. Emmerich was formerly a member of the Hanseatic League.

EMMIUS, Abbo (1547–1625), a celebrated historian and geographer, was born at Gretha in East Friesland. He was chosen rector of the college of Norden in 1579; but was ejected in 1587 for refusing to subscribe the confession of Augsburg. He was subsequently rector of the colleges of Leer and Gröningen, and ultimately professor in the university of the latter city. His principal works are—*Opus Chronologicum,* Grönin., 1619, fol.; *Vetus Græcia illustrata,* Leyd., 1626, 8vo; *Rerum Frisicarum Historia,* Leyd., 1616, fol.; *Historia Temporis nostri,* Grönin., 1732, 4to.

EMPALEMENT (Lat. *in,* and *palus,* a stake), a fencing or inclosing with stakes; a stockade. The word is particularly applied to a barbarous kind of punishment by thrusting a stake up the fundament, and thus leaving the victim to perish. Instances are on record of persons who lingered under this torture for several days. Empalement was much practised in ancient times at Rome; and even within a very recent period among the Turks and other barbarous nations.

EMPEDOCLES, a celebrated philosopher of Agrigentum in Sicily, who flourished about the middle of the fifth century B.C. Of his history little is known. He joined in the revolution by which Thrasydæus was expelled; and amongst his countrymen he enjoyed a reputation not only for statesmanship, but for supernatural ability to control the adverse powers of nature. The general story in regard to his death is that he threw himself into the crater of Mount Ætna, in order that no trace of his earthly existence might remain, and that he might seem to have been translated into heaven. The origin of this marvellous account, however, may be found in the too personal interpretation of his haughty pretensions as a philosopher, and especially of the opening lines of his *Katharmoi;* in which, in his own name, he treats of the divinity of the human soul. According to Aristotle, however, Empedocles died peacefully at the age of sixty. It is not easy to determine his relation to the great philosophical schools of antiquity; and in the allusions which he makes to a great master, it is difficult to say whether the reference is made to Pythagoras, Parmenides, or perhaps Anaxagoras. His philosophical scheme, although in the doctrine of transmigration of souls bearing some affinity to the Pythagorean system, and in the application of a mechanical physiology being closely related to the philosophy of Anaxagoras, belongs most properly to the Eclectic school. The whole phenomena of nature were by him resolved into the combinations of four primal elements—fire, air, water, and earth—by the attractive and repulsive forces of love and hate. Neither of these forces are to be regarded as external to the matter on which they act; love or Deity residing in the original chaotic mass of things, and hate or strife in the elements individually, among which fire holds the chief place as the great centre of intellectual and sentient life. The present normal order of things arose out of chaos by successive stages of combination, as the two great principles passed from inertness to activity; and as the elements become exhausted by a ceaseless change, they gradually yield to the blending influence of love, and withdraw into the inertness of the chaotic sphere. Empedocles seems also to have recognised a third force, that of necessity, based on the unconditional decree of the Deity. His theory of cognition is in strict accordance with his philosophical scheme in regard to the construction of the universe. Man, as composed of the four elements, and subjected to the influence of the two antagonistic forces, can only rise to a comprehensive knowledge of the universal whole through the paramount influence of love. Accordingly, what is apprehended by the senses must be carefully distinguished from the results of the pure intellect alone, the pure unity

of truth residing only in the pure unity of love or Deity. The fragments of Empedocles have been collected and published by F. W. Sturz, Leipzig, 1805.

EMPEROR (*imperator*), among the ancient Romans, signified the general of an army, who, for some extraordinary success, had been complimented with this appellation. Thus Augustus, having obtained no less than twenty famous victories, was as often saluted with the title; and Titus was thus styled by his army after the reduction of Jerusalem. Subsequently it came to denominate an absolute monarch or supreme commander of an empire. In this sense Julius Cæsar was called *imperator*. The same title descended with the dignity to Octavianus Augustus, Tiberius, and Caligula; and afterwards it became elective. In strictness the title *emperor* does not, and cannot, add anything to the rights of sovereignty. In the East the title of emperor is more frequent than in Europe. Thus, the sovereign princes of China, Japan, Mogul, &c., are all emperors. In Europe, the first who bore the title was Charlemagne, who assumed it on his coronation at Rome by Pope Leo III.

EMPHYSEMA, a distension of the body or its members from an accumulation of air in the cellular or adipose membrane, by which the part is rendered tense and elastic, so that it crepitates when pressed.

EMPIRE (*imperium*), in *Political Geography*, the territory, region, or countries under the jurisdiction or government of an emperor. We read in ancient history of four great monarchies or empires; namely, that of the Babylonians, Chaldeans, and Assyrians; that of the Medes and Persians; that of the Greeks; and that of the Romans. The first subsisted from the time of Nimrod, who founded it in the year of the world 1800, according to the computation of Usher, till that of Sardanapalus, their last king, in 3257; and consequently lasted above 1450 years. The empire of the Medes commenced under Arbaces, in the year of the world 3257, was united to that of the Babylonians and Persians under Cyrus in 3468, and closed with the death of Darius Codomannus in 3674. The Grecian empire lasted only during the reign of Alexander the Great, beginning in the year of the world 3674, and terminating with the death of this conqueror in 3681, his conquests having been divided amongst his captains. The Roman empire commenced with Julius Cæsar, when he was made perpetual dictator, in the year of the city 708, and of the world 3956, forty-eight years before Christ. The seat of the empire was removed to Byzantium by Constantine, in the year of our Lord 334; and the East and West were then united under the title of the Roman empire, till the Romans proclaimed Charlemagne emperor in the year 800. From this epoch the East and West formed two separate empires. That of the East, governed by Greek emperors, commenced in the year 302; and, being gradually weakened, terminated under Constantine Palæologus in 1453. The Western empire was afterwards known by the appellation of the empire, or German empire. Antiquaries distinguish between the medals of the Upper and Lower Empire. The curious only value those of the Upper Empire, which commenced with J. Cæsar, or Augustus, and ended in the year of Christ 476. The Lower Empire comprehended near 1200 years, reckoning downwards till the destruction of Constantinople in 1453. Two ages or periods of the Lower Empire are usually distinguished; the first beginning where the Upper ends, namely, with Aurelian, and terminating with Anastasius, including 200 years; and the second beginning with Anastasius, and ending with the Palæologi, which includes 1000 years.

The Empire, used absolutely and without any addition, signifies the empire of Germany, which is also called in juridical acts and laws the Holy Roman Empire. It had its beginning at the commencement of the ninth century, when Charlemagne was created first emperor by Pope Leo III., who put the crown on his head in St Peter's church on Christmas day in the year 800.

EMPIRIC (ἐμπειρία, *experience*), one whose knowledge is founded on experience. The name of *Emperici* was given to an ancient sect of Greek physicians who contended that experience alone was needful in the healing art. Philinus of Cos is the reputed author of this system, which was greatly extended and improved by Serapion of Alexandria. From the pretensions and ignorance exhibited by many of this sect, the term empiric has become a common designation for one who enters on practice without a regular professional education; and, in general, for a quack, or pretender to medical skill.

EMPORIUM, in a general sense, signifies a city or place where extensive commercial transactions are carried on; but it is more particularly applied to the commercial centre of a country, or the place to which buyers and sellers from various countries resort.

EMPSON, WILLIAM, an able critic and scholar, professor of civil law at Haileybury College, was born in 1790. He was educated at Winchester, and afterwards at Trinity College, Cambridge. On the death of Napier he succeeded to the editorship of the *Edinburgh Review*, chiefly through the influence of Francis Jeffrey, whose only child he had previously married. He contributed to the *Review* upwards of sixty articles on various subjects. The best known is that on Stanley's *Life of Arnold*. Empson died at Haileybury, Dec. 10, 1852.

EMPYEMA, a collection of pus in the cavity of the thorax; a not infrequent result of pleurisy. The purulent matter is sometimes removed by making an opening for its discharge between the sixth and seventh ribs.

EMPYREUM, or EMPYREAN (ἐμπυρεύω, *I kindle*), a fanciful name given to the highest heaven, because of its supposed splendour, as being formed of the pure element of fire or light.

EMPYREUMA, in *Chemistry*, the offensive odour given out by burnt oils; as in the distillation of animal and vegetable substances.

EMS, a watering-place of Nassau, and 6 miles W.N.W. of the town of that name. It is pleasantly situated on the Lahn, and has several thermal springs. Pop. about 800.

EMS, the ancient *Amisus*, a river in the N.W. of Germany, rising in the Teutoburg forest, Westphalia, S.W. of Detmold. It flows first westward through the Prussian territory, and afterwards takes a northern direction through Hanover, to the Dollart, a gulf of the North Sea between Holland and Hanover. It has an entire course of about 160 miles, and is navigable for vessels of 80 or 100 tons as far as Passenburg. The principal tributaries are the Aa, the Haase, and the Leda, which fall into it from the right.

EMU, or EMEU. See ORNITHOLOGY.

ENALIOSAURIA (ἐνάλιος *living in the sea*, and σαύρος *a lizard*), in *Geology*, a name given to the entire group of extinct saurian animals which are characterized by broad paddle-shaped feet, like those of the whale or turtle, and a head and trunk resembling those of the crocodile.

ENAMEL (Fr. *émail*) a semi-transparent or opaque vitrified substance, of the nature of glass, but differing from it by possessing a greater degree of fusibility and opacity. The compound which serves as a basis to most kinds of enamel is formed by the fusion of a pure crystal glass or frit, ground up with a fine calx of lead and tin, in certain proportions; to which is usually added white salt of tartar. The different kinds of enamel are made by the addition of colouring substances, and melting or incorporating the whole by fusion.

For white enamel, Neri (*De Arte Vitriar.*) directs only manganese to be added to the matter which constitutes the basis; for azure, zaffer mixed with calx of brass; for green, calx of brass with scales of iron, or with crocus martis; for black, zaffer with manganese or with crocus martis, or manganese with tartar; for red, manganese, or calx of copper and crude tartar; for purple, manganese with calx of brass; for yellow, tartar and manganese; and for violet-coloured

enamel, manganese with thrice-calcined brass. In making these enamels great nicety is requisite. The general way of making the coloured enamel is this: Powder, sift, and grind all the colours very nicely, and first mix them with one another, and then with the common matter of enamels; next set them in pots in a furnace, and when they are well mixed and incorporated, cast them into water; when dry, set them in a furnace again to melt; and when melted, take a proof of the enamel. If too deep-coloured, add more of the common matter of enamels; and if too pale, add more of the colours.

ENAMELLING, the art of laying enamel upon metals, as gold, silver, copper, &c. Enamel ornaments for trinkets, in almost endless variety, may be produced by the aid of the blowpipe. The enamel is usually first drawn out into threads, or reduced to thin laminæ, to facilitate the process of fusion; and by the same means the enamel may be laid upon metals. Very elegant ornamental work may be thus produced. Enamelling also signifies to paint in enamel.

Painting in enamel is performed on plates of gold or of copper, but seldom on silver, as this metal is apt to occasion imperfections in the surface of the enamel. Copper is the metal most generally used for this purpose, enamelled with the white enamel, on which painting is executed with colours which are melted in the fire, where they take a brightness and lustre like that of glass. This kind of painting is particularly prized for its peculiar brightness and vivacity, which is permanent, the force of its colours not being liable to be effaced or sullied with time, as in other painting, and continuing always as fresh as when it came out of the workman's hands. This method of painting is almost entirely confined to miniature; larger works being liable to certain accidents in the operation. The most perfect kind of enamelling is practised on plates of gold, the other metals being less pure. Copper, for instance, sometimes scales with the application; and silver turns the yellow white. To obviate the cracking of the enamel, the plates are generally made a little round or oval and rather thin. The operation is usually commenced by laying on a couch of white enamel on both sides of the plate, which prevents the metal from swelling and blistering; and this first layer serves for the ground of all the other colours. The next step is to draw out exactly the subject to be painted with red vitriol, mixed with oil of spike, marking all parts of the design very lightly with a pencil. After this, the colours (very finely ground, and mixed with oil of spike somewhat thick) are to be laid on, attention being given to the mixtures and colours which agree to the different parts of the subject; for which purpose it is necessary to understand painting in miniature.

When the colours are all laid, the painting is to be gently dried over a slow fire to evaporate the oil, and the colours are afterwards melted to incorporate them with the enamel, making the plate red hot in a fire such as enamellers use. Afterwards, the painting may be retouched; and is then to be committed a second time to the fire, and so on till the work be completed.

ENCAUSTIC, and Encaustum, the same with enamelling and enamel.

Encaustic *Painting*, a method of painting among the ancients, in which wax was employed to give a gloss to the colours, and to preserve them from injury.

This ancient and lost art was in a manner revived by Count Caylus, who announced his method to the Academy of Painting and Belles-Lettres in the year 1753; though M. Bachelier, the author of a treatise *De l'Histoire et du Secret de la Peinture en Cire*, had produced a picture in wax in 1749; and was the first who communicated to the public the method of performing the operation of inustion, which is the principal characteristic of encaustic painting. The count kept his method a secret for some time, but exhibited at the Louvre, in 1754, a picture representing the head of Minerva, painted in wax, which excited much curiosity. In the interval of suspense several attempts were made to recover the ancient method of painting; such as that of melting wax and oil of turpentine together, and using this composition as a vehicle for the colours. But this method did not explain Pliny's meaning, as in this way of managing it the wax is not burnt. In another attempt, the wax was melted with strong lixivium of salt of tartar, and with this the colours were ground. When the picture was finished, it was gently heated, so as to melt the wax, and diffuse it through all the particles of the colours; and thus they were fixed to the ground, and secured from the access of air or moisture. But the method of Count Caylus was much more simple. The canvas or panel was waxed over by rubbing it simply with a piece of bees-wax; the panel or canvas being held before a fire, that the wax might gradually penetrate the body, and fill the interstices of the texture of the cloth, which when cool was painted upon; but as water-colours, or those which are mixed up with common water, will not adhere to the wax, the count directs that the canvas or panel thus prepared be first rubbed over with Spanish white. When the picture is dry, it is to be placed near a fire, when the wax melts and absorbs the colours.

Mr J. H. Muntz, in a treatise on this subject, proposed several improvements. If the painting be on cloth, he directs it to be prepared by rubbing one side several times over with a piece of virgin wax, till it be coated to a considerable thickness. In fine linen this is the only operation necessary previous to painting; but coarse cloth must be smoothed on the unwaxed side with a pumice-stone. The subject is then to be painted on the unwaxed side with colours prepared and tempered with water; and when the picture is finished, it is to be exposed to the fire, that the wax may melt and fix the colours. Crayons may be used in a similar manner.

ENCEINTE (Fr. from *cingere, to gird*), in *Fortification*, the interior wall or rampart which surrounds a place; sometimes composed of bastions or curtains, and sometimes only flanked by towers, which is called a *Roman wall*.

ENCHANTMENT. See Divination; Magic; Dæmon; Witchcraft.

ENCHASING, or Chasing, the art of embossing or making figures in low relief upon gold, silver, and other metals. It is practised only on hollow thin works, such as watch-cases, tankards, cups, &c. The design having been traced on the exterior surface of the metal, the work is hammered upon steel blocks or puncheons introduced within; and thus the workman proceeds to indent the metal by the successive application of the block and hammer to the several parts of the design; after which the work is cleared with small chisels and gravers. In this simple manner a skilful artist is able to represent foliages, figures, &c. with admirable precision.

ENCHORIAL Characters. See Demotic.

ENCYCLOPÆDIA (ἐν *in*, κύκλος *a circle*, παιδεία *instruction*), a term nearly synonymous with Cyclopædia, but adopted in preference to it in denominating the present work, as being etymologically more definite and complete. For, as it has been justly remarked—*Cyclopædia* may denote "the instruction *of* a circle," as *Cyropædia* is "the instruction of Cyrus;" whereas in *Encyclopædia*, the preposition determines the meaning to be "instruction *in* a circle." Vossius, in his book *De Vitiis Sermonis*, observes—"that *Cyclopædia* is used by some authors, but *Encyclopædia* by the best." Some account of the history and merits of the different Encyclopædias which have appeared will be found in the General Preface to this work.

ENDEMIC, or Endemial (ἐν *amongst*, δῆμος *the people*), peculiar to a people or nation. *Endemic diseases* are those to which the inhabitants of a particular district are peculiarly subject, and which, for that reason, are attributed

to such causes as bad air or water, or the manner of living. Thus agues or intermittent fevers are endemic in low marshy districts; the *goitre* in the Alps; *plica trichosis* or *Polonica* in Poland.

Epidemic, again, is applied to those diseases which, independently of such causes, seize many persons at or about the same season, in the same country or district. Thus, influenza, measles, scarlet-fever, &c., are sometimes epidemic. It may be observed—that according to the medical notion of the term, it is essential that the prevalence of the disease be temporary.

ENDOGENS, one of the primary classes of plants, which includes those of which the stems grow by successive additions to the interior; as in the palms, grasses, and liliaceous plants.

ENDOR, a town of Galilee; chiefly memorable as the abode of the sorceress whom Saul consulted on the eve of the battle in which he perished (1 Sam. xxviii.) In the time of Eusebius and Jerome it still existed as a large village, 4 miles S. of Mount Tabor; and at this distance, on the northern slope of the lower ridge of Hermon, there is still a village of this name.

ENDYMION, the poetic impersonation of perennial sleep. By the ancient mythologists he is variously represented as the successor of Aëthlius on the throne of Elis, or as a shepherd or huntsman perpetually asleep in the caves of Mount Latmus in Caria, and lulled by the kisses of the fair Selene, the goddess of the moon. According to the former and more prosaic tradition he was the son of Aëthlius and Calyce; and on his wandering to Caria, was succeeded by his son Epeius, who won the crown of Elis by a successful contest in the race-course at Olympia. He was thrown into an eternal sleep either as a punishment or as a gift from Jupiter; or according to others, under the spell of the enamoured Selene. On this legend Keats has founded his exquisite poetical romance of *Endymion*.

ENFIELD, William, LL.D., a Dissenting divine of considerable eminence, was born at Sudbury in 1741. He received his education at the Dissenting academy at Daventry, then conducted by Dr Ashworth, and was chosen minister of the congregation of Benn's Garden, Liverpool, in 1763. During his residence in Liverpool he published two volumes of sermons, as well as a collection of hymns and family prayers, which met with a very favourable reception. In 1770 he was appointed tutor and lecturer on the belles-lettres at Warrington academy, an office which he held till the dissolution of the academy in 1783. After the interval of a few years spent in private tuition, he was chosen pastor of the Dissenting congregation of Octagon Street, where he remained till his death, which took place Nov. 3, 1797, in the 57th year of his age. During his residence in Liverpool he married the daughter of a respectable draper in that city, and to her he was much indebted for the tranquillity and happiness of his life. Of the works of Dr Enfield a considerable number are mere compilations in which no higher quality is displayed than the taste which dictated the selection. To this class belong the *Preacher's Directory*, the *English Preacher*, the *Speaker*, and others. Among his original works, however, and especially those published or written at the close of his life, there are some that display considerable powers of thought and great elegance of expression. His posthumous sermons on the principal characters of the Old and New Testaments not only evince the author's ability as a commentator, but show profound insight into the ethics of history. At the recommendation of Dr Bagot, bishop of Norwich, he published an abridgment of Brucker's *History of Philosophy*, in 2 vols. 4to. He also wrote a work entitled the *Institutes of Natural Philosophy, theoretical and experimental*, 4to, 1783; besides a variety of occasional pamphlets and sermons.

Enfield, a village of the hundred of Edmonton, in the county of Middlesex, 10 miles from London. There are the remains of an ancient royal palace, in which Edward VI. kept his court, and where Elizabeth rested on her way to London in order to assume the crown. Near to it was Enfield chase, disforested in 1779, divided between various parishes and the crown, and now occupied by several country seats of the more opulent traders of London. The parish is extensive. Pop. (1851) 9453.

ENFILADE, in the military art, is used of the situation of a trench or other place which may be scoured by shot along its whole length. *To enfilade*, signifies to scour or rake with shot through the whole length of such line.

ENGADINE, the largest valley of Switzerland, after the Vallais, is in the Canton of the Grisons, and extends from S.W. to N.E. between the Lepontian and Rhaetian Alps. It is 18 leagues in length, with an average breadth of half a league, and is traversed through its entire extent by the Inn. The valley is rich in pasture, and a great part of the mountains are covered with pine forests; the climate is cold, and snow is absent only from June to September.

ENGASTRIMYTHI, in Pagan theology, the Pythias or priestesses of Apollo who delivered oracles without any action of the mouth or lips. The ancient philosophers, and others, are divided upon the subject of the engastrimythi. Hippocrates mentions this peculiar manifestation as a disease; some have regarded it as a kind of divination; others attribute it to the agency of an evil spirit; and others again to art and mechanism. Scotus supposes that the engastrimythi were poets, who, when the priestesses could not speak, supplied the defect by explaining in verse what Apollo dictated in the cavity of the sacred tripod.

ENGHIEN, a town of Belgium, province of Hainault, 18 miles N.N.E. of Mons. Pop. (1851) 3785. It has a fine chateau with a park and garden, a gymnasium, and manufactures of linen and cotton stuffs.

Enghien, *Louis-Antoine*—Henri de Bourbon Condé, Duc d'Enghien, was born at Chantilly on the 2d of August 1772. He quitted France with the French princes in 1789, and travelled till 1792 in Belgium and Piedmont, where, the emigrants having formed several corps, the Duc d'Enghien served in the army of the Condé and greatly distinguished himself in numerous engagements. At the treaty of Lunéville the corps of Condé was disbanded, and he was forced to lay down his arms. He then retired to Ettenheim, an ancient residence of the Cardinal de Rohan, on the right bank of the Rhine, four leagues from Strasburg, in the electorate of Baden, accompanied by Mademoiselle de Rohan, with whom he had formed a connection in 1794, which was only terminated with his death in 1804. (For an account of his seizure and murder, see France.)

ENGINEER, properly signifies a person who is employed in devising or constructing engines or machines, and in directing their applications.

The *Military Engineer* is an officer whose business it is to delineate the plans and direct the formation of military works, and to regulate attacks and defences. The branches of knowledge which more particularly relate to his profession are treated under the heads Artillery, Fortification, Gunnery, and War.

The *Civil Engineer* is one who applies the principles of mechanical and physical philosophy to the construction of the machines and public works by which the arts and accommodations of civil life are rendered more efficient, extensive, and secure. The subjects which more immediately belong to his important calling are treated under the following heads; Bridge, Carpentry, Docks, Gas-Lights, Navigation, Navigation Inland, Railways, Roads, Lighthouses, Ship-Building, Tunnels, Water-works, &c.; and also under the heads Dynamics, Hydrodynamics, Machinery, Mensuration, Resistance of Fluids, Strength of Materials, &c.

ENGLAND,

History. 700.

THE southern division of the island of Great Britain. In treating of this grand division of the British empire, we shall divide the subject into three Parts; the first comprehending the History of England, the second the Statistics of that country, and the third some account of its Government and Laws.

History. 800.

PART I.

HISTORY.

THE history of England, till the period of the Saxon Conquest, has been fully treated of in the first chapter of the article BRITAIN. After that event the country relapsed into a state of obscure barbarism, nearly as great as that from which it had been rescued by the Romans. The provincial Britons had profited by their intercourse with that great people. From the latter they had learned many of the arts of civilized life, and during the period of their subjugation they had erected a considerable number of cities, towns, and villages; but these were subsequently levelled with the ground by barbarian invaders, and the natives were frequently involved in the same ruin with their habitations. We are informed by one historian that a mighty conflagration began on the western coast, and gradually extended itself over the whole island. To escape from the exterminating swords of the Saxons, the Britons sought refuge in their native fastnesses; and thus the spark of civilization which had been struck out amongst them, and which, in more auspicious circumstances, might have kindled into a generous flame, was totally extinguished.

About the year 700, the island of Great Britain was divided into no fewer than fifteen sovereignties. Of these, eight were Saxon; but the union of the two Northumbrian principalities reduced the number to seven; and from this circumstance, as well as from some vague alliance amongst these petty states, historians have designated the whole by the name of the Heptarchy. They ruled over a considerable portion of England, and whilst they waged a fierce and endless war with every other kingdom in the island, they also maintained amongst themselves a continual struggle for the superiority. It would appear that one state usually exercised an undefined power over all the others; and the prince who possessed this equivocal ascendency had the title of *Bretwalda*, or wielder of the Britons, bestowed upon him. The history of this period is not characterized by any event which would lead us to take an interest in the fluctuating fortunes of the various states. Our information relating to the earliest portion of the Saxon rule is also scanty; but what we do possess is not of such a nature as to awaken any feelings of regret that more minute particulars have not been transmitted to us. Details of the shedding of kindred blood, and acts of oppression, treachery, and cruelty, exercised towards the natives by the fierce invaders of their soil, are not calculated to interest human feelings. The re-introduction of Christianity, however, in some degree alleviated the darkness of the picture. The exact date of its first appearance in Britain is uncertain, but it had made some progress before the close of the second century. It disappeared however, with the other traces of civilization, when the Saxons commenced their devastations. It was in the year 596 that Gregory the Great sent over St Augustin, with forty other missionaries, to convert the Saxons; and their arrival in Kent marks a new era in its history, and probably in that of the country. At this period Kent was governed by Ethebert, an able and powerful monarch and the third who bore the title of Bretwalda. He received kindly the deputies of Rome, and became a convert to their doctrine; an example which his subjects were not slow in following. From this period the spread of the Christian faith over the island appears to have been rapid; for we find that in about a century after the arrival of St Augustin it was professed and believed throughout Anglo-Saxon Britain. That it conferred many temporal benefits upon the community, cannot be doubted. But, however its divine precepts may have influenced the conduct and ameliorated the lot of individuals, crimes upon a great scale continued to be perpetrated as formerly. It may have mitigated the horrors of war, but battle followed on battle with as uniform a succession, and native blood flowed as freely, as heretofore. The continual struggle amongst the Anglo-Saxon principalities for the supremacy was however fast coming to a crisis. It is evident that such a state of affairs could not continue for any length of time, and that it must necessarily end in the establishment of a regular hereditary magistracy in the island. This took place partially at the beginning of the eighth century, in the person of Egbert, king of Wessex, who was a lineal descendant, and the only surviving prince, of the house of Cerdic, the founder of that kingdom. The great talents which he early exhibited had given offence to Brihtric, king of Wessex, who, jealous of his popularity, projected his destruction. Egbert, however, eluded his vengeance, and fled for protection to Offa, king of Mercia, a monarch illustrious for the talents he displayed and the prosperity he enjoyed, but whose name is stained with perfidy and blood. Thither the vindictive Brihtric pursued the youthful fugitive, who was finally compelled to cross the channel and to seek shelter beneath the broad shield of the victorious Charlemagne. France, governed by that renowned sovereign, excelled all the states of the West in civilization and the arts of government, as well as those of war. Trained in such a school, therefore, and early disciplined by adversity, he was undergoing an admirable probation for wielding with judgment and moderation the perilous sceptre which was destined to be transferred into his hands. The death of Brihtric, who perished by the machinations of his queen, recalled the fugitive from his exile. In Wessex the claim of Egbert was at once acknowledged, while his accession to the throne of his celebrated ancestor, an event highly popular in itself, was ennobled by a victory, the omen of many a future triumph.

At this period the island, though nominally under a hexarchy, was rapidly verging to a triarchy, from several of the smaller states becoming gradually blended and identified with their more powerful neighbours. Wessex had been enlarged by the incorporation of Sussex; and various favourable circumstances conspired to concentrate in the hands of Egbert a well-organized power, which he was prepared to wield when summoned by any great emergency. For several years, however, after his accession to the throne, his sword remained in its sheath; and this pro- A. D. 800.

pitious period of tranquillity afforded him an opportunity of turning his undivided attention to the affairs of government. His administration was as mild as it appears to have been politic; circumstances which completed the attachment of his subjects, and consolidated his growing strength. It was upon the unfortunate Britons of the west that he first made trial of his military prowess. About the year 809 the struggle between him and the natives commenced. The latter made a strenuous but unavailing resistance; and Egbert carried the havoc of war and the flames of destruction from the east to the west. In a few years the greater part of modern Wales, as well as the people who occupied the northern shore of the estuary of the Severn, acknowledged his authority. The king of Mercia, whose strength had been augmented by the appropriation of the petty sovereignties of Kent, Essex, and East Anglia, was now the only rival for the supreme authority whom Egbert had to fear or to contend withal. Their power was nearly equally balanced, for what Wessex wanted in numerical force was compensated by discipline and skill. War had now become inevitable; neither would brook a superior, and only one Bretwalda could be acknowledged. The conflict began, therefore, and was speedily brought to a termination. In an obstinate and bloody battle the king of Mercia was totally defeated, and Egbert became lord of the ascendant. State after state was annexed to Wessex; Mercia was invaded and subdued; and in nineteen years after he had first drawn the sword, Egbert was acknowledged over the greater part of the island as the eighth Bretwalda.

The authority of Egbert, however, still continued doubtful; and the Anglo-Saxon power was as yet very far from being consolidated. The fortunes and immunities of those composing the several states were not dependent upon one common legislature; and in regard to the details of government, the whole principalities remained as distinct from each other as before. Wales still continued to annoy him; and it was not until he had marched an army to Snowden that North Wales quietly submitted to that of the Saxon Bretwalda. But new and more formidable enemies than any he had yet encountered had begun to threaten England, and trouble the tranquillity which it in some measure enjoyed. These were Scandinavians, recognised in France by the name of Normans, and in England by that of Danes. Familiarized, from their maritime situation, to the dangers of the ocean, this people, like the Saxons of old, spent the greater portion of their time upon its waves. A pernicious law of succession, which consigned the whole patrimony to the eldest son, drove the younger branches of families to seek their fortunes by means of their ships and their swords. It was only in this manner that they could acquire riches and renown; and such pursuits were peculiarly agreeable to a people who unhappily preferred the acquisitions of rapine to the fruits of laborious industry. It was the custom of these pirates to set sail for some distant province in squadrons, under the command of chieftains called *Vikingr*, or Sea-Kings. After pillaging the coast where they landed, they collected the spoil and returned to their own country, where they disencumbered themselves of their booty and prepared for fresh expeditions. Three descents upon England are recorded as having taken place in the eighth century, but these attempts produced no permanent alarm. Towards the termination of Egbert's reign, however, the numbers of the pirates greatly increased, whilst their visits were annually renewed; and for two centuries to come the country was destined to be a prey to these fierce and fearless invaders.

After making several successful inroads into various parts of England, in 835 they landed on the coast of Cornwall, where they succeeded in seducing the Britons from their allegiance. The king of Wessex met the united forces of the enemy at Hengstone Hill, and gained a bloody but decisive victory, which restored the glory of his arms. This was the last exploit of Egbert, who died the year following, after a reign as prosperous as it was long, and which, allowing something for the condition of society at the period, may also be termed glorious.

Ethelwolf succeeded his father on the throne of Wessex; but an unfortunate arrangement, by which the former king bequeathed all his dominions except Wessex to a younger son, greatly weakened the power of his successor, and lessened the influence of the Bretwalda. Ethelwolf had been a monk, and appears to have been better adapted for the cloister which he had left than the throne which he now ascended. The history of his reign presents little of interest or variety. It is merely an account of the atrocities of the Danes, who made repeated descents upon England, laying waste the country, plundering towns, and despoiling the rich monasteries, where treasure was supposed to have been accumulated. No defeat, however signal and decisive for the time, was capable of permanently expelling them from the island; and although routed and compelled to flee for shelter to their ships one year, they returned the next with persevering audacity. In the meanwhile Ethelwolf found leisure to perform a pilgrimage to Rome; and in passing through France on his journey homewards, he espoused Judith the daughter of Charles the Bald, king of the Franks. But he was not permitted to enjoy undisturbed domestic tranquillity. On his return to England he found his son Ethelbald at the head of a formidable conspiracy, which threatened him with deposition and exile. The two parties, however, came without bloodshed to terms of accommodation. It was agreed that Ethelwolf should possess the eastern states appertaining to Wessex, whilst the kingdom of Wessex proper, which belonged of right to the head of the family, should be enjoyed by Ethelbald, but, it would appear, with a nominal subjection to his father. Ethelwolf survived these arrangements only a few years, having died in 858.

After his demise Ethelbald continued to occupy the throne of Wessex; whilst Ethelbert, a younger brother, succeeded to the government which had been left vacant by the death of his father; but both these princes died in a few years, and left their thrones to their brother Ethelred, who assumed the sceptre at a most unpropitious period. Not only was the kingdom divided against itself, but the Danes, acting now in a well-organized confederacy, and terrible from their numbers as well as from the frequency of their inroads, threatened the total annihilation of the Saxon dynasty and the subjugation of the island. In the reign of Ethelred ancient chroniclers present us with little else than accounts of battles fought and towns sacked, prolonged by all the sickening minutiæ of rapine and bloodshed. The conflicts were numerous and sanguinary; and in one of these, which took place at Merton in the year 870, the king received a wound of which he soon afterwards died.

By the death of Ethelred the throne of Wessex devolved upon Alfred, the fifth and favourite son of Ethelwolf. As an account of this extraordinary individual has already been given under the head of Alfred, it is unnecessary to recapitulate the events of his life. He was succeeded by his son Edward, who ascended what may now almost be termed the throne of England, in the year 901. Alfred had been called to the crown in preference to the children of his elder brother, who were considered at the time as too young to be entrusted with the government. Their pretensions being also set aside at his death, Ethelwold, one of the rejected princes, attempted by violence to seize hold of the royal authority. He formed an alliance with

History. 924.

the Danes and other enemies of Edward; but in a battle with the men of Kent he met his fate, and the island was once more rescued from a destructive competition for the crown.

Previously to this event the Danes had contrived, by a union with some of the disaffected provinces, to obtain a kind of permanent footing in the country. They possessed the north of England from the Humber to the Tweed, and the eastern districts from the Ouse to the sea. Emboldened by their strength, they invaded Mercia, but were met by Edward, who obtained over them a decisive victory, which effectually restored his supremacy. The most remarkable individual after Edward was his sister Ethelfleda, upon whom the mantle of Alfred seems to have descended. She governed Mercia, and vigorously seconded her brother in fortifying the country against the common enemy. Upon her death in 920 the Anglo-Saxon monarchy received additional security from the final incorporation of Mercia with Wessex. After various successes over his northern and other enemies, Edward the elder expired at Farrington in Berkshire, in the year 924. This monarch would appear to greater advantage were he not viewed in such close proximity to Alfred the Great, the brilliancy of whose reign was calculated to eclipse that of his successor, had the latter been even a greater man than he actually was. Edward, however, was a great man, and every way worthy to wield the sceptre of his father, which he did with uncommon judgment and success.

He was succeeded by his son Athelstane, whom historians, on the faith of an old song, are in the habit of styling illegitimate; but a contemporary poetess has recognised his mother as the partner of Edward's throne, a circumstance which fairly balances the former authority. There is one argument in favour of his legitimacy, which, as far as we are aware, has been overlooked; it is the exceeding partiality evinced towards him by his grandfather Alfred. It seems improbable that an individual, whose moral rectitude and ardent piety were so conspicuous as those of Alfred, should have singled out as his especial favourite one whose birth was a public scandal; that he should also have invested him with the insignia of knighthood whilst yet a child, and looked upon him as the future hope of Britain, more especially as, supposing the youth to have been a natural son, the legitimate children of his father had a preferable right to the throne. Viewing the matter in this light, the truth of the hypothesis that Athelstane was the fruit of a union sanctioned by law and religion appears highly probable, even allowing that the distinction of natural from legitimate children was at that period somewhat faint. It does not appear to have been so in the mind of Alfred the Great.

Athelstane was thirty years of age when his father expired; and Mercia immediately, and Wessex shortly afterwards, recognised him as king. Opposition was, however, experienced in other quarters; but he ultimately succeeded in seating himself firmly upon the throne, and fully justified the early popularity he enjoyed with his grandfather. In the person of Athelstane the Anglo-Saxon sovereign became a character of dignity and consequence in Europe. His connections with the most respectable potentates on the Continent gave to his reign a political importance, and he is moreover entitled to be considered as the first monarch of England.

The sovereignty of the whole island appears to have been the object of Athelstane's ambition. In his military enterprises he was completely successful, and compelled the princes of the Scots, Cambrians, and Britons, to swear fealty to him, in the same manner as the Saxon vassal was accustomed to swear to his lord. But his prosperity was interrupted by a powerful confederacy formed against him, which threatened not only to emancipate Northumbria from his authority, but even to overwhelm his hereditary government. The confederates were Constantine king of the Scots, and Anlaff the son of Sigtryg or Sihtric, who was king of Northumbria at the time of Athelstane's accession. Anlaff had received the hand of Athelstane's sister; but he drove her from his court, for which barbarous conduct the Anglo-Saxon monarch stripped him of his kingdom and ejected him from the island. Anlaff had fled to Ireland, whence he returned with a large fleet, in order to retaliate the insult of his expulsion. The remaining malcontents were the Welsh princes who had been humbled into submission, the Danes who inhabited the eastern coast from Tweed to Thames, the petty states of Cambria, and a constantly increasing host of lawless pirates and freebooters from Scandinavia.

History. 955.

Athelstane prepared with firmness and energy to meet the storm which threatened him with destruction. The armies met at Brunanburgh in Northumbria, and a battle was fought, celebrated in Saxon and Scandinavian poetry. The confederates were routed with great slaughter, and Anlaff and Constantine effected their escape with great difficulty. So complete was the overthrow, and so decisive the victory, that the remainder of Athelstane's reign was undisturbed by the rebellion of his subjects or the invasion of a foreign enemy. The throne of his ancestors was now effectually secured to him; and the Britons were so completely humbled, that to him belongs the glory of having been the founder of the English monarchy. The fame of his accomplishments, his talents, and his successes, was not confined to the insulated kingdom which he governed; it extended throughout all Christendom. With several foreign courts he maintained a friendly correspondence; and three princes, who afterwards became eminent in Europe, were fostered under his care, and restored by his aid or influence. These were Haco of Norway, Alan of Bretagne, and the son of his sister, Louis d'Outremer, so called from his residence in England. A concern in the death of a brother named Edwin is generally ascribed to him, but the story is somewhat doubtful; and if the other events of Athelstane's life, his public services and private virtues, be allowed to have any influence upon our judgment, it must be pronounced as improbable. Athelstane died in the year 940, regretted by his subjects, amongst whom he was revered as a prince alike distinguished for wisdom, justice, and benevolence.

Having left no issue, he was succeeded by his brother Edmund, who perished by the dagger of an assassin six years afterwards. The life of this king is not characterized by any events of importance. He was succeeded by his brother Edred, whose reign was short, and distinguished by no remarkable circumstance, except the complete incorporation of Northumbria with the rest of the Anglo-Saxon kingdom.

Edred died in 955, and left the throne to Edwin, who is usually styled Edwy, the eldest son of Edmund the Elder. The name of this monarch is intimately connected with that of the celebrated Dunstan, abbot of Glastonbury. The life of that individual having been already given under the head of Dunstan, we shall only mention here a few circumstances which are indispensably necessary to the complete chain of historical events. The reign of his uncle Edred had been looked upon by Edwy as a usurpation, and when he himself ascended the throne, the counsellors of the former monarch became the objects of his antipathy. He discarded them altogether, and surrounded himself with a host of young courtiers, more ready to emulate the vices of their master than to suggest prudent measures of government. At their instigation Edwy imposed

History. 959.

unjust taxes upon his subjects, despoiled the clergy, and committed other unseemly acts. Dunstan, having been one of the leading advisers of Edred, was most probably obnoxious to the young king; and at his coronation a circumstance occurred which brought the hostile parties immediately into collision. On that day Edwin, after the ceremony, withdrew from the festive board at which the nobles and clergy were regaling themselves, and retired to his own apartments. This indecorous act appears to have displeased the assembly; and Odo, archbishop of Canterbury, deputed Dunstan and another individual to bring back the king to join in their carousals. Dunstan penetrated into the private apartments of his sovereign, whom he found in company with Ethelgiva or Elgiva, his wife or mistress; the mother of the latter was also present. The two deputies forcibly tore the king from the company of the ladies, and brought him back to that of the nobles. This daring and insolent conduct of the monk towards the newly-consecrated monarch drew down upon him the royal vengeance. At the instigation of Elgiva, Dunstan was deprived of his honours, and condemned to exile. During his absence, Odo contrived to take Elgiva from her husband's residence, and send her a prisoner to Ireland, where her face was branded with red-hot irons, for the purpose of obliterating her charms; but in vain. They revived with the healing of the wounds; but on her return to England she was pursued by the opposite party, who falling in with her at Gloucester, actually hamstrung the unfortunate fair one. In a few days death released her from the vengeance of her enemies and from her own sufferings.[1] In the meanwhile a conspiracy was formed against the now unpopular Edwy; and at the head of it was his brother Edgar, who, supported by the Northumbrians and Mercians, drove the unfortunate monarch beyond the Thames. His sufferings and humiliation, however, were of short duration, for he died in 959, ere he had attained the full age of manhood. By some historians he is said to have been assassinated; others state that he pined to death for the loss of his throne, and his Elgiva, whom he tenderly loved; but all agree that his demise was as miserable as it was premature. His youth was the source of all his calamities, for it seems certain that he was only sixteen or seventeen years of age when he assumed the sceptre. He had also the misfortune to live at a very critical period. It was the commencement of that struggle between seculars and regulars which was to be maintained for many centuries thereafter. The intrusion of Dunstan into the king's private chamber was the earnest of many a bold step upon the part of the clergy. It is thus memorable as being one of the earliest instances in our history, of the putting forth of that overwhelming strength with which the church of Rome was armed, and which was destined ere long to exercise so preponderating an influence over the political affairs of every court in Christendom, whose haughtiest monarchs were soon taught to tremble at the thunder of the Vatican.

The death of Edwin put his brother and rival Edgar in peaceable possession of the whole Anglo-Saxon territory. His reign was tranquil, neither foreign enemy nor domestic broils having interrupted its quiet, so that posterity has styled him "the peaceful." The only event of a warlike character ascribed to him is an invasion of Wales. In his personal character he was distinguished alike for his religious zeal and for his licentiousness. A few facts relating to each of these may be stated here. He espoused the cause of the monks, and, during the sixteen years of his reign, erected a vast number of Benedictine monasteries. He recalled Dunstan from exile, placed the bold saint at his right hand as chief counsellor, and conferred upon him the see of Canterbury. In this situation that celebrated ecclesiastic prosecuted his ambitious schemes connected with the order to which he belonged with redoubled vigour. He expelled the clergy from the monasteries, and supplied their places with Benedictines, making the rule of their founder everywhere predominant throughout the nation.

History. 959.

We now find the church so intimately mixed up with political affairs, that some account of it is necessary for the elucidation of history. Although religious individuals had been collected in monasteries from the period of Augustin's landing in Kent, yet the order of Benedictines seems to be the most ancient example of monastic rule. Each congregation of recluses lived according to its own internal regulations, nor were the several monasteries consolidated into one community before the time of Dunstan. The Scottish or Irish, the Pictish and British churches, though in communion with Rome, were still independent of the papal see; and it was the object of the popes to suppress this independence of the different national churches; a cause which was warmly espoused by Dunstan. His policy was to enforce clerical celibacy; to expel at least all the married clergy from canonries and prebends in cathedrals, in order to make way for Benedictines; and to reduce all monasteries to the rule of the founder of that order. The opposition he encountered was formidable, and the cause of the clergy was espoused by the laity. Amongst the latter the secular priests found many powerful partizans, and the schisms of the church at last degenerated into factions amongst the people. But Dunstan was impetuous, and determined to carry through the reformation which he had begun, for he looked upon himself in the light of a reformer; and although the extension of his own power and that of his order may have been so blended with his zeal for the service of God as to deceive even himself, yet there seems no reason to doubt his sincerity. That there were many clerical abuses to be corrected, is consistent with the history of religion in all ages. The Danish invasions, and other national calamities, dispersed the clergy amongst the laity, with whose vices they doubtless became contaminated. The necessities of his situation compelled the prelate to be a statesman and an intriguer. He made some progress during the reign of Edred; in that of Edwy we have seen him checked; but in the present one, invested with the highest ecclesiastical dignities, and backed by the power of his sovereign, he appears before us under auspices which enabled him to carry his loftiest projects into execution. And he was not slow in seizing the opportunity. Not content with the ordinary engines of intrigue and supple policy, he drew upon the superstitious feelings of the time, and arrogated to himself divine intuition and the power of working miracles. He succeeded in deceiving that unenlightened age, and perhaps also himself.

The foregoing remarks may afford a key to some of the more prominent events of Edgar's reign. A national synod was held, at which the king publicly expressed his sentiments in favour of the Benedictine cause. It followed as a consequence of this, that the unfortunate seculars were ejected if they refused to comply with the enactments made by Dunstan and his party, under the

[1] There is no direct proof that this atrocity was perpetrated under the sanction of the Archbishop of Canterbury; and it is impossible to implicate Dunstan in the guilt, for he was in Flanders at the time. The deed, however, was done by the adherents, and praised by the encomiasts, of the archbishop.

sanction of the sovereign; whilst monks were everywhere received with honour, and the erection of monasteries was
975 for a time a royal mania. During the sixteen years of his reign Edgar built no less than forty-eight of these establishments.

In the midst of all this holy zeal, however, he found leisure for the indulgence of his licentious appetites. On one occasion he violently carried off a young lady educated in a convent, and made her his concubine. For this offence he was reproved by Dunstan, and compelled to do penance during seven years; but the mortifications imposed were not of a very severe character. His second marriage was connected with circumstances of a very tragical nature. The beauty of a young and noble lady having been praised to him, he commissioned Ethelwold, a favourite minister, to visit her residence, and report upon her charms. The deputy was himself captivated with the lady. He represented her in an unfavourable light to his sovereign, and married her himself; but Edgar, not being satisfied with the report, paid a personal visit to Elfrida, and, fascinated by her beauty, he procured the destruction of her husband, and espoused the bereaved lady himself.[1]

In extenuation of these delinquencies, he has been allowed the honourable distinction of having warmly patronized trade with foreigners. His commuting the tribute from Wales into three hundred wolves' heads, and his reformation of the coinage, also redound to his credit. By his orders a numerous fleet constantly guarded the kingdom from invasion, and he regularly visited his provinces in order to countenance the execution of the laws. His reign was glorious, and he seems to have converted his prosperity into ostentatious pomp. It is stated that eight kings, amongst whom were Kenneth of Scotland, and his son Malcolm of Cimbria, did him homage by rowing his barge down the river Dee.

Edgar died in 975, in the thirty-second year of his age, and was succeeded by Edward, surnamed the Martyr, his eldest son. A younger brother, Ethelred, by Elfrida, disputed the crown with Edward; but the latter was finally established upon the throne through the influence of Dunstan. His reign was chiefly occupied with disputes between the two clerical systems before mentioned, Elfrida having, on account of her son Ethelred, espoused the cause of the seculars, in opposition to Dunstan, who headed the regulars, and who was also the means of supplanting her son. The monks gained a complete victory over the seculars, who were now totally expelled from their convents. During this reign occurred that tragical circumstance which has afforded modern historians an opportunity of accusing the primate of murder. A council of nobles had been summoned to meet at Calne. During the proceedings, and just as the wily Dunstan had pronounced these words, "I confess I am unwilling to be overcome; I commit the cause of the church to the decision of God," the floor fell instantly down, and numbers of his opponents were killed and wounded. The primate, and probably his partizans, escaped unhurt, a circumstance which can 991
only be accounted for by supposing that their seat remained unmoved. Some historians charge Dunstan with having secretly loosened the floor from the walls, and affirm that during the debate the temporary props which supported it were withdrawn according to his directions. This is very improbable; but there can be little doubt that he interpreted the occurrence as a divine judgment upon his enemies, and thus wrought upon the prejudices of that superstitious age. Several heinous crimes are laid to the charge of the queen dowager, but the last was the darkest and most atrocious of all. Edward, in one of his hunting excursions, visited Corfe Castle, in Dorsetshire, where Elfrida resided with her son Ethelred. He was received with the utmost cordiality, and invited to enter the castle, but declined, requesting at the same time to see his brother, and also the favour of some refreshment. Whilst in the act of raising a cup of wine to his lips, he was mortally stabbed in the back by the orders of his stepmother. On account of his violent death he has been surnamed the Martyr.

Edward was succeeded in 978 by Ethelred, the unconscious cause of his untimely fate. When the latter attained the crown he was only in his boyhood, and throughout a long life he never rose above it. This is one of those reigns which it is painful to narrate. It was the saddest which the descendants of Alfred yet had seen, and presents a strong contrast to that of his father. Edward compelled kings to be his watermen. His son by Elfrida became the sport of traitors; and having five times purchased his crown from the roving Danes, he was forced at last to make an ignominious surrender of it to a foreign invader.

For more than a century the Northmen had formed the chief part of the population of Northumberland and East Anglia, and they now stretched their power to the utmost in order to place one of their chiefs upon the Saxon throne. In 980, and for ten years thereafter, England was insulted by a series of inroads, which, although unimportant of themselves, were calculated to excite some alarm amongst the people, when the latter contemplated on the one hand the power and audacity of the Danes, and on the other a pusillanimous monarch and an unguarded country. But these petty aggressions were followed, in 991, by the appearance of a formidable armament upon the English coast. The invaders advanced without opposition as far as Malden, where they gained a victory, and their retreat was disgracefully purchased by a bribe of ten thousand pounds. Repeatedly afterwards did the Northmen play the same game, and Ethelred make the same debasing submission, by purchasing a momentary respite from their ravages. But the very means which were employed to rid the kingdom of these invaders one year, insured their return the

[1] Dr Lingard, in his *History of England*, vol. i. p. 333, states that he is disposed to doubt this tale as improbable. "Malmesbury," says the learned and able historian, "on the faith of an ancient ballad, has transmitted to us a story probably invented by his (the king's) enemies." The story *may* possibly have been invented by his enemies, but where is the evidence, direct or indirect, that this was the case? Dr Lingard goes on to say, "it is improbable in itself, and supported by questionable evidence." Now, where lies the improbability? The tragical character of the transaction is in perfect keeping with that of the times in which it was committed; and as for the perpetrator himself, does not the abuse of the nun prove that, in order to gratify his unhallowed desires, even the religion, for the propagation of which he displayed such unbounded zeal, offered no impediment. Was the law of nature with regard to moral evil stronger in his mind than that which religion had imposed? This is much to be doubted. Nay, it may be surmised that the erection of so many monasteries was a voluntary penance which his conscience dictated him to perform, in extenuation of such crimes as those that are laid to his charge. The evidence is also said to be questionable; but if historians, and the learned Doctor along with the rest, unhesitatingly embody as historical facts the events and transactions related in similar compositions, we see no reason for making an exception with respect to the legend before us, because it happens to stand in the way of a favourite hypothesis. If we take one we must take all, exceptions being made where there is direct contradiction by more authentic evidence, which is not the case in the present instance. Sir James Mackintosh observes, "William of Malmesbury, who might have known the counsellors of Edward the Confessor, relates the incident on the authority (not to be despised) of a Saxon song. The same story is told by a later chronicler called Brompton (*Dec. Scrip.* 865), at great length, and with particulars characteristic of barbaric manners."

History. 992.

next. Treason, famine, and disease, also aggravated the calamities which overwhelmed the nation. Amongst the instances of defection, that of Alfric, earl of Mercia, demands particular attention. On account of his misconduct he had been deprived of his government, but had recovered it again through the influence of his friends. In 992, a meeting of the witenagemote took place at London, where it was resolved to put the kingdom in a posture of defence, by constructing a powerful fleet, and manning it with picked men. This was accordingly done, and the command of it conferred upon Alfric, with another nobleman and two prelates. Their commission was to surprise the Danes at some part where they could be surrounded; but this judicious scheme was foiled by the treachery of the commander, who not only gave the Danes notice of the intentions of the English, but consummated his perfidy by secretly joining them. He urged an immediate flight; but in the pursuit his vessel was taken, though the traitor himself escaped. The king revenged himself upon Alfric, by ordering his son Algar to be deprived of his eyes; an act as barbarous as it was useless.

This bold exertion on the part of the invaded compelled the Danes to transfer their arms from the south to the north of England, where they extended their ravages; but in 994 appeared two new and more powerful chieftains, Sweyn, king of Denmark, and Olave, king of Norway. With ninety-four ships they sailed up the Thames, and, although repulsed at London, they succeeded in ravaging several counties. But another humiliating subsidy redeemed England from their grasp; and, what is more astonishing still, Olave was honourably received at the court of Ethelred, where he pledged his word never to molest England more. This promise is only remarkable inasmuch as it was faithfully kept. The army of his companion Sweyn, however, continued to occupy the country, to which in course of time it became almost naturalized. That it should remain inactive was not to be expected; but that with impunity it should have been allowed to despoil provinces, displays a want of firmness, courage, and national spirit, which seems unnatural to the island, and can only be accounted for by supposing the existence of a weakness almost amounting to imbecility in the sovereign or his counsellors.

In 1002, Ethelred having lost his first wife, who bore him ten children, married a Norman princess, who assumed the name of Elgiva. The same year became memorable in the history of England for the perpetration of a crime of as black a dye as ever darkened the annals of any people. This wicked act, which rose out of a mischievous policy, is known by the name of the Massacre of the Danes. On the 13th of November, the festival of St Bride, the unsuspecting Northmen, with their wives, children, and all belonging to them, were cruelly put to death by a royal warrant. The details of this fearful transaction are too horrible to be related. Suffice it to say, that no place, however sacred, saved the victims from their pursuers; and that when they fled to the churches for shelter, they were slaughtered in crowds around the altars. One painful episode is interwoven with this tale of blood. Gunhilda, the sister of Sweyn, king of Denmark, who was wedded to an English earl, saw her husband and children massacred before her eyes, and was herself afterwards beheaded. It is related by all historians, that in the agonies of death she foretold the vengeance which would descend upon the English nation for the barbarous act which it had committed; and the prediction was realized, as we shall hereafter see.

The calamities of England seemed now to thicken as the atrocities of its ruler grew darker. Common pity for the failings of humanity would lead us to pardon Ethelred's pusillanimity; but this dark deed has affixed a blot to his scutcheon too deep for time ever to wash away. Sweyn was not slow in revenging the fate of his countrymen; and, through negligence and perfidy on the part of England, he succeeded in ravaging the island, for several years. almost with impunity. In 1007, thirty-six thousand pounds of silver abated his thirst of revenge. Two years afterwards the most powerful armament which had yet obeyed the flag of England was collected at Sandwich; but treason again paralyzed its operations. The captains abandoned their vessels, which were steered up the Thames by the mariners. "Thus," say the annalists, "perished all the hopes of England." The surrender of sixteen counties, and forty-eight thousand pounds, stayed for a short period the rapacity of the Northmen. The picture which the now fallen and devoted England presents, it is painful to contemplate. Accumulated treasons and defeats had unnerved the courage of the natives; whilst the numerous victories of the Danes had swelled their pride, and inspired them with a preposterous idea of their warlike powers. Many fortified cities withstood all their assaults; but the open country was abandoned to their rapacity. Systematic destruction and spoliation was their principle; and the fields, deserted by the husbandmen, ceased to yield the necessary supplies of food, so that the Danes themselves were compelled to quit the island in search of provisions. Taxation, direct and annual, which must be traced to this period, weighed also upon the energies of the people, and materially increased the now almost universal discontent. In the midst of this ignominious submission and disaffection, it is pleasing to record instances of magnanimity, and painful to reflect that these were so few in number. The Archbishop of Canterbury having been made a prisoner by the Danes, was offered his liberty for a moderate ransom, on condition that he would advise Ethelred to pay them heavy sums of money as a largess. "I have no money," he replied, "and I will not advise the king to dishonour himself." Still they persisted; but the dauntless prelate remained unshaken. The barbarians condemned him to death; and he was immediately assailed with bones, horns, and other remains of a feast in which they had been indulging. "Gold, bishop; give us gold," they exclaimed, as they dragged him forth; but he remained unmoved, and having been felled to the earth with the rude missiles which were showered upon him, he received a mortal stab from the hand of a man whom he had himself baptized.

History. 1013.

Sweyn made his last incursion into the country in 1013. Terrified at the universal disaffection, Ethelred fled at last to Normandy, whence he returned on hearing of Sweyn's death, which occurred shortly afterwards. The latter was succeeded by his son Canute; for the Danes would now appear to have put in a claim for the sovereignty of the whole country. Ethelred was recalled by the English chiefs, who exacted a promise from him that he would govern with less tyranny than formerly; and pledges were also interchanged between the Danes and English. But a contest soon ensued between the two parties; and although Ethelred succeeded in repeating upon a small scale that system of treacherous massacre for which he had so severely suffered, yet Canute maintained his superiority in open warfare, and took a barbarous revenge upon the hostages in his hands, for the murder of his friends. Treason again added a fearful contribution to the accumulated evils which surrounded the unfortunate Ethelred. His son Edmund, surnamed, from his hardihood, Ironside, vainly attempted to make head against the Danes; for Canute penetrated to York, where he was joined by the Earl of Northumbria and a number of the people. The country was now a prey to two contending armies; but just at this crisis it was reliev-

History. 1016.

ed from its greatest enemy, Ethelred, who died towards the end of 1016, worn out by care and disease.

Edmund Ironside was immediately chosen king by the English; and if the exertions of one man could have saved the country, this achievement would have been performed by the new king. During his short reign, for it extended to only a few months, he gave proofs of bravery and ability equal to any exigency, and worthy of a happier fortune. The first struggle between him and Canute was for the possession of London, which was held by the English. During the siege Edmund fought two battles in the provinces, one of which took place at Scearston, and is celebrated by our annalists. Twice the darkness of night came to the relief of the exhausted armies, which had both suffered severely; but the dawn of the third morning showed the result to be in favour of the English. Canute, however, had taken advantage of the night, and marched upon London. Not long afterwards another battle was fought, in which Edric, a traitor thrice steeped in infamy by his defection, played the game of victory into the hands of Canute. After this calamitous event the greatness of Edmund's soul became more conspicuous. Although a numerous army had again rallied around his standard, he shuddered to lavish more of his country's blood in this murderous warfare, and challenged Canute to decide their quarrel by single combat. Whether this proposal was accepted or not, is matter of uncertainty; but at all events a pacification was shortly afterwards agreed upon, and England was divided between the rivals; the north being given up to Canute, whilst Edmund retained possession of the south. The latter, however, died shortly afterwards; and there is reason to believe that he perished through the machinations of the perfidious Edric.

Edmund left two sons, infants; but by the unanimous voice of the nation Canute obtained the sovereignty of England. This remarkable prince was only twenty years of age when he assumed the reins of government. His qualities as a monarch were of a very high order, not unalloyed, however, with the ferocity natural to the Northmen of the period. The first object of his policy was the removal of the children of the two preceding kings. Some of the sons of Ethelred were slain, and the rest consigned to banishment; whilst those of Edmund were sent over to Sweden, for the purpose of being dispatched. But their fate was averted by the prince to whom they were conveyed. He sent them both to the king of Hungary, by whom they were educated in a manner befitting their station. One died in his youth, the other married the daughter of Henry, the emperor of Germany; and their issue was Edgar Atheling, who will be mentioned hereafter.

Canute divided the kingdom into four governments. He retained Wessex to himself. East Anglia was conferred on a chief named Thurchil, who had formerly distinguished himself; and Eric and Edric were continued in Northumberland and Mercia. But the latter shortly afterwards received the full reward of his crimes and perfidy. At a Christmas festival celebrated in London, he had the audacity to boast of his services, when Canute ordered him to be cut down, and his body thrown into the Thames. The Danish king had embraced Christianity, and also taken to wife Emma, widow of Ethelred. The profession of the former removed the main barrier between his English and Danish subjects; and his espousal of a royal female was no doubt intended to conciliate the affections of the Saxons; and it seems to have had a considerable effect in this respect. The other events of this reign will be found related under the head of CANUTE. He died at Shaftesbury in 1035, and was interred at Winchester. By his wife Emma he had a son and daughter; the former called Hardicanute, or Canute the Hardy. But previously to his marriage he had by another lady two sons, named Sweyn and Harold. The former was installed in the sovereignty of Norway, and the latter ascended the throne of England.

History. 1051.

Harold was not entitled to the crown; for it had been provided in the marriage settlement of Emma, that the issue of Canute by her alone should reign; yet he being on the spot, succeeded in obtaining the sceptre as well as the treasures of his father. Edward the son of Ethelred, certainly the legitimate sovereign of the kingdom, made an attempt to obtain it, but proved unsuccessful. His brother Alfred renewed the enterprise, which proved fatal to him and to most of his followers. This prince received a letter, which purported to be from his mother, inviting him to come over and take possession of his father's dominions. The proposition was flattering, and in an unlucky moment he yielded to it. Having landed with six hundred followers, he was treacherously made prisoner, along with his companions. Every tenth man was set at liberty, a few more were reserved as slaves, and the remainder were massacred and mutilated with the most capricious cruelty. Prince Alfred himself was deprived of his eyes; and this shocking barbarity soon afterwards terminated in his death. The unfortunate sufferer was the dupe of a forgery; and the whole villanous transaction seems to have been planned by Harold, and executed by his minions, particularly Earl Godwin. This remarkable individual, according to the only account of him which we possess, was the son of a Saxon herdsman. In his youth he had assisted Ulfr, a Danish chieftain, to make his escape to the ships of Canute. The Northman took him under his charge, and by successive steps he rose to the dignity of a Jarl, and to the possession of power little less than sovereign during three reigns. The atrocious deed of blood above related is the only event of importance associated with the name of Harold the First. He died in 1040, and was succeeded by Hardicanute, his brother by the half blood.

This sovereign reigned about two years; and the little that is recorded of him is of a very mixed character. He came over from Denmark, breathing revenge against the murderers of Alfred, and even went so far as brutally to insult the lifeless remains of Harold. Godwin stood prominently forward as an object of punishment, but a splendid present turned aside the shaft of vengeance. Others also escaped by appealing to his avarice, which seems to have been his ruling passion. Edward the son of Ethelred was kindly and honourably received at his court—a noble act of generosity; yet the author of it died of intemperance at the nuptial feast of a Danish lord.

Edward, surnamed the Confessor, the surviving son of Ethelred, was chosen king of England in 1042. He was a weak and feeble prince, and incompetent to the task of vigorous government; yet the commencement of his reign was characterized by an act of severity. He despoiled his mother Emma of her property, and deprived her of her influence. These proceedings were prompted by the antipathy which she bore to the king, and by her lukewarmness in not punishing the murderers of her son Alfred, of whose blood it was even whispered she was not entirely guiltless. The weak and irresolute character of the king threw the power entirely into the hands of the three noblemen who divided the Saxon territory amongst them, Siward earl of Northumberland, Leofric earl of Mercia, and Godwin earl of Kent, whose daughter, Editha, Edward had been induced to marry. Godwin was by far the most powerful of the three; for besides his own territory in Wessex, his two sons, Sweyn and Harold, held large domains northward of the Thames. In 1051 he at last presumed to bid defiance to his sovereign and son-in-

History. 1051. law. Edward, who had sojourned a long time in Normandy, where he was well treated, when he ascended the throne invited the guardians and friends of his youth to accompany him to England. They accordingly flocked to him in great numbers, and received ample preferment. One of them, named Robert, obtained the primacy, at that time the station of highest dignity and power. Amongst those who resorted to England was Eustace count of Boulogne, who had married Edward's sister. At Dover, one of Godwin's towns, a foolish affray took place between the followers of the count and the English. This circumstance gave vent to the popular jealousy of the people against foreigners. Godwin assembled a force, and claimed the surrender of Eustace; but the latter was supported by the king, who ultimately succeeded in driving Godwin and his sons into exile. The star of Godwin seemed now to have fairly set; but just at this moment there arose another of far more disastrous omen to the Saxon line. William duke of Normandy came to England with many of his followers, on a visit to his cousin Edward. He was received with great honour, and loaded with presents when he returned to his own country.

Had the illustrious stranger never risen to be ruler of England, his first visit to it would probably have been passed over by historians with a simple relation of the event. But his singular fortune has induced some writers to find in it a clue to his subsequent proceedings. It is impossible to conjecture what may have passed in his mind upon this occasion. On the one hand he saw, that in the course of a few years, the crown would soon become vacant, for its possessor was now stricken in years, and, moreover, childless. On the other hand, there stood in the way of his claim to it, first of all, Edward, the son of Edmund Ironside; then his son Edgar Atheling, a weak prince, however; and afterwards the brothers of Edward's queen. Under such circumstances his vaulting ambition may have led him to indulge in aspirations to the crown; but only a vague probability of ultimate success must have been awakened in a mind possessed of such high reflecting powers as that of William the Conqueror. Too many obstacles stood in the way of his fostering any sanguine hopes of acceding to the throne of England; and it is certain that the objects of his first visit were pacific. It appears highly probable that his politic foresight might induce him to take measures for securing the crown after the death of Edward the son of Ironside, which took place some years subsequently to his visit to England; and a conjecture may be hazarded that it was immediately after the demise of his brother's son that the Confessor made a promise to William of leaving him the crown. That such a promise was given was afterwards alleged by the Conqueror, as we shall see when he comes before us as a claimant of the sovereignty. In about a year after this the Godwins were restored to their honours and estates; and Editha, who had been repudiated by the king, was called from her prison to the throne. She was innocent of any participation in her father's guilt. The annalists of the time represent her in the most amiable light, and as incapable of devising evil either against her husband or any other individual. On his re-instalment in his earldom and possessions, Godwin succeeded in inducing the king to outlaw Archbishop Robert and all the Frenchmen; and not long after he died ripe in years and in crimes. In 1055 Siward followed him to the grave; and two years afterwards expired Leofric, the wise and powerful duke of Mercia, who was succeeded in his dukedom by his son Algar. Tostig, brother of Harold, received the earldom of the former; but in a few years afterwards (1065), he was deposed for his cruelties, and his sovereignty conferred upon Morcar, son of the Duke of Mercia.

Soon after these transactions, the pacific monarch of England began to sicken. When he saw his end approaching, he ordered the magnificent church of St Peter at Westminster, which he had built, to be consecrated with solemnity and splendour. He died two days after, on the 4th or 5th of January 1066, in the twenty-fourth year of his reign, and was interred in the church which he had so recently dedicated. He left no issue; for he had taken a vow of continence for life. Edward Atheling, the only surviving son of Edmund Ironside, had landed from Hungary with his wife and children, for the purpose of being proclaimed heir to the crown; but shortly after his arrival in London he expired, bequeathing his claim to his son Edgar. History. 1066.

Edward the Confessor presents himself to us only in one character, that of a royal monk. His piety and gentleness might have adorned a cloister, but, unallied with those sterner virtues which fit a monarch for wielding the sceptre with firmness and energy, they rendered him unfit for ruling, except under the influence of able counsel, which he had the good fortune to possess during the greater part of his reign. Abject superstition will unnerve even a strong mind, and to a weak one it imparts a character of childlike feebleness, and forms such an individual as Edward. But he had many amiable qualities, which would have redeemed even greater weaknesses than those with which he is chargeable. He loved his people much; he was averse to the imposition of taxes, some of which he abolished; and his charities were frequent and extensive. His subjects repaid his attentions by lamenting his loss as a national misfortune, and consigning his memory to the veneration of posterity.

The day which witnessed the funeral of Edward, saw the coronation of Harold, the son of Godwin. A report had been circulated that the Confessor had appointed him his successor, which greatly conciliated the chiefs; indeed the only opposition which he experienced was from his own unnatural family. On Edgar Atheling, the last surviving prince of the house of Cerdic, was conferred the earldom of Oxford, in lieu of the crown. Tostig, the brother of the king, was a competitor for the crown. Harold Hardrada, king of Norway, promised him his support, and the politic duke of Normandy did the same. In Flanders he was permitted to raise an army, with which he landed in Northumberland; but he was defeated by Morcar, on whom the earldom of the province had been conferred. The discomfited Tostig fled to Malcolm, king of Scotland, where he was well received. The Caledonian monarch had himself been sheltered at the English court during the usurpation of Macbeth, and was established on the throne of his ancestors by the aid of England. As a grateful return for the attentions he had received in that country, he always readily welcomed the malcontents who fled from it. The arrival of his Norwegian ally recalled Tostig from his exile. They joined forces at the mouth of the Tyne, and marched upon York, in the neighbourhood of which city the Saxon army sustained a defeat. But this was only a prelude to the grand struggle. Harold, the king, notwithstanding the necessity under which he lay of watching the south-eastern extremity of the island from a still more formidable rival, collected a considerable army, and marched with promptitude and secrecy to meet Tostig and his Norwegian ally. So rapid had been the movements of the king that he took the enemy in some degree by surprise. They, however, retired upon Stamford-bridge on the Derwent, where they drew out their line of battle. The contest which ensued was bloody, and long of doubtful issue. For a while the firm array of the Norwegians bade defiance to all the efforts of the English cavalry, which, accustomed to charge in detached masses,

fell in this dispersed state almost harmless upon the bristling rampart of Scandinavian spears. The king of Norway, conspicuous by his blue tunic and glittering helmet, made the most heroic exertions; but victory forsook his standard; a fatal dart pierced his throat, and he fell lifeless to the ground. Tostig assumed the command, and after a desperate effort to turn the fortune of the day, he perished, with the flower of the Norwegian army. This victory, which is memorable on account of the dreadful slaughter that distinguished it, was gained on the 25th of September 1066. It must be recorded to the honour of Harold, that twice he offered peace and pardon to his rebellious brother, once before and once during the heat of battle, when the Norwegian had fallen, but both times these offers were refused. Three days after this conflict William duke of Normandy landed in England, and Harold had to prepare for another desperate struggle to retain the crown. It will now be necessary to examine how far the pretensions of the new competitor for it were legitimate.

This celebrated claimant to the sceptre of England was the descendant of Rollo, a renowned Vikingr or Sea-King, who flourished at the beginning of the tenth century. Rognvalldr, the father of Rollo, was one of those earls appointed by Harold Harfager, or the fair-haired, to guard his conquests. He had two sons, Thorer and Rolfr, better known by his more celebrated name of Rollo.[1] The progenitor of William the Conqueror was expelled from his country on account of a violation of the law which forbade freebooters, under pain of death, to destroy cattle on the Norwegian shore. Driven from his paternal shores, he resolved to seek for a kingdom elsewhere; and after much successful valour he succeeded in establishing a Scandinavian state in France. Rollo proved himself a prince worthy of a kingdom, and his acquisition in course of time assumed the name of Normandy. His exertions for the improvement of his dominions, the civilization of the rude Northmen, and the humanizing of their minds to the love of order, justice, and the arts of peace, class him with those illustrious individuals who have proved themselves benefactors of the human race. He died in 931, and was succeeded by his son William. After two others, Robert the Magnificent, or the Devil as he was perhaps more appropriately designated, succeeded. He was father to the duke, who now appears before us as a competitor for the English throne. William was an illegitimate child by a damsel of humble condition, of whom his father was enamoured, but could not wed during the lifetime of his duchess, the sister of Canute. Like their northern progenitors, the nobles of the Norman duke were careless of the distinction between concubinage and wedlock, so that on the death of Robert in 1035, William, although then only eight years of age, was triumphantly placed upon the ducal throne, which he filled with renown for fifty-three years.

The circumstance of numerous Norman barons having settled in England during the reign of Edward the Confessor, who was the grandson of a duke of Normandy, has already been noticed; as also the visit paid by William to the childless monarch. It was afterwards asserted by the Duke of Normandy, that upon one occasion, probably that to which we have already alluded, Edward had bequeathed to him the crown of England. He also alleged a testamentary bequest, as well as Harold. Both were alike destitute of any claim founded on the modern principles of hereditary descent, but both by consanguinity made out a species of right to inherit; William as the grand uncle of Emma the king's mother, and Harold as the king's brother-in-law. The claims of the champions were therefore nearly balanced, and seem to have contented their partizans; the sword alone could decide to whom the real title should belong.

In the mean time the claim of Harold suffered considerably on account of a circumstance which occurred a short time before the demise of the late king. The Saxon had been shipwrecked in France, but obtained leave to proceed to Normandy by alleging that he was intrusted with some communications to Duke William. That prince received him kindly, and imparted to him the hopes which he cherished of obtaining the English crown. He received a promise of aid from Harold, and by an artifice succeeded in making him swear fealty to his cause. Underneath the missal on which the Saxon had sworn were concealed various sacred relics, such as the bones of saints and martyrs, and thus he had unconsciously bound himself by the most solemn oath. When the struggle came, Harold urged the plea of compulsion as releasing him from any obligation to keep his vow. Abhorrence of oath-breakers, however, is characteristic of a superstitious age; and whilst the circumstance materially weakened the cause of Harold, it strengthened in a corresponding degree that of his rival. There is also every reason to believe that it was the principal means of enabling William to obtain from the holy see a declaration in favour of his enterprise. At such a period a bull from the pope was itself worth an army, and this the adventurer not only obtained, but also a consecrated standard, a ring, and a lock of his holiness's hair.

William now set busily to work in preparing the means of offensive aggression. When his purpose was known, he was speedily joined by all the young knights of the neighbouring countries who sought fortune or renown, and by all the freebooters whom the hope of spoil allured to his standard. With an armament more formidable than the western nations had yet witnessed, he accordingly put to sea. Annalists have greatly exaggerated the number of his troops; for altogether they did not probably much exceed twenty-five thousand men. With this army he landed without opposition at Pevensey, in the county of Sussex, as has already been observed. He made no stay at that place, however, but proceeded immediately to Hastings to procure provisions. Harold, apprised of the arrival of his most dreaded enemy, flew to attack him. William, informed of his victory and advance, was counselled by some to remain in his entrenchments, and not to hazard an open engagement. But the mind of the future conqueror was not liable to the agitations of fear. He had thrown his life upon a cast, and was resolved to stand the hazard of the die. In this emergency the conduct of Harold has been severely censured. He appropriated to him-

[1] In the *History of England* by Sir James Mackintosh (vol. i. p. 90), the following sentence occurs:—"One of the sons of Roguevald, called in the Icelandic poems *Hrolpt*, better known to us by the name of Rollo, had, for reasons unknown to our authorities, been excluded from all share in his father's domains, and had no resource but piracy." The reason of his exclusion was in all likelihood his being a younger son. We have already noticed, that amongst the Northmen of this period an absurd law obtained, by which all but the eldest son were excluded from any participation in the property left by the father. By this pernicious arrangement the younger branches of families were driven to seek their fortune upon the sea. It is certain that Roguevald left two sons; it is also next to certain that he would observe the law of the land as it then existed. Now, the question comes to be, which of the two was the first born. There is no direct evidence upon the point, but the circumstance of Thorer's name having always the precedence when the brothers are mentioned together, and also that of Rollo's piratical exploits, whilst there is no mention made of his brother in that capacity, seem to determine the point that the progenitor of a future royal family of England was the youngest son;—and thus the difficulty is explained.

History. 1066.

self all the spoils of the late battle, which added to his unpopularity; whilst the death of his brother was by common report imputed to him. On his march against William, a considerable portion of his army deserted him, and their place had to be supplied by raw and undisciplined levies. When the two rivals were near enough to interchange messages, the Norman offered Harold the choice of abdication, of single combat, or of appeal to the pope. These propositions being rejected, he was then offered Northumberland for himself, whilst Kent would be conceded to his brother Gurth; but the latter proposal shared the fate of the former one; upon which William declared his intention of giving battle to his rival, whom he looked upon and designated as a liar and a perjured wretch, excommunicated by the holy father. He even expressed astonishment that an individual conscious of such guilt as that with which Harold was chargeable should venture his person in battle. We are told that such a feeling also prevailed in the English army, and that the king was advised by his brothers Gurth and Leofwin to withdraw, whilst they would lead on the battle. Harold, however, only smiled at their apprehensions, and expressed his resolution of commanding the army in person.

On the morning of Saturday the 14th of October William advanced to the attack of the Saxons, after having solemnly heard mass and received the sacrament. The previous night is also said to have been passed in devotion, whilst songs and revelry resounded throughout the Saxon camp. The spot which Harold had fixed upon for this important contest was a piece of rising ground about eight miles inland from Hastings. It was open towards the south, and was covered at the back by an extensive wood. On the front of the declivity the troops were arranged in one compact mass, in the centre of which floated the royal banner, with the king and his two brothers near it. On an opposite hill stood William in front of his warriors, with the relics upon which Harold had sworn hung round his neck, and the consecrated standard waving by his side. After a short address to animate his soldiers, he advanced upon the enemy, shouting the national war-cry "God is our help;" whilst the cry of "Christ's rood, the holy rood," rose from the adverse ranks. The impetuous onset of the Normans was received by the English with their battle-axes, with which they broke the lances and cut the coats of mail, on which their opponents placed great reliance. The confidence of the Normans began to waver, and the left wing, both horse and foot, actually gave way. With eager rashness the English pursued, and thus exposed themselves to the hazard of being cut off; for William with dauntless fortitude and presence of mind had succeeded in rallying his fugitive bands. The attack was renewed, and again the English repulsed it. The duke had now recourse to an artifice which ultimately proved the destruction of the enemy's army. By a feigned flight he allured a body of them from their strong position, and, whilst the latter too eagerly pursued, he turned upon them with his cavalry, and hewed them in pieces. Twice was this stratagem repeated, and each time with perfect success. Still the main body of the English presented an unbroken rampart of shields, against which the mass of Norman chivalry for a long time was hurled in vain.

During the conflict both leaders gave proofs of personal bravery and skill worthy of the crown which the one was combating to retain and the other to wrench from his grasp. William had three horses killed under him, and hand to hand he had grappled on foot with his adversaries. A little before sunset Harold, both of whose brothers had already fallen, received an arrow in the eye, which penetrated to the brain. His fall relaxed the vigour of the English. Their lines were penetrated, their standard taken; and a panic having seized upon them, they broke and dispersed through the wood, whilst darkness closed upon the spoils of the field and the hopes of the Saxons.

History. 1066.

Thus ended the battle of Hastings, memorable in various respects, first, as introducing a new dynasty of monarchs to rule the southern part of Britain; and secondly, as opening up to the inhabitants of the island the means of a more extensive intercourse with the continent than they had ever yet enjoyed. By this means were introduced into Britain those modes of life, manners, customs, and institutions which were at the time considered as characteristic of civilization and refined society; and henceforth England was destined to take a large share in the transactions and fortunes of the continental powers, perhaps ultimately for the mutual benefit of all parties.

On the morning after the battle, the victors, having stripped the bodies of the slain, pranced wantonly over them with their horses. The mother of Harold, like another Andromache, begged the corpse of her son from the conqueror; but whether her maternal request was complied with or not is a matter of great uncertainty; for upon this point our annalists are either contradictory or ambiguous. By one party it is asserted that the corpse of the fallen monarch was interred upon the beach; by another that it was given up when demanded, its weight in gold having been offered as a ransom. Perhaps both are correct; for it is probable enough that it was first buried on the shore, and afterwards exhumated at the request of the mother. Without entering into any speculation connected with the Norman conquest, we may simply remark, that in order to interest the reader of English history, and excite commiseration and pity for Harold, he has, by a number of historians, been invested with talents, virtues, and accomplishments which he did not possess in a degree sufficient to command the entire affection of his countrymen during his life; whilst his death has also been deplored with unnecessary regret, as a sort of national loss. Where the stakes are equal, and the game a fair trial of strength and dexterity, sympathy will always side with the loser. Over his opponent Harold had the advantage of fighting for his native land against a foreign invader; but it must be observed that his own aggrandisement and the independence of the nation were inseparably connected, and that in pursuing the one he was combating for the other.

Before entering into the subsequent history of the conqueror's proceedings, it will be necessary to pause and take a rapid glance at the Anglo-Saxon institutions before they were supplanted by the system which the successful invasion of the Normans was destined to introduce.

The Anglo-Saxon king, without possessing despotic sovereignty, was in dignity, property, and power elevated far above the level of the rest of the nation. He was elected by the assembly called the *wittena-gemote*, a meeting of wise or prudent men. This was the great council of the nation, and seems to have resembled what our modern parliament would be if lords and commons mingled together and debated in one house. It was composed of the prelates, earls, and a great many thanes or considerable proprietors of land, a class similar to our modern gentry; so that the Saxons may be said to have possessed the elements of a free and popular government, though as yet in a rude and chaotic state. This supreme judicial and legislative assembly was convened by the king, and held its meetings on the great festival days of the church, such as Christmas. But these were not confined to such seasons, being called together according as circumstances required. Besides electing the king, and presiding at his coronation, they assisted him in making laws and treaties, in military preparations, in administering justice, and the other affairs of government. Their power was considerable, but it de-

History. 1066.

pended in a great measure upon the character and capacity of the sovereign. The highest officer in the kingdom was the ealdorman; he was chief of a shire, and had great judicial powers. An eorl was the next dignity, which remained separate from the former until towards the close of the Anglo-Saxon period, when the title of ealdorman seems to have been superseded by that of eorl; under them were other officers, whom it is unnecessary to particularise. There was of course a wittena-gemote to every kingdom; and when all the principalities merged in Wessex, and gave rise to a single one for the whole country, the monarch occasionally held *shire-gemotes*, or county meetings, where the laws made by the king and his counsellors were proclaimed, and being acknowledged and sworn to, became binding on the whole nation.

The Anglo-Saxons were divided into freemen and slaves. But there was a third class, such as bordars, cottars, and others, who were cultivators of the soil, and, ranking probably in the lowest order of freemen, were scarcely reduced to the degrading level of slaves. As far as has yet been ascertained, the class which was subject to the most complete thraldom was small in comparison with those who enjoyed superior privileges, probably about one in seven. The Anglo-Saxons paid some attention to the cultivation of the land, which was held by various tenures, and liable to certain burdens, which varied in kind and quantity. Military service, which consisted in providing a certain number of armed men when public safety required them, was one of these. The other two great services were the constructing or repairing of bridges, fortresses, and walls. Besides these, the sub-proprietors of land were more or less liable to many other burdens. With regard to their conveyances, we have several of their grants of land without any pecuniary consideration; of their conveyances on purchase; of their deeds of exchange; of their testamentary devises, and their leases. These were, in the early periods of Anglo-Saxon history, short and simple; but in grants of a more recent date the general words are nearly as numerous as in our present deeds.

The supreme legal tribunal was the wittena-gemote, which, like the present House of Lords, was paramount to every other. There were also shire-gemotes and burgh-gemotes, so many yearly meetings of which were strictly enjoined upon those who composed them. Much of their judicial proceedings rested upon oaths, and perjury was therefore severely punished. For the various breaches of the law the punishments were commonly pecuniary. In the case of murder, the amount, which was partly levied by the state as a penalty, and partly granted to the family of the deceased as a satisfaction for the loss of their relative, was proportioned to the rank of the murdered man. Persons accused of crimes had occasionally to pass through an ordeal of hot water or hot iron, of which they had their option.

There were many popular institutions which rendered the king subordinate to the community. The meetings of the people at the various courts, from the folkmote of the hundred, to the wittena-gemote of the nation, contributed to foster the principles of equal law and of popular government. From the Anglo-Saxons we derive our language, the names of the most ancient officers among us, and those of the greater part of the divisions of the kingdom, and of almost all our towns and villages.

In their domestic habits the Anglo-Saxons were social, and loved the pleasures of the table. Their food was that mixture of vegetable and animal diet which always marks the progress of civilization. Ale and mead were their favourite drinks, and wine was an occasional luxury. They had become so far acquainted with the conveniences of civilized life as to display both variety and vanity in adorning their persons. Their dwelling-houses seem to have been small and inconvenient, although they were both expensive and magnificent in their ecclesiastical buildings. Amongst the Anglo-Saxons females were very respectfully treated, and occupied the same independent rank in society which they now enjoy. The trades and mechanical arts had made considerable progress, and even foreign commerce was carried on and considered as a highly honourable calling. With regard to their circulating medium, it may be shortly stated, that they had their pounds, shillings, pence, and farthings, exactly as we have at present. Learning, except amongst ecclesiastics, was neglected; and with regard to literature, little can be said with certainty, for the monuments of this kind which they have left us, except what is historical, have not yet been examined with sufficient care.[1]

The conquest of England did not altogether terminate with the battle of Hastings. London and other important towns were put in a posture of defence, whilst a numerous fleet had assembled at Dover to interrupt the proceedings and distract the attention of the invader. Edgar, the legitimate heir to the throne, appears to have been either crowned or acknowledged as sovereign at London, where the two powerful earls Morcar and Edwin, with the loyal inhabitants, resolved to make a desperate stand against the advancing foe. William, however, instead of attacking the city, chose rather to lay waste the country, which he did most effectually, consigning to the flames what could not be forcibly removed. He now appears before us in a character somewhat new. Formerly he had combated for the crown against an individual who, according to all modern notions of legitimacy, had no more right to it than himself; but in the present instance he was attempting to snatch it from the brow of him who alone had a hereditary claim to wear it. On this account the atrocities committed by his troops are justly contemplated with horror, whilst the disposition to palliate them is proportionally lessened.

William, however, was the candidate favoured by the see of Rome, and the bishops interfered in his behalf. Stigand, the metropolitan, was the first to throw himself on the mercy of William, whom he met as the conqueror crossed the Thames at Wallingford, and swore fealty to him as his sovereign; others followed his example, as did Edgar, Edwin, and Morcar upon the part of the nobility. The crown was offered to him, and he was formally invested with it in Westminster Abbey, on Christmas 1066. During the ceremony a tumult arose which made the stout heart of the conqueror to tremble beneath its iron mail; and, had an English force, led by any competent commander, and capable of making head against the Normans, appeared at the moment, it might have cost him his crown and his life. Whilst, by loud acclamations, both English and Normans expressed their willingness to have William for king, his troops set fire to the houses, and commenced the plunder of the city. The coronation service was hastily concluded, and the insurrection quelled without much difficulty, although the English looked upon it as a bad omen, and William as a most unfortunate occurrence. It was his interest to propitiate the affections of the people whom he had now been appointed to govern, and he anxiously wished to do so. In explanation of this occurrence, it is usually alleged that the Normans mistook the acclama-

[1] Turner's *Anglo-Saxons*, vol. ii. *passim*. Mackintosh's *England*, vol. i. p. 71.

History. 1066.

tions of those who shouted within the church for an alarm of the English to rise in revolt. But if this had been the case, why did they not instantly fly to the rescue of their king, instead of spreading themselves about and firing and pillaging the city? His safety was surely their first care; for had he fallen, their fate was inevitable. The whole unquestionably originated in the desire of the troops for sack and pillage.[1]

Hitherto William had been called the Bastard; from this period he obtained the surname of the Conqueror, a term which at the time was employed to designate a person who had sought and obtained his right, as well as a subjugator. It was necessary for William to maintain a strong military force in order to compel the obedience of his subjects; and he could only feel himself secure surrounded by his trusty Norman barons. But the duration of their services being limited to a certain term, they naturally expected to be released from their engagements, and re-conveyed to their country, when the period of servitude had expired. In order to encourage them to remain, he put into their hands the strongholds and principal towns of the kingdom, whilst all the conquered territory of the English, which he had at his command, was likewise distributed amongst them. Having thus put his dominions in a secure posture, he embarked for Normandy, carrying along with him Morcar, Edgar, and Edwin, and leaving the chief management of affairs in England in the hands of William Fitzosbern, a Norman baron, and Odo, bishop of Bayeux, the son of his mother by a plebeian husband. During the absence of the Conqueror, the Saxons began to mutter threats of vengeance, and even went so far as to enter into a conspiracy to cut off the Normans as their forefathers had done the Danes. It appears, from the testimony of several credible annalists, that the oppression which the English suffered at the hands of the insolent soldiery was most galling, and called loudly for retaliation. These alarming rumours crossed the channel, and reached the ears of William, who hastened from his continental dominions, and, landing in England in December 1067, made a sort of second conquest of that country. The Saxons of Devonshire, joined by the neighbouring Britons in Cornwall, had thrown off their allegiance to him, and against them he first turned his arms. They made a gallant stand; but William having reduced Exeter, succeeded in breaking the spirit of resistance for a time. About this period, Edgar, with his mother and two sisters, having embarked for Hungary, were driven by a tempest upon the coast of Scotland. That country was at the time governed by Malcolm, surnamed Ceanmore, who gladly received the fugitives, and made them a return for that kindness which he had himself experienced under similar circumstances at the English court. Many Saxon nobles followed Edgar, who, with subsequent emigrations of disaffected Normans, founded the greater number of the Scottish noble families. Malcolm afterwards married Matilda, the eldest sister of Edgar.

William the Conqueror now turned his attention to the north, where his authority had not yet been properly established. From the heart of Mercia to the confines of Scotland a spirit of open insubordination prevailed, and was fostered by Edwin, who had been at one time promised the hand of William's daughter, but was afterwards refused it. The insurrection became formidable; but it was soon quelled, and this served more and more to confirm the power of the Normans. William penetrated as far as York, which opened its gates to him, scattered the isolated and feeble bands who opposed his march, and reduced all the important towns on his way. During this expedition he also fortified a number of castles. The tranquillity thus produced was, however, of short duration. At Durham the English succeeded in massacring the whole Norman force established there, excepting two men. York followed the example of Durham, and rising upon the garrison, killed the governor, with many of his retainers. Shortly after this event, the sons of Harold, the late king, landed from Ireland with the intention of making an effort to recover the crown; but they were utterly defeated in two engagements, by Brian, son of the Earl of Bretagne.

History. 1067.

A new and formidable auxiliary of the malcontents had now however arrived in the Humber; this was a powerful Danish armament. Edgar Atheling, several illustrious Saxons, and crowds of the English, having joined them, they successfully assaulted York; but William, apprised of their descent, hastened to the scene of war. His usual good fortune attended him; and the Danes were compelled to quit the country without crossing arms with the Normans in any conflict worthy the name of a battle. Hints have occasionally been thrown out that they were bribed by the Conqueror; but of this circumstance there is no direct evidence. Upon another point, however, all historians are agreed, namely, that, piqued by these repeated insurrections, the king, in a transport of passion, had sworn to extirpate Northumbria. This merciless vow was performed nearly to the letter. Unbounded license was given to the soldiery, who ravaged the country with fire and sword. The destroying angel could scarcely have left a more desolate wilderness behind. An historian, William of Malmesbury, who wrote sixty years after the event, thus describes it: "From York to Durham not one inhabited village remained; fire, slaughter, and desolation made it a vast desert, which continues to this day." The dead remained unburied; famine, with pestilence in its train, stalked throughout the neighbouring provinces; whilst confiscation brought up the rear of this terrible visitation, and completed the ruin of the country and its inhabitants, gleaning whatever the sword had not destroyed. Such atrocities as these imprint a blot upon the escutcheon of William which it is impossible to obliterate. To his authority the rebel chieftains were compelled to submit; and having thus in the most summary manner crushed rebellion in this quarter of his dominions, he returned southwards, clearing the provinces of the disaffected as he proceeded, and repairing or building castles for the subjection of the country.

William was now undisputed master of England. The conquest of the country, properly speaking, only began

[1] Although not mentioned by our historians, contemporary annalists establish and illustrate the fact that the armies of the continent at this period were in a great measure composed of mercenaries, who followed war as a profession, and hired themselves out to the best paymaster. These individuals were different from those who followed the banners of the barons according to the feudal system. They were little better than hired banditti, and were very numerous in the Low Countries, whence William had sprung. That the force with which he invaded England contained vast numbers of these condottieri, is not only probable, but appears nearly certain, when we contemplate the methods of furnishing out an army in those days. The plunder of the provinces which they overran or conquered seems to have been looked upon by them as not only allowable, but as forming part of their reward. That the affair at William's coronation arose from their rapacity for pillage, which they looked upon as a right, there can be little doubt; and they chose the most fitting time for successfully carrying their project into execution; a time when their leaders were withdrawn, and in attendance at the ceremony going on within the church. They had previously broken out in the same way at Dover.

History. 1067.

with the battle of Hastings. It was not until seven years thereafter, when he carried the terror of his arms to York, that the country was completely subdued. Before that period not one half of England acknowledged his authority. But the spirit of the Saxons was now fairly broken, and finding themselves pursued with such extirpating vengeance, many of them sought refuge amongst the hills and forests, whilst others emigrated to foreign lands. A party of them under Hereward, a resolute chief, attempted to make a stand in the island of Ely, immediately after the northern massacre. This land of fens and marshes was the last asylum of Saxon independence; and Morcar, with some bishops and the remainder of the most conspicuous Saxons, repaired thither. For a while William disdained to notice the efforts of Hereward; but at last he invaded his circumscribed territory, and, scattering his little band, compelled him to fly. This bold and patriotic chieftain afterwards gave in his submission, and being allowed to retain his paternal possessions, the end of his days proved happy. His daring exploits had endeared him to his countrymen, and conferred on him a romantic celebrity. His actions were the theme of many a Saxon song; and even the Normans did homage to his warlike virtues. He was the last of the Saxons who drew the sword in the cause of national independence.

William having now quieted the tumults at home, turned his attention to Malcolm, king of Scotland, whom he compelled to submit. The affairs of the church also occupied him for a time; and several changes were effected, not, it may well be believed, to the advantage of the Saxon prelates. One of them, the Archbishop of Canterbury, was deposed, and his place supplied by Lanfranc, who, although a worthy man, was the creature of William, and in bondage to Rome. In the meanwhile, Edgar Atheling had sought and obtained the friendship of the Conqueror, who, to his honour, ever afterwards maintained this weak and almost imbecile youth in ease and affluence at his court.[1] William now ventured upon another visit to Normandy, where we shall leave him engaged in petty contests, and take a view of the state of England after its subjugation.

By the introduction of a foreign sovereign, a foreign hierarchy, and a foreign nobility, the native population suffered severe depression. To supply the liberal grants of land and places of honour and trust to his followers, the English were of course sacrificed; and thus they were compelled to become the servants or dependents of their conquerors. Contempt and oppression became their heritage. Their farms were pillaged, their females violated, their persons imprisoned, and other indignities heaped upon them, at the caprice of the petty tyrants who were set over them. The principal favourites of the Conqueror had another distinction conferred upon them in addition to the grants of land. This was the earldom or command of the several counties. Two legal revolutions occurred or were completed during the reign of William; the separation of the ecclesiastical from the civil judicature, and the introduction or consummation of the feudal system, for an account of which the reader is referred to the proper head. He effected various other judicial changes which were ultimately beneficial to the community. The crown revenues were a continuation of those which the Anglo-Saxon kings enjoyed; but they appear to have been considerably increased by the various changes which took place, and also very carefully collected; for from an ancient historian we learn that the king's daily income amounted to above one thousand pounds, a sum almost incredible when we reflect that gold was then three times and silver ten times the value which they possess in modern times.

History. 1087.

During the visit of William to his continental possessions, the Norman barons rebelled against him, and were joined by some Saxon chiefs. The king hastened across seas with a band of auxiliaries, and made an easy conquest of the insurgents. The remaining events of his reign are not sufficiently important to require a minute recital. The most remarkable is the revolt of his son Robert, who had been promised the duchy of Normandy when William first invaded England. The French monarch fomented the hostilities between the father and son, which existed for several years, and closed with a most romantic incident. Robert, being besieged in the castle of Gorberoi, engaged a knight enveloped in complete armour, and unhorsed him, at the same time inflicting a wound in his arm. When about to pursue his advantage, Robert recognised in the fallen warrior the voice of his father. A reconciliation was finally effected by the tears and entreaties of Matilda, the mother of this Norman Absalom.

Whilst engaged in a desolating warfare against Philip, king of France, William came before the town of Montes in July 1087, and ordered it to be burned. He rode to view the scene, and galloping among the smouldering ruins, his horse reared and plunged so violently as severely to wound the rider, who was at the time very corpulent and unwieldy. He was carried in a dangerous state to the vicinity of Rouen, where he breathed his last, on the 9th of September. On his death-bed the conscience of the Conqueror appears to have stung him deeply; for he ordered that several prisoners in England, amongst whom was Odo his half-brother, should be set at large; and that restitution should be made for what he had violently destroyed. But these atonements were inadequate to expiate the crimes of which he had been guilty.

The character of William has been drawn in the Saxon chronicle by an Englishman, who was his contemporary, and lived at his court. From this document we learn that the king was very wise, very rich, and "more worshipfull and strong than any of his fore-gangers." It is added, that "he was mild to good men who loved God, and stark beyond all bounds to those who withstaid his will;" and the chronicler goes on to show that he exercised a passionate as well as politic tyranny. That, in fact, he surpassed his contemporary rulers in capacity for command, the events of his life bear ample testimony. All those qualities which fit an individual for directing and controlling the minds of men in troubled times he possessed in an eminent degree. In extenuation of his perfidy and cruelty, it may be urged that these detestable qualities were not more characteristic of him than of the age in which he lived; and that he is conspicuous for them above his competitors only because, from the vigour of his mind, and the great transactions in which he interested himself, he was their superior in every thing else. In a happier state of society, when moral restraint is generally recognised, and influences the development of the mental con-

[1] Sir James Mackintosh, in his *History of England* (vol. i. p. 108), gives a somewhat different account of this youth, but upon what authority is not stated; ours is Mr Turner, who quotes from William of Malmesbury. There is considerable ambiguity in the passage; for Sir James (p. 102 of the same work) says that Malcolm Ceanmore "married the Princess Margaret, after the *death of her brother Edgar*." Now the king of Scotland espoused this princess several years before the events noticed in p. 108, so that one or other of these statements must be erroneous; for none of our historians makes mention of *two* contemporary princes named Edgar belonging to the royal house of Wessex.

stitution of man, his glories would not probably have appeared more stained with blood than those of Cromwell and other warriors who have attained the seat of successful ambition and uneasy power. Neither these palliatives, however, nor his death-bed penitence, can atone for irrevocable crimes, or erase from the page of history such deeds as the Northumbrian massacre.

Much has been written concerning the Norman conquest, for it is a subject of inexhaustible interest. That it became ultimately of incalculable benefit to the country, whatever may have been the suffering immediately consequent upon the event itself, no one can doubt who reflects upon the fluctuating condition of England, its oscillation between foreign bondage and native independence, its internal broils and never-ending distractions, previously to the invasion of the Normans, with the consolidated strength which it internally displayed, and the dignified bearing which it outwardly assumed, after it was conquered by them. Insurrections, though not unknown afterwards, were of less frequent occurrance, and far less alarming, than before; and from the period of the invasion of William, no foreign enemy dared to set his foot upon the soil with impunity. Amongst the financial innovations of his reign was the composition of the Doomsday Book, for an account of which the reader is referred to the article under that head.

The Conqueror left three sons by his wife Matilda. Robert, the eldest, was installed in the duchy of Normandy; whilst William, surnamed Rufus or the Red, from his complexion, obtained the throne of England, and was crowned on the 26th of September 1087. An attempt was made by his half-uncle Odo to dethrone him, and to set up his brother Robert in his stead. But William, alarmed at the formidable demonstrations which were made against him, appealed to the English for aid, and his call was most loyally obeyed. The Normans who had invaded England were compelled to fly, and William carried the war into Normandy, where a reconciliation was effected in the year 1091. The king of England had acquired several continental fortresses, of which he was still to retain possession. It was also stipulated between the brothers, that on the decease of either, the survivor should succeed to the dominions of the other. Henry, the younger brother, who suffered by the treaty, held out several strong places in Normandy; but they joined their forces together, and besieged him in St Michael's Mount, whence he was compelled to fly from want of water.

Robert accompanied his brother to England, where he had been promised possessions as an equivalent for the fortresses which he had yielded up in Normandy. But William did not find it convenient to fulfil the terms of the treaty; upon which his brother, who had again crossed the channel, sent over two heralds for the purpose of declaring him a false and perjured knight. In order to defend his honour, the king followed them into Normandy; but his transactions there belong rather to his own individual history than to that of the country which he governed. The possession of his brother's dominions was a leading object of William's ambition; and he gradually acquired an ascendency in Normandy, which he repeatedly invaded, obtaining new cessions at each adventure. Robert finally mortgaged the whole country to him for three years, at an equivalent of ten thousand merks.

The other events of William's reign were, an invasion of Wales, which was crowned with the usual success; and a war with Scotland, in which the monarch of that country was slain. His government of England was most unpopular. For the gratification of his own appetites, and the enriching of worthless favourites, he plundered the country with impunity. During the life of Lanfranc, his undisciplined rapacity was checked by the wisdom and influence of that excellent prelate. His death, however, removed every restraint, for the king supplied his place by the appointment of an able but remorseless counsellor, who, according to the king himself, was capable of braving the execrations and the vengeance of mankind, in order to gratify his master's desires. Many bishoprics, including amongst these the see of Canterbury, were kept vacant by the king for several years, until a severe illness convinced him of the necessity of appointing a primate. The individual whom he fixed upon was Anselm, one of the most learned and meritorious men of his age. This individual at first demurred to accept the archbishopric, dreading the violence of the king; but the earnest solicitations of his friends at last induced him to comply, and he thus became primate of England. William, as long as his illness was of a dangerous character, showed himself penitent and submissive. He commanded all his prisoners to be released, all his debtors to be forgiven, and all offences to be remitted; and he solemnly vowed that if he recovered he would govern the land in righteousness. But no sooner was he convalescent than he showed that his profession of amendment was only a matter of convenience, and extorted from an unforgiving spirit by the terrors of death. Anselm, as was usual in such cases, brought a voluntary present to his master as an acknowledgment for the dignity which had been conferred upon him; but the gift, not corresponding to the avaricious views of the monarch, was refused, and the unfortunate primate was ever afterwards persecuted by him with the most unrelenting tyranny. Anselm at last sought shelter in Rome, where he continued until William's demise.

The death of the monarch, like his life, was violent. Whilst hunting in the New Forest, he was accidentally struck by an arrow, which buried itself in his breast, and he expired on the spot. The shaft is believed to have been shot at random, and to have come from the bow of Walter Tyrrel, a French knight, who immediately made his escape. This event happened on the 2d of August in the year 1100.

Henry the First, surnamed Beauclerk or the Scholar, ascended the throne of England three days after the death of his brother, the preceding monarch. The compact which had been made between William and Robert was set aside; but the latter, considering himself as aggrieved, invaded England. The formidable demonstrations made by his brother, however, intimidated him, and a pacification was at last effected at the accession of Henry; and the latter propitiated the favour of his subjects by many wise acts. He removed the unpopular agents of his unfortunate brother, particularly Flambard, the obnoxious minister formerly alluded to, and also abolished the oppressive exactions which the latter had enforced. Anselm was recalled, and the clergy conciliated, whilst the people had restored to them the Anglo-Saxon laws and privileges as amended by Henry's father. He also gratified the nation by espousing Matilda, or Maud, daughter of Malcolm, king of Scotland, by Margaret, the sister of Edgar Atheling.

The king now turned his attention to the punishment of the outlaws who had thrown off his authority. Amongst these were included several noblemen, and particularly Robert de Belesme, the most powerful subject in England, and a man haughty, rapacious, and deceitful. He had secured himself within the walls of Shrewsbury, but at the arrival of Henry before this place he made a humiliating surrender, upon which his life was spared, but he was condemned to perpetual exile. Some time after these events Robert unexpectedly arrived in England, where he was received with apparent affection by his brother,

History. 1106. but very soon discovered that he was in reality a captive. The purpose of his visit was to intercede with Henry in favour of the rebels; but instead of compounding for their liberation, he was reduced to solicit his own, which he obtained by consenting to pay an annuity of three thousand merks. After his return to Normandy he entered into terms of friendship with the outlaw Belesme, who possessed numerous castles in the country. Intelligence of this having reached Henry, he renounced the alliance by which he had bound himself to keep the peace with Robert. This compact was similar to that which had subsisted between William and Robert, and a second time the latter became a brother's dupe. Henry invaded Normandy, and a decisive conflict before the walls of Tinchebrai, on the 27th of April 1106, decided the fate of Robert. His army was completely routed, and he himself taken prisoner and sent to England, where he remained in close confinement till his death, which happened in 1135. The cruel fate of this prince has served as a foil to the virtues which he possessed, and shed over them an artificial or spurious lustre. There can be no doubt, however, that his qualities as a warrior were brilliant, and his mind would seem to have been forgiving and conciliatory. Perhaps an amiable weakness in the latter respect was the ultimate cause of his misfortunes. Amongst the prisoners taken at Tinchebrai was Edgar Atheling. Either from his inherent weakness precluding any thing like fear on his account, or from a desire to retain the golden opinions of the Saxons, Henry pardoned him, and from this period the descendant of Alfred intrudes himself no more upon the page of English history.

Robert had a son about five years of age named William, whom a faithful vassal succeeded in conveying to the French court. As the age of this prince advanced, the hopes of his partizans proportionally increased. Henry, after obtaining possession of Normandy, had succeeded in tranquillizing it, and restoring peace and order; but as his nephew grew up, the claims which he possessed to the duchy of his father became more and more popular, and disturbed the quiet both of his uncle and the country. Henry should have at once yielded his paternal inheritance to the young prince; and the withholding of it was an act of injustice which harassed his life and dishonoured his name. The Norman barons, along with the king of France, took part with the injured youth; but this coalition terminated with the battle of Brenville, which was fought in the year 1119. Louis, the French king, had four hundred, and Henry of England five hundred knights. Both princes displayed great bravery during the engagement, which ended, with comparatively but little bloodshed, in favour of the English. William of Normandy made his escape; and the pope, who paid a visit to Henry at Gisors, effected a reconciliation between him and Louis, without touching upon the main cause of quarrel, namely, the difference between the English monarch and his brother Robert, or rather his nephew William, the father being now politically dead.

Matters having been once more pacifically arranged, and the ambition of Henry gratified, he set sail for England towards the end of November 1120. Upon this occasion a most calamitous event occurred in his family, namely, the loss of his only son William. The prince, with a large retinue of gay young knights and noblemen, embarked shortly after his father. Festivity, riot, and intoxication prevailed on board; but in the midst of this feasting and debauchery, the care of the vessel being forgotten altogether, she struck upon a rock near Harfleur, and went down. Of three hundred individuals who were on board, only one escaped to record the dismal fate of his companions. Prince William would have been saved but for the shrieks of his natural sister, which recalled him to the wreck with the boat in which he was proceeding towards shore; and it sunk under the multitudes who crowded into it. History 1135.

This sudden calamity revived the hopes of Henry's nephew William, and disturbed all the arrangements of the king in Normandy. A new war was kindled in that country; but it terminated in 1124 in favour of the English monarch. The discomfited youth, however, received a new favour of fortune. Louis of France bestowed upon him the hand of his sister-in-law; and along with her he received several of the provinces nearest to Paris, which had been united to Normandy by conquest. Soon afterwards he was invested with the earldom of Flanders, which had been left vacant by the assassination of Charles the Good in 1127. In the meanwhile, Henry had endeavoured to perpetuate the succession in his own family, by marrying a second time, after the death of Matilda, his first wife, who had brought him a son and daughter. The premature fate of the former we have already noticed; and the latter, named Matilda, had espoused the Emperor of Germany. The marriage of the king proved to be without issue; and his daughter having recently become a widow, was invited to England, for the purpose of settling upon her the succession to the throne. In a general assembly of the prelates and chief tenants of the crown she was proposed by her father and acknowledged by the meeting as heiress presumptive; and shortly after this transaction her father privately married her to the Count of Anjou. This secret negociation drew forth loud complaints from the barons; and many of them declared that the duplicity of the king had released them from the obligation of their oath. This doubtless disturbed the serenity of the king's reign; but another and more important cause of disquietude arose from the increasing power and fame of his nephew in Flanders. However, the death of that prince soon afterwards removed all uneasiness on his account, and restored at least the prospect of tranquillity. But this was not realized; for a quarrel with his son-in-law retained him in Normandy, and embroiled the last years of his reign, which was now drawing towards a close. Robert, the unfortunate duke of Normandy, died at Cardiff Castle in Wales, in the eightieth year of his age and twenty-eighth of his captivity, a great part of which had been spent in total blindness; for an unsuccessful attempt to escape had provoked his brother to deprive him of sight. All the historians of the period do not mention this circumstance, and some state that the prisoner enjoyed every indulgence; so that the point is doubtful, and for the honour of humanity we leave it in this state. In about a year thereafter, he was followed to the grave by king Henry, who died of a surfeit of lampreys, on the 1st of December 1135, in the sixty-seventh year of his age and thirty-fifth of his reign.

The character of Henry has been drawn by both friends and enemies, his contemporaries. The former extol him as wise, rich, and brave; and the latter execrate him as cruel, avaricious, and incontinent. By joining the two characters together, we will form a pretty fair estimate of the monarch. He was undoubtedly an able statesman and a courageous soldier, whilst his resolute attack upon the popular system of rapine which disgraced Europe at the time is entitled to very high praise. He punished offences severely; but his administration of justice was highly beneficial to the country; and hence arose his title of the Lion of Justice. On the other hand, the immorality of his private life, his exactions, his cruelty to his brother and others; his dissimulation, for even his favourites distrusted him; and his avarice, for he hoarded gold like a miser; render his character exceedingly equi-

History. 1135.

vocal as a man, whatever estimate we may form of him as a sovereign. His reign offers little worthy of praise, excepting what has been noticed above. It was moreover so agitated, that he passed only five years of untroubled tranquillity in England.

It was the darling plan of Henry that his beloved daughter Maud should be his successor. By her second husband she had three sons, one or other of whom their uncle no doubt looked upon as the future monarch of England. But the claims of the ex-empress of Germany were waived, and Stephen earl of Boulogne, son of Adela, the daughter of William the Conqueror, succeeded to the throne. He was crowned upon the 26th of December 1135, and soon made himself very popular. According to custom, he immediately issued a charter, which promised of course good government and ample redress of grievances. His courts at the solemn festivals were held with extraordinary magnificence. He repulsed the invasion of David king of Scotland, who received a severe defeat at the Battle of the Standard, which was fought near Northallerton; he subdued his enemies in Normandy; and, by a yearly pension, he pacified the husband of the lady whom he had supplanted upon the throne. Robert earl of Gloucester, natural son of Henry, and the great supporter of Maud's rights, perceiving all hostility to be unavailing, at last swore fealty to the king. For the first two or three years of his reign, Stephen sat secure upon the throne; but he was doomed to be overtaken by a series of calamities. These arose partly from the inevitable consequences ot his usurpation, and partly from his defects as a sovereign. That passion for depredation and conflict which the preceding monarch had subdued, again broke out. Every one built his own castle and maintained his own band of mercenary ruffians, who sallied forth day and night to plunder the surrounding country, and drag into dungeons such as they expected would give a high ransom for their freedom. A contemporary chronicler has drawn a horrible picture of the atrocities thus committed with impunity; for the mildness of Stephen's character, and probably the recollection of his own conduct in obtaining the crown, induced him to be forbearing and indulgent. His popularity rapidly declined; and in the fourth year of his reign it appears to have altogether ceased. In 1139 Matilda, with a few attendants, landed in England, for the purpose of recovering her lost inheritance. She was joined by Robert earl of Gloucester, with a hundred and fifty knights, who commenced a warfare which nearly hurled Stephen from the throne. After many conflicts, which were only characterized by the misery attendant upon them, the army of the Empress Matilda or Maud defeated that of Stephen near Lincoln, in the year 1141. The king was captured after a brave resistance; and Matilda was soon afterwards crowned queen of England at Winchester. The clergy, although they countenanced the accession of Stephen, now acknowledged her prior claim; and the queen, proceeding to London, was joyfully hailed by the citizens.

But her popularity was of short duration. By her arrogance and contemptuous conduct towards the friends of Stephen, she soon alienated the affections of the people, and was at last compelled to fly from the city and to establish her head-quarters at Oxford. In one of the numerous struggles which followed, the Earl of Gloucester was taken prisoner, which put the fortunes of the belligerents nearly upon a level. The king and the earl were exchanged for each other; and as both parties had now a commander upon whom they could depend, the conflict was perpetuated, with increasing misery to the nation. For some years the balance of power hung nearly in equipoise between them. Stephen reduced Oxford, but Robert defeated him at Wilton; and this miserable warfare continued, until, on the death of her brother Robert, Matilda returned to Normandy in 1147, when a breathing time of two years intervened.

History. 1154.

In the meanwhile Henry, the son of Matilda, was advancing in years and in fortune. By his uncle David, king of Scotland, he had been knighted at the age of sixteen; a year thereafter he obtained from his father the cession of the duchy of Normandy; and at the death of that prince he succeeded to the earldom of Anjou. In 1152, by a politic marriage, he annexed the extensive duchy of Aquitaine to his dominions. This aggrandizement of her son's power having elevated the hopes of Matilda and those of her partizans, Prince Henry landed in England; but in consequence of the death of Eustace, the oldest son of Stephen, the two parties agreed to terms of peace. Stephen adopted Henry, and appointed him as his successor, one of the best acts of his troubled reign. They lived in harmony with each other for about a year, when Stephen died on the 25th of October 1154. He reigned nineteen years, during the greater part of which time England exhibited a scene of misery unequalled since the invasion of the Danes. The cause of these calamities we have already alluded to. The character of Stephen is not so deeply stained with atrocities as that of some of his predecessors, probably because it was not so determined. In comparison with them, the grasp which he held of the sceptre was as feeble as his right to seize it at all was equivocal.

Henry II. or Plantagenet, the son of Matilda, ascended the throne without a dissenting murmur. He was crowned, along with his queen Eleanor, at Westminster, on the 19th of December 1154, in presence of an immense concourse of people. The prospect which opened up to this young sovereign was more glorious than that of any of his forerunners in England, or his contemporaries in other countries. An unprecedented mass of power was concentrated in his hands. A third part of France, including almost the whole western coast from the borders of Picardy to the mountains of Navarre, acknowledged his authority. These possessions, along with England, comprehended the most warlike portion of Europe; and had the ambition of the individual who ruled over them been commensurate with his power, the humiliation, if not entire subjugation, of France would not have been reserved for the Henries and Edwards of after times. Although by no means destitute of a passion for power, Henry possessed a love of literature, which led him to eschew the cloudy and troubled atmosphere of war. The civil discord which prevailed during the reign of his predecessor had inflicted numerous evils on the nation, and to the alleviation of these Henry devoted the first years of his reign. He issued a new coinage, of standard weight and purity; he drove beyond seas the foreign mercenaries who had harboured in England during the reign of Stephen; he seized the royal castles which had been usurped, and demolished those which had been reared for the purpose of systematic plunder. By these vigorous steps of reformation Henry secured the effective administration of justice in his English dominions. One of the leading features of his character was restless activity. On foot or on horseback he was perpetually in motion; and the moments which he could spare from more important concerns were usually devoted to the chase.

Some of the leading events of Henry's reign are associated with the name of Thomas a Becket, who has been portrayed as a saint and martyr, or a hypocrite and traitor, according to the religious bias of the historian who happened to draw the picture. Under the article Becket an account of this celebrated prelate will be found; and it is only necessary in this place to allude to those events of his life which are identified with the history of his

History. 1161. country. One of Henry's first measures was the promotion of this individual to the chancellorship of England, in which capacity he vigorously seconded the measures of reform which the king had undertaken. His administration has been characterized as alike beneficial to the country and to the sovereign, who loaded his favourite minister with honours and emoluments. By the advice of Becket, Henry proposed a treaty of marriage between his eldest son and the daughter of Louis king of France. On this occasion the chancellor undertook a journey to Paris, displaying upon the occasion a pomp and parade transcendently elaborate. Henry himself followed; and although a rupture ensued between the sovereigns about the city of Toulouse, which belonged of right to the king of England, their enmities terminated with the marriage of their children whilst the infants were as yet in the cradle. We have now arrived at that period of Becket's life in which his conduct has been the subject of a kind of historical crusade. In 1161 Theobald the archbishop of Canterbury died, and Becket was recommended as his successor by the king. The clergy of England, however, resisted the nomination, declaring it to be unseemly for a man who was rather a soldier than a priest, and whose life had been devoted to hunting and falconry, to be appointed an archbishop. More than twelve months elapsed between the nomination and appointment, during which time Becket still retained the chancellorship, and evinced no change in his feelings or way of living, which was eminently worldly. He even went so far as to smile at the idea of metamorphosing the gay and pompous Chancellor of England into the Archbishop of Canterbury; and he appears himself to have thought that the choice arose from Henry's confidence that he would become the pliable instrument of his will in ecclesiastical affairs. If the king anticipated such a consummation, never were the hopes of man more miserably disappointed. For no sooner was Becket invested with the primacy, than a change took place in his manners, more strongly contrasted with his former life than were the two offices which he had held. Instead of a train, which in splendour and fastidious pomp had rivalled the retinue of kings, he chose a few monks the most conspicuous for their humility and mortification. Instead of the oriental magnificence and gorgeousness of apparel with which he loved to dazzle the eyes even of courtiers, he selected as his chosen garment the roughest sackcloth. His sports and revels were exchanged for deeds of penitence and humiliation. And thus far his conduct appears to have been commendable; but did his future behaviour warrant a belief that this sudden change was attributable to the sincere conviction of a pure and lofty spirit, which had changed its views regarding the relative value of earthly and heavenly things, or to the policy of a deep and designing hypocrite? The remaining particulars of his life will best enable the reader to form his own judgment as to this, which is one of the most disputed points in our history.

The first step which Becket took after his promotion was to return the seals of his former office to Henry, on the ground of his incompetency to hold two such offices. This measure is said to have at first excited the indignation of the king, who had never before heard Becket object to the prelacy on that account. But it was not until 1163, when hostilities commenced between the church and the state, that Becket and the king came fairly into collision. Previously to the Norman conquest, ecclesiastical affairs had, like others, been decided before the hundred, with the addition of the metropolitan sitting as one of the judges. The Conqueror, however, had instituted a separate tribunal, where the clergy were judged by a court composed of themselves, and from that time they were independent of secular jurisdiction. Becket upheld this claim with firmness, as he ought to have done, until it was formally set aside by the king and his counsellors. This, however, did not justify the decisions which were pronounced, and which had now become notoriously partial. Crimes of the darkest description had frequently been perpetrated by ecclesiastics with the most scandalous impunity; for the judges could not inflict capital, nor indeed any adequate punishment. An abominable instance of seduction having attracted the notice of the king, he determined that those chargeable with such atrocities should be tried before the criminal tribunals of the state. For this purpose he summoned a great council at Westminster, where he demanded that ecclesiastics, whenever convicted of such offences, should be degraded, and handed over to a secular justiciary. His question was, Would they agree to observe the ancient customs of the realm? Becket answered yes, saving his order; an ambiguous reply, which was echoed by the conclave of bishops present, with only one exception. But, although not at this assembly, he was afterwards compelled to yield the point without any reservation respecting his order. This formal assent was obtained at the celebrated council of Clarendon, which took place on the 25th of January 1164. At this great or common council of the realm, for the word parliament had not yet been introduced, Becket was compelled to yield compliance to the demands of his sovereign. At first he peremptorily refused his acquiescence; but the king, incensed at his obstinacy, menaced him with exile or death, whilst several individuals of rank present entreated him with genuflections and tears to submit; by which means a compliance was at last reluctantly wrung from him. These customs and usages, the recognition of which was thus so vehemently urged, were contained in sixteen articles, which were afterwards well known under the name of the Institutions of Clarendon, by which it was enacted that clergymen accused of any crime should be tried in civil courts; that laymen should not be tried in spiritual courts, except by legal and reputable witnesses; that no ecclesiastical person should quit the realm without the king's license; that all causes not ecclesiastical should be finally determined in the king's court; that all ecclesiastical persons who were tenants *in capite* of the crown should follow the king's customs, sue and be sued respecting their fiefs before his justices, and attend, like other barons, at his courts; that vacant dignities in the church should be in the king's hands; and that he should also receive the profits of his seignorial dues. These, with some others, to the number of sixteen, were subscribed by all the ecclesiastics present, including Becket himself. He was now not only mortified in the highest degree, but, pretending extreme contrition for what he had done, did open penance for his supposed delinquency. He attempted to make his escape to France, but was arrested for an offence against the institutions which he had recently signed. Henry was now exasperated beyond all bounds at the archbishop, and assembled a parliament at Northampton, obviously for the purpose of crushing him. Becket was accordingly summoned to account for rents and profits connected with his primacy. He arrayed himself in his sacerdotal vestments, and, with the cross in his hand, proceeded to the place appointed. The king complained to the council of the insolent behaviour of Becket, and the whole assembly joined in condemning his inconsistency. The suit regarding rents, which was only intended as a menace, he attempted to free himself from, by pleading a release by Henry the king's son; but this was overruled. After being condemned as a perjured traitor he left the palace, his eyes fixed upon the cross, which he held uplifted in his hands; and, travelling in disguise, he

History. 1164.

History. 1164. reached the port of Sandwich, whence he immediately embarked for the Continent.

Becket was received with marks of esteem by the king of France, and likewise by the pope, whose cause he had so strenuously defended in England. When Henry learned the flattering reception which the obnoxious exile had received, he dispatched an embassy to expostulate with Louis, and sent another to Rome, to justify his conduct to the pontiff. But the ambassadors were received with coolness, if not with something which bordered upon contempt. The judgment of the barons and bishops was annulled by the pope, and those who should invade the property of the church were declared to be cut off from the society of the faithful. Henry's irritation had now reached its climax, and he resolved upon taking a bold step, which, had the human mind been ripe for such a measure, might have ended in the separation of the English church from that of Rome; but this achievement was reserved for the Henry of a future day. He gave orders to his justiciaries, prohibiting, under severe penalties, all appeals to the pope or the archbishop, and forbidding any person to receive mandates from them, or to apply to their authority; and he declared it treasonable to bring over from either any interdict against the kingdom. On the other hand, the pope was not slow in issuing his fulminations. Becket was ordered to excommunicate Henry's chief ministers, and put the see of Canterbury, including about three fourths of the kingdom, under an interdict. But Henry stood firm, and looked with indifference upon the papal lightnings which played around him. At last, however, he began to dread the powers of his victim, chiefly on account of his continental dominions, and proposed a reconciliation. The treaty of accommodation, although more than once broken off, was finally concluded, and Becket returned to the see of Canterbury without having been compelled to make any express submission to the institutions of Clarendon.

But the wounds had been too deep to be thus suddenly healed, and, though closed at the surface, the venom still rankled underneath. The arrogance and presumption of the primate returned along with his dignity. He refused compliance with the terms of the general amnesty, and would not submit to take the oath of homage for his baronry; neither would he withdraw the whole of the ecclesiastical censure from the prelates who lay under it on account of their obedience to the king's commands. Several very imprudent excommunications soon followed, and so provoked Henry that he is said to have dropped certain passionate expressions, intimating something which was interpreted into a desire that Becket's life might be taken away. The supposed will of the king was instantly accomplished by four knights of distinguished rank, who repaired to the church of Canterbury, where the primate then officiated, and barbarously slew him at the foot of the altar. See Becket.

Thus perished by foul murder, in the fifty-third year of his age, Thomas a Becket, who, every thing considered, was probably the most remarkable man of his time. That he believed he was all the while conscientiously performing his duty, in preserving the immunities of the church, there seems little reason to doubt; for he would not have met his fate with such heroic and martyr-like firmness unless this had been the case. His virtues were of an austere character, and wanted that amiable attractiveness which we usually associate with the character of one who is profoundly inspired by the morality of the gospel. His vices, on the other hand, were the reverse of mean and grovelling; for his spirit was lofty and aspiring, and his designs were invested with a dazzling grandeur, and pursued with a fearless firmness much more calculated to excite awe than detestation, far less contempt. That Henry did not intend the murder of Becket, appears certain from his subsequent conduct. He was thrown into the utmost consternation on hearing of it, knowing well that the primate's death would accomplish what his most violent opposition during his lifetime could never have effected. He abandoned himself to sorrow and mortification, and for some time refused to take any nourishment. The pope was with some difficulty made sensible of the king's innocence; but declined to grant him a pardon, except on condition that he should make every future submission, and perform every injunction which the holy see thought proper to prescribe or impose. He was likewise enjoined to perform a humiliating penance at the tomb of Becket, who was in due time canonized as a saint and venerated as a martyr. The assassins, despairing of pardon, sought refuge in a distant castle. By the pope they were enjoined to make a pilgrimage to the Holy Land, where they all died, and were buried before the gate of the temple at Jerusalem.

History. 1172.

We come now to a very important event in the reign of Henry II. that is, the annexation of Ireland to the English crown; but the details of his invasion it is unnecessary to relate here, as they will come in due order to be treated of under the head Ireland.

The king was scarcely freed from the Irish war, and the dangerous controversy in which he had engaged with the church of Rome, when he found himself involved in the most unnatural contests with his own children, to whom he had always behaved in the most tender and affectionate manner. He had ordered Henry, his eldest son, to be anointed king; and he had destined that prince as his successor in the kingdom of England, the duchy of Normandy, and the counties of Anjou, Maine, and Touraine, territories which lay contiguous, and which might thus easily afford mutual assistance to each other when necessity required. Richard, his second son, was invested with the duchy of Guienne and the county of Poitou; Geoffrey, his third son, inherited, in right of his wife, the duchy of Brittany; and the new conquest of Ireland was destined for John, his fourth and youngest son. The last sixteen years of Henry's life were embittered by family hostilities. A mighty confederacy was secretly formed against him, in which his three eldest sons participated. Louis VII. king of France, fed the discord; for the power of the English monarch had now become so formidable as to excite alarm and kindle up jealousy in the breasts of the continental sovereigns. The young prince was persuaded to demand of his father some of the dominions which he had been promised, and of which he was nominal sovereign; but he was refused. Upon this the prince made his escape, and put himself under the protection of the king of France. The French monarch then invaded Normandy; and Richard and Geoffrey, the sons of King Henry, severally raised the standard of revolt in Guienne and Bretagne. William the Lion, king of Scotland, considering this as a favourable opportunity for invading England, advanced into the northern counties, destroying all he met with. A great force of foreign mercenaries, called Brabançons, landed in Sussex, under the command of the Earl of Leicester, whilst Prince Henry collected another army in France in order to co-operate with them. To meet this formidable coalition against his authority, King Henry made the best preparations which circumstances admitted of; and if we may judge of these by the results which followed, he must have taxed his constitutional activity to the utmost in collecting forces, and in opposing a barrier to the tide of war which thus rolled onward from every quarter, threatening to overwhelm his throne. Few of his own barons could be depended upon, and he had

History. 1174. recourse to the foreign mercenaries so largely employed by his adversaries. Twenty thousand of these auxiliaries enlisted under his banners, and with them were united such of his own nobles and retainers as could be trusted.

The enmity of the young princes against their father had been in no inconsiderable degree excited and fostered by Eleanor their mother, whom the incontinent and licentious life of Henry had for ever estranged from her affections. She attempted to make her escape; but was taken prisoner, and consigned to close imprisonment, where, with the exception of a short interval, she remained till the death of her husband.

In the meanwhile, the plan devised by the allies began to be acted upon, as already indicated; but Henry of England proved himself superior to the emergency. His foreign enemies were on all sides discomfited, and William of Scotland having accidentally fallen into the hands of Henry, the Scottish army broke up and dispersed. Their sovereign afterwards obtained his freedom by the humiliating surrender of his authority as king of Scotland; for conceding to Henry the title of lord paramount of his kingdom was virtually casting his crown at the feet of his enemy. A pacification was brought about at Falaise, on the 28th of September 1174, by which the princes were pardoned and enriched with new liberalities.

King Henry, however, was permitted to enjoy but a few years of repose. The dissensions between him and his children again broke out. The latter also quarrelled amongst themselves, and a most unnatural war ensued, in which neither party gave quarter. But the death of Henry, the eldest son, for a time suspended these disputes. This unfortunate prince died in 1183, of a fever brought on by vexation and fatigue. Three years afterwards Geoffrey perished beneath the feet of a horse in a tournament at Paris, so that the subjects of discord were diminished. The widow of Geoffrey, soon after his decease, was delivered of a son, who was named Arthur, and invested with the duchy of Brittany, under the guardianship of his grandfather, who, as duke of Normandy, was also suzerain lord of that territory. Philip, as lord paramount, disputed the title of the English king to this wardship; but he was obliged to yield to the wishes of the Bretons, who preferred the government of Henry. Some other causes inflamed the dissension between these monarchs, and Philip once more seduced Richard from his duty. He insisted that the marriage of that prince with Adelais, his sister, should be immediately completed, and threatened to enforce his demands with a formidable army. This lady had been confined for a long time in a castle by Henry, who procrastinated the nuptials, until a suspicion arose that he intended to appropriate her to himself. At the conclusion of the truce which had followed the death of Geoffrey, Richard finally forsook his father, and did homage to the king of France for his continental dominions.

For some time the eyes of the monarchs of Christendom had been turned to Palestine, which the Sultan Saladin was overrunning with his mighty hosts. Henry of England was desirous of taking the cross and proceeding to Syria, but his perpetual contests with his family detained him until the holy city was taken by the infidels. The news of this event awakened feelings of regret and indignation throughout Christendom. The Emperor of Germany marched his bravest knights towards Asia. Philip of France and Henry agreed to follow, but the union of the former with Richard the son of the latter compelled the king of England, in the first place, to look to the defence of his own territories, which were once more invaded by the confederates. The war proved very unfortunate for Henry, who lost several towns, and very narrowly escaped falling into the hands of the enemy. A treaty was at length agreed to, but the terms of it were very humiliating to the English monarch. With a heart overwhelmed with grief, he returned to the castle of Chinon, where he soon afterwards expired, on the 6th of July 1189, in the thirty-fifth year of his reign and the fifty-seventh of his age. Upon his death-bed he was sedulously attended by one of his natural sons, the fruit of an amour with Rosamond, whom popular romance and tradition have surnamed the Fair, and invested with every virtue but one. Henry was interred with little pomp in the convent of Fontevraud, in the presence of his rebellious son Richard, and a few knights; but Eleanor, his queen, survived him many years, having been liberated by her son Richard. The character of Henry II. has been already detailed at sufficient length. During his reign important changes in ancient law and usage were matured, and became conspicuous, on which account they have been ascribed to the administration of this monarch; but it is more probable that they resulted from the slow growth of circumstances, with little aid from rulers, who were perhaps unconscious that any change had occurred.[1] History. 1189.

Richard I. succeeded to the throne without opposition, and was crowned on the 3d of September 1189. The reign of this monarch, the Achilles of modern Europe, is interwoven with events which are more akin to romance than to real history. His life is made up of the adventures of a knight-errant. His character was a singular compound of qualities noble and mean; of the grand and the grovelling, the sublime and the grotesque. It has been thus drawn by Mr Turner, in his *History of England:* "Haughty, irascible, and vindictive, a towering and barbaric grandeur, verging sometimes into barbarian cruelty, distinguished his actions. Valiant beyond the common measure of human daring, unparalleled in his feats of prowess; inferior to no man in hardihood, strength, and agility; stern and inflexible in his temper; rapacious and selfish, yet frequently liberal to profusion; gorgeous to ostentation, yet often gay, familiar, satirical, and jocular; unshaken by adversity; resolute to obstinacy, furious in warfare, fond of battle, and always irresistibly victorious; his life seems rather the fiction of a poet's imagination than the sober portrait of authentic history." But this character for martial prowess and heroism was softened by a love of literature, particularly Provençal poetry; and although the specimens of his compositions which have been transmitted to us scarcely deserve the name of poetry, still they evince the presence of the passion in his mind. It was the same sentiment which thus penetrated the tempestuous atmosphere so congenial to his soul that imbued his exploits with the spirit of genius and romance. An overweening love of praise added its inspiration to his feelings, and contributed to render his actions pre-eminently conspicuous even in the high and palmy age of chivalry. He had no sooner ascended the throne than he began to make arrangements for joining the new levies of crusaders preparing to embark for the Holy Land. In such a sphere nature had fitted the king of England to shine without a rival. His landing in Palestine was destined to mark an era, when the Moslemins were to encounter a warrior superior even to the most distinguished of their own in lofty daring and proud contempt of danger, and when the brows of their bravest chieftains were to darken at the name of Richard.

[1] Mackintosh's *History of England*, vol. i. p. 172.

History. 1189. At his coronation an event occurred which it is painful to mention, and too shocking to give in detail. The Jews, eager to express their fealty to the new sovereign, approached him in numbers, bearing rich presents of gold and silver, commodities which they well knew would be peculiarly acceptable to the king. In their endeavours to press forward towards the hall door during the state dinner, a scuffle ensued. The Jews resisted the ill treatment they received, which so inflamed the passions of the English mob that they arose upon the defenceless strangers, and drove away or destroyed them. This example of violence spread not only over the city, but throughout the country; and the unfortunate Israelites were massacred and plundered without mercy. It was in vain that the king attempted to allay the tumult; the sanguinary rabble would not desist until its ferocity and rapacity were completely satiated.

Richard having equipped his armament, and acquired the necessary treasure by every means in his power (and from his natural impatience he was never scrupulous upon that point), joined Philip of France and marched with him to Lyons. As the principal events connected with this expedition are already embodied in the article CRUSADES, we shall not recapitulate here the whole details, but only notice such as have not been there introduced. On his way Richard relieved Portugal, by joining the sovereign of that country with five hundred knights, and bidding defiance to the Moors or Saracens. This was an evil omen for the followers of the Prophet. After landing at Messina, he remained there six months, which were chiefly occupied in warm disputes with Tancred, who had usurped the Sicilian crown. On the 10th of April 1191 Richard set sail from this place; but his fleet having been dispersed by a storm, and the ship in which were his sister Joan, and his betrothed wife Berengaria, being driven into Cyprus, he landed on that island for the purpose of chastising the governor, who had treated the royal ladies with some discourtesy. Richard reduced the whole island, and after marrying Berengaria, and causing her to be crowned queen of England, he set sail for St Jean d'Acre, which afterwards surrendered to him. (See ACRE.) The fall of this place opened the way to Jerusalem, towards which he now advanced, performing on his way those chivalrous deeds which taught the infidels to shudder at the apparition of his name. (See CRUSADES.) In October 1192 Richard set sail from the Holy Land for England, with a fleet, which contained his wife and sister, who appear to have reached their destination in safety. But a storm having dispersed the ships, Richard was driven near Marseilles. Having learned, however, that plans were in agitation to seize his person (for Philip of France and other continental sovereigns, together with his brother, were leagued against him), he formed the unfortunate resolution of passing through Germany in disguise.

He landed at Zara, and after a variety of adventures and hairbreadth escapes, he was at last arrested by Leopold, duke of Austria, who immediately ordered him to be loaded with fetters. This prince had served under Richard at the siege of Acre, where he received, or imagined he had received, some injury at his hands, and took this base method of revenging himself. Henry VI. emperor of Germany, was then equally an enemy to Richard, on account of his having married Berengaria, the daughter of Tancred king of Sicily. He therefore required the royal captive to be delivered into his hands, and stipulated to pay a large sum of money to the duke as a reward for his services. History. 1199.

The disaster which had befallen the English monarch could not be long concealed. The news of his captivity spread general indignation at home; a feeling which was responded to by the disinterested portion of Europe. Richard's mother, along with the clergy of Germany, appealed to the pope; and the emperor, finding that his conduct was condemned as disgraceful, made an attempt to justify it, by charging his prisoner with several weighty crimes. These were, his behaviour in Sicily, his conquest of Cyprus, and the alleged murder of Conrad, who was assassinated whilst contending for the Christian kingdom of Palestine. The latter charge being by far the most serious, every effort was made to vindicate Richard from the guilt of the alleged crime. At home the ministry exerted themselves to the utmost; and the most able prelates set out for the Continent to bargain for his ransom. He was removed from a dungeon in the Tyrol to the residence of the emperor at Haguenau, and was taken from thence to Worms, for a final adjustment of differences.

In the meanwhile, his brother John, with Philip of France, were busily prosecuting their plans for his destruction. Their design was to effect the utter ruin of Richard; and every method was tried to accomplish their purpose. John made his feudal submission to Philip for his brother's continental possessions; and having assembled an army, he returned to England with the intention of seizing the crown, whilst his colleague invaded Normandy. Both the confederates were completely unsuccessful. John, by circulating false reports of his brother's death, attempted to give a gloss of right to his projected usurpation; but his duplicity was too well known, and his armament of foreign mercenaries was repulsed from the coast.

The negociations for Richard's liberation ended at last in the agreement that a ransom of one hundred thousand marks of silver should be paid for it. It was in vain that his mortal enemies, Philip and John, protracted his imprisonment. By a general tax the sum was raised; and soon after his emancipation he set out for England, where he arrived on the 13th of March 1194. The remainder of his reign is very unimportant; it was chiefly occupied with a species of petty bickerings with Philip of France. The money required for the crusade, and the ransom of Richard, had so exhausted the finances of England, that the king found himself unable to undertake war upon a grand scale. If we contemplate the character of the individual who found himself thus fettered by pecuniary necessities, this was a fortunate circumstance. It would be difficult to estimate the amount of human misery which was thus saved. After various undecisive battles and equivocal victories, Richard was mortally wounded before Chaluze, an obscure castle in the province of Limousin, held by a rebellious vassal, and expired on the 6th of April 1199, in the forty-second year of his age and the tenth of his reign.

Thus perished, in the prime of life, one of the most romantic characters to be met with in real history.[1] His character we have already given; and with respect to his reign, we cannot discover anything in which it added to the civilization or prosperity of the country. For the immense sums of money which he drew from it, the only

[1] The lines which Dr Johnson applies to Charles XII. of Sweden are literally true of Richard Cœur-de-Lion of England

His fate was destined to a foreign strand,
A petty fortress, and a dubious hand;—
He left a name at which the world grows pale,
To point a moral or adorn a tale.

History. 1199. return worthy of notice was an equalization of weights and measures throughout the realm.

John, the brother of the late king, and the youngest legitimate son of Henry II., succeeded to the throne without opposition; for, although the hereditary right, according to the modern acceptation of the term, was vested in his nephew Arthur, son of John's elder brother Geoffrey, the uncle had likewise a hereditary claim, as being nearest of kin to the deceased monarch, and the nation declared in his favour. His coronation took place on the 27th of May 1199. The character of John is perhaps more strongly marked, and possesses more individuality, than that of any other monarch on the list of English kings. In cowardly villany, in perfidious malignity, in base ingratitude, in unprincipled cruelty, in grossness of appetite, in meanness, weakness, and every vicious infirmity, this prince figures in the page of history almost without a rival. Other kings there may have been whose vices are black enough to call forth the execrations of posterity; but the halo of talent which emblazons their names serves to mitigate the severity of censure. John, however, stands before us utterly divested of any such quality; his character is unredeemed by one solitary virtue; his reign is unillustrated by one solitary good action performed without compulsion. He is altogether alone, the lowest and most abject slave that ever wore a crown.

Richard had destined Arthur as his successor, and, on his death, Mons, Tours, and Anjou, appointed the youth, then Earl of Bretagne, their lord. On the assumption of the crown of England and the dukedom of Normandy by John, Constance, the mother of Arthur, gave her son over to the care of Philip, king of France, who claimed for him his continental possessions. A struggle ensued between the monarchs of France and England. Philip, who, it would appear, used Arthur entirely as a tool to suit his own purposes, sent him with a military retinue into the dominions to which he laid claim. He took the town of Mirabeau, saving a tower, which held out under Eleanor, the widow of Henry II.; but on the night between the 31st of July and 1st of August 1202, John arrived, and compelled the besiegers to surrender. The prisoners were treated with a cruelty truly demoniacal, and worthy of the man; but this was only the opening scene of the tragedy. Prince Arthur was brought to Falaise, where he was confined for some time. He then all of a sudden disappeared, and contemporary history has ascribed to John the guilt of his murder. That the hapless youth met with a violent death is evident, and that he fell either by his uncle's own hands, or by his orders, there seems no reason to doubt. Even in that semi-barbarous age, there was scarcely an individual capable of committing such an atrocity, excepting the wretch who, a few years afterwards, took a diabolical pleasure in starving to death the wife and children of a nobleman who had offended him, and hanging twenty-eight Welsh hostages, besides other atrocities too horrible to be named.

By this foul deed, a third part of John's dominions were wrenched from his grasp. Philip Augustus summoned John, as duke of Normandy and Aquitaine, to answer before a court of peers to the charge of having murdered Arthur duke of Brittany. But he dreaded the tribunal, and having refused to appear, he was branded as a murderer, condemned to death, and adjudged to lose all his French territories. The king of France moved onwards from conquest to conquest, and one by one the provinces of the English monarch were seized and annexed to the dominions of Philip; Touraine, Maine, and Anjou in 1203, the duchy of Normandy in 1205, and the county of Poitou in 1206.

Another important event in the reign of John was his contest with the pope, the only contest indeed in which he ever displayed any thing of that spirit which had fired the bosoms of his ancestors. The clergy had for some time acted as a community independent of the civil power, owning subjection to the pope alone, by whom their elections were usually confirmed. The election of the Archbishop of Canterbury had been a subject of contention between the suffragan bishops of the province, and the monks of St Augustin's Abbey in that city. Each party claimed the right of choosing; but under this question was concealed the more important one, whether the king or the pope had the power of nomination; for the bishops were accessible to the influence of the crown, and the monks, in consistency with the genius of their order, were biassed by Rome. In the mean time the archbishop died, and the monks privately elected Reginald their superior in his room. The bishops remonstrated against this as an innovation on their privileges; and the king took part in the contest, with the resolution of raising the Bishop of Norwich to the primacy. The cause was appealed to Rome; and Pope Innocent III., eager to extend his power in England, commanded the election of Stephen Langton, a most unexceptionable individual, and one who, in the sequel, proved himself eminently worthy of the highest station. John, however, incensed at this proceeding, violently expelled the monks from their convent, took possession of it himself, and seized upon the revenues. The tiara, however, was not to be thus contemptuously treated. An interdict was threatened, unless compliance with the wishes of the papal court was immediately yielded. In vain the prelates in the most supplicating manner entreated the king to give his consent to the measure. With that stoical indifference to human suffering which he uniformly evinced, he determined that both himself and the nation should brave the vengeance of Rome. He swore that if it descended upon him, he would banish the whole clergy, and confiscate their possessions. The pope, however, laughed his menaces to scorn, and published that terrible interdict, which in those ages was calculated to make the heart of a nation tremble. A stop was immediately put to divine service, and the administration of all the rites of religion except baptism, and the confession, absolution, and extreme unction to the dying. The church-doors were shut, and the images of the saints deposed. The dead were refused Christian burial, and thrown promiscuously into ditches and on the highways, without any funeral solemnity. Other injunctions, equally severe, were included in this formidable interdict; and John, in revenge, persecuted the clergy with unsparing rigour. But his furious and imprudent efforts proved useless. Innocent remained firm, and, in two years thereafter, 1209, launched his last thunderbolt at the English monarch. He excommunicated John, absolved his subjects from their oath of allegiance, and soon afterwards deposed him. He also commissioned the king of France to take his crown; and published a crusade all over Christendom against King John, exhorting the chivalry of Europe to take up arms against him, and enlist under the French banner. Philip was not less active on his part. He summoned all the vassals of the crown to attend him at Rouen; and having collected a fleet of 1700 vessels, was ready in 1213 to invade England.

History. 1213.

But the fulminations of the pope were alike disregarded by John and his subjects, who had now become familiar with them. His strength does not appear to have been lessened, for the only successful expeditions of his reign, those against Ireland and Wales, were undertaken during the period of his proscription by the see of Rome. In order to meet the king of France, he assembled a vast army; but it was not the interest of his holiness to allow matters

History. 1213. to be carried to extremities. He accordingly sent over two legates, Pandulf and Durand, who, in a meeting of parliament holden at Northampton, ventured to declare to John that he was bound to obey the holy see as much in temporal as in spiritual affairs. After shuffling, according to custom, John, at the head of an army capable of bidding defiance to any invader, surrendered himself to the will of the pope, and acceded to all the terms which Pandulf had exacted. With a meanness of spirit almost exceeding belief, he laid his crown at the feet of the haughty legate, resigned England and Ireland into the hands of the pope, swore homage to him as his liege lord, and took an oath of fealty to his successors. The terms of this remarkable oath deserve a place in every history.

"I John, by the grace of God king of England and lord of Ireland, in order to expiate my sins, from my own free will and the advice of my barons, *give* to the church of Rome, to Pope Innocent and his successors, the kingdom of England, and all other prerogatives of my crown. I will hereafter hold them as the pope's vassal. I will be faithful to God, to the church of Rome, to the pope *my master*, and to his successors legitimately elected. I promise to pay him a tribute of 1000 merks; to wit, 700 for the kingdom of England, and 300 for the kingdom of Ireland." This memorable submission took place on the 15th of May 1213.

This oath was taken by the king before all the people, kneeling, and with his hands held up between those of the legate. Having then agreed to install Langton in the primacy, he received the crown which he had been supposed to have forfeited; whilst the legate, to add to his former insolence, trampled under his feet the tribute which John had consented to pay, but afterwards stooped to gather it up. The king of France was enraged at this behaviour of the pope, and resolved to execute his project of conquering England in spite of him and his censures. His fleet, however, was attacked in their harbours by the English, who took three hundred vessels, and destroyed about a hundred more; whilst Philip, finding it impossible to prevent the rest from falling into the hands of the enemy, set fire to them himself, and thus abandoned the enterprise. This naval action is memorable as being the first which took place between the fleets of France and England, and was a good omen for the latter.

John being thus delivered from all danger, continued to follow the same cruel and tyrannical measures which had hitherto rendered him odious to his subjects. His scandalous subjection to the clergy now gave the barons an opportunity of exerting themselves, in order to reduce the enormous prerogatives of the crown. Their designs were greatly facilitated by the concurrence of Langton the primate, who on all occasions showed a sincere regard for the interests of the kingdom. At a synod of his prelates and clergy, convened in St Paul's on pretence of examining into the losses of some bishops who had been exiled by John, he privately conferred with a number of barons, to whom he expatiated upon the vices and injustice of their sovereign. He showed them a copy of Henry I.'s charter, the only one in the kingdom, having been found amidst the rubbish of an obscure monastery. Langton exhorted the barons to insist on a renewal thereof; and this they solemnly swore to perform. The same agreement was afterwards renewed at a more numerous meeting of barons summoned by Langton at St Edmondsbury. Here it was resolved that at Christmas they should prefer their common petition in a body, and in the mean time they separated, intending to put themselves in a posture of defence, to enlist men, and to make other warlike preparations. In the beginning of January 1215 they repaired to London, accoutred in the military garb and with their equipage, and presented their petition to the king, alleging that he had promised to grant a confirmation of the laws of Edward the Confessor, at the time when he was absolved from his excommunication. John resented their presumption; and required a promise under their hands and seals that they would never demand or attempt to extort such privileges in future. But this they refused with such unanimity and resolution, that the king desired time to consider of their petition; at the same time promising that, at the festival of Easter, he would give a positive answer. He also offered securities, which the barons accepted, and thereafter withdrew. History. 1215.

John, however, had no intention of complying with their demands, for it is evident that his promise was extorted from him by fear. He had recourse to the clergy, whose favour he propitiated by promising many things which he had not the slightest intention of ever performing. The pope was likewise appealed to, who threw the weight of his authority into the scale of his vassal, and exhorted the barons to abandon their treasonable enterprise. At the same time his holiness also agreed to consider their petition, and to endeavour to obtain for them the concession of those demands which appeared to be just. But, happily for English liberty, the confederates disregarded the injunctions of Innocent III., who by his decision had now more embroiled the fray. Both parties gave up all hopes of a peaceful negociation at the ensuing festival, and made the best preparations they could for war, in which the barons had an unequivocal superiority.

After waiting until Easter, when the king promised to return them an answer, they met by agreement at Stamford. There they assembled a force of above two thousand knights, with a prodigious number of foot, and thence marched to Brackley, about fifteen miles from Oxford, then the court residence. John, hearing of their approach, sent the Archbishop of Canterbury, the Earl of Pembroke, and others of his council, to know the particulars of their request, and what those liberties were which they so much importuned him to grant. The barons delivered a schedule containing the chief articles of their demands, founded on the charters of Henry and Edward, but which were in the highest degree displeasing to the king. He burst into a furious passion, and, asking the barons why they did not also demand his kingdom, swore that he would never comply with such exorbitant requests. The confederates then as their general chose Robert Fitzwalter, whom they dignified with the title of Mareschal of the army of God and of the holy church. They laid siege to Northampton, but were repulsed; they, however, took Bedford, and were joyfully received into London.

The concurrence of the metropolis proved decisive of the contest. It was in vain that the pope fulminated a bull in favour of his vassal John; the many were unanimous, and the few were compelled to yield the point. The king, with a court now reduced to seven attendants, retired to Odiham, where, seeing the necessity of submitting, he agreed to a friendly conference. The barons named, as a proper place for meeting, Runnymede. It was a meadow situated between Staines and Windsor, and, like the holy ground of the Hebrews, it is still held in veneration as the spot where the standard of English freedom was first unfurled. On the 15th of June 1215, both parties met there; and having taken up separate stations, a long discussion ensued, which terminated in the king signing the charter, called, by way of pre-eminence, Magna Charta. For a particular account of the great charter, which for centuries afterwards was looked upon as the palladium of our national freedom, the reader is referred to the article MAGNA CHARTA.

This charter, however, at the time when it was granted,

History. 1215. secured liberty to the clergy, the barons, and the gentlemen, much more than to the bulk of the people, who did not for a long time obtain any privileges of importance. Freedom of elections was secured to the clergy; and it was determined that fines imposed on them for any offence should be laid on in proportion to their estates, and not the value of their benefices. The privileges secured to the barons were, either abatements in the rigour of the feudal laws, or relief from arbitrary and ambiguous decisions before the courts. It was also decreed that barons should recover the lands of their vassals, even though forfeited by felony, after having been in the possession of the crown for a year and a day; and no tax was to be imposed without consent of the great council of the nation, excepting in case of the captivity of the king, the knighting of his eldest son, or the marriage of his eldest daughter. No land belonging to any baron was to be seized for a crown debt, except when the possessor had not personal property enough to pay it; neither was any vassal to be allowed to sell so much of his land as to incapacitate him from performing the necessary service to his lord. It was also determined, that when the great council of the nation was called, the prelates, earls, and barons should be summoned by a particular writ, and that the lesser barons should receive a summons from the sheriff. In favour of the people it was stipulated, that they should receive from the barons all the immunities and privileges granted by the king to the former. Merchants were to be allowed to carry on their business without any arbitrary tolls or impositions, and to go out of the kingdom and return at pleasure. The goods of every freeman were to be disposed of according to his will; or if he died intestate, the nearest heir was in that case to succeed him. No carts, horses, or wood were to be taken by the crown officers without the consent of the owner. The king's courts were to be stationary; no delay was to take place in doing justice to every one; and no freeman was to be taken or imprisoned, dispossessed of his free tenement, outlawed, or banished, unless by the legal judgment of his peers. It was likewise stipulated that London should remain in the hands of the barons, and that the Tower should be consigned to the primate, till the 15th of August following, or till the articles contained in the charter were fulfilled. In order to secure the accomplishment of this, the king allowed them to choose twenty-five of their own number, to whose authority no limits were assigned. If any complaint were made of a violation of the charter, either by the king or his officers, any four of the barons might admonish the king to redress the grievance; and if satisfaction were not obtained, they might assemble the whole council of twenty-five and, in conjunction with the great council, compel him to fulfil the charter. In case of his resistance, they had liberty to levy war against him, attack his castles, and use every kind of violence, except against his person, or those of his queen or children. All men throughout the kingdom were bound, under the penalty of confiscation, to swear obedience to the twenty-five barons; and the freeholders of each county were to choose twelve knights, whose business it was to report such obnoxious customs as ought to be redressed in terms of Magna Charta.

But although John had thus been obliged to recognise the liberty of his subjects, he had no mind that they should in reality enjoy it. The sense of his subjection to his own vassals sunk deep into his soul, and he became sullen, silent, and reserved. He shunned the society of his former friends, and retired into the Isle of Wight, as if to hide his disgrace in solitude, but, in reality, to meditate plans of revenge. He sent to the Continent in order to enlist a large body of mercenary troops, and made heavy complaints to the pope on account of the insurrections of the barons against him. The pontiff, as might be expected, warmly espoused his cause; a bull was sent over annulling the whole charter; the principal barons were excommunicated by name, and declared to be worse than Saracens; and at the same time the foreign troops arriving, the king once more found himself in a condition to demand his own terms from his untractable subjects. History. 1216.

The barons had made no preparations for war, not suspecting the introduction of a foreign army. The king, therefore, was for some time undisputed master of the field, and the most horrid cruelties were committed by his army. The nobility who had been most active in procuring the great charter accordingly fled with their families to Scotland, where they obtained the protection of King Alexander by doing homage to him. The barons, finding themselves totally unable to raise an army capable of contending with that of John, resorted to the equivocal and perilous expedient of calling in foreign aid. They applied to their old enemy Philip of France, offering the crown to his eldest son Louis, upon the condition of their being protected from the fury of John, and the unprincipled mercenaries whom he commanded. The French king eagerly accepted their proposals, and dispatched his son with a powerful army to England. He was received by the barons with great acclamations, and having united their forces, they secured all the southern counties. Essex and Sussex were soon after added; and they advanced successfully into Norfolk, spreading around them all the devastations of civil war. The forces of John occupied the northern districts, where the king of Scotland harassed him by an invasion of Northumberland. But these hostilities, which might ultimately have ruined the independence of the country, by sinking it to the level of a French province, were happily terminated by the death of John, in the forty-ninth year of his age, and seventeenth of his reign. His demise took place at Newark, on the 19th of October 1216. The death of this monarch was as much a public blessing as his reign had been a national misfortune. The signing of Magna Charta is the only event of his life which is worthy of being recorded in history. He, however, deserves no credit for that act, which was the result of compulsion. As well might we consider honesty the actuating principle or motive of the malefactor who consents to deliver up the treasure of which he had possessed himself, when he comes in sight of the wheel upon which, in case of refusal, he is to be broken alive.

John left six legitimate children, namely, three sons and three daughters. The eldest of the former, Henry of Winchester, was only ten years of age when he found himself in possession of the title, although not entirely of the power, of king. He was crowned as Henry III. upon the 28th of October 1216, nine days after he succeeded to the inchoate right to the throne. The care of his person was entrusted to the Earl of Pembroke, earl-marshal, with the style and title of guardian of the kingdom. Through the instrumentality of this nobleman the great charter of liberties was revived, and the claims of the crown were reconciled with those of the subject, to the satisfaction of the adverse barons. Besides the eldest son of John, there was another competitor for the crown, namely, Louis of France, who had been called over by the barons of Runnymede, in order to take possession of the English throne. For some time Louis kept the field, and not without success; but he was defeated at Lincoln; and a fleet which his father had sent to him with succours having been totally destroyed by the English, he was compelled to abandon the enterprise, and to make an honourable retreat.

A peaceful king is looked upon either as imbecile or as pusillanimous by an age which feels the intoxication of military glory, and considers the principal duties of a mo-

narch to be "to go out and in before his people, and fight their battles." The reign of Henry III. is but little adorned with the triumphs of war; and, if we are not mistaken, it has been too much depreciated on this account. But this fact, as well as his monarchical character, we will be enabled to ascertain with more certainty after we have passed in review the principal events of his reign. Its early history exhibits only some of those evils incident to an injudicious, but not, strictly speaking, wicked administration. In 1225 the great charter was a third time confirmed, upon the occasion of Henry assembling a great council, and urgently demanding aid against a pretended invasion of the French. In consequence of this, it has ever since retained its place at the head of English statutes. The wardship of the young king had now solely devolved upon Hubert de Burgh, the grand justiciary, and a man of ability and spirit, but nurtured under Richard and John. For several years he ruled as the favourite without control, repressing the disorders of the times with a vigorous, but, in the eye of an enlightened age, cruel policy. In 1227, Henry was declared in parliament to have attained to the years of discretion; and two years afterwards he resumed the project of conquering France, and landed there with a considerable army. The expedition proved most disgraceful to the English arms; and in a year after he returned to his country not a little humbled in its estimation, as well as his own. The next event of importance which we meet with is the disgrace of De Burgh, who was accused of negligence and treachery in the discharge of his duties; with what degree of truth it is difficult now to determine. He was imprisoned for some time, but afterwards restored to liberty, honours, and emoluments.

In 1236, Henry espoused Eleanor of Provence. This event gave rise to a new immigration of foreigners of higher rank and more specious pretensions than those who usually flocked to the soil of England. One of the queen's uncles became prime minister, a second was made primate, and a third Earl of Richmond. This favouritism excited much discontent both amongst the native barons and the people. The other events of this long reign consist of petty wars and bickerings with France, Scotland, and Wales. The prodigality of the king was extreme, and he was repeatedly compelled to lay his necessities before parliament and solicit supplies. These were as often afforded; but notwithstanding these grants, he had frequent recourse, under specious pretexts, to the most unjust exactions. Meanwhile England rapidly increased in wealth, and widely extended her commercial relations with other countries.

In the year 1254, at the instance of the pope, Henry accepted of the crown of Sicily for his son Edmund. It had been formerly offered to his brother Richard, who was wise enough not to accept of it, probably because he felt himself unable to compete with the other powerful princes who aspired to it. In order to raise the money necessary to carry his foolish project into execution, Henry had recourse to every expedient which the regal or papal ministers could devise. The principal burden fell upon the clergy, who, by the menace of excommunication on the one side, and of forfeiture on the other, were compelled to submit. This oppression widened more and more the breach between the king and his people; and he found it necessary at last to look to the security of his own crown, instead of fighting for a foreign diadem to grace the brow of his son.

Amongst the foreigners of distinction who established themselves in England during the reign of Henry III. was Simon de Montfort, earl of Leicester. He was the younger son of the Count de Montfort, celebrated in the annals of religious warfare for his cruel crusade against those dissenters from the Roman faith called Albigois or Albigenses. Simon the younger received the hand of King Henry's sister in marriage, and very early began to act a conspicuous part in the civil commotions which agitated the country. He was a bold and ambitious man; and placing himself at the head of the disaffected barons, he formed a powerful confederacy against the king. In the year 1258, a famous parliament was summoned at Oxford, in order to digest the new plan of government, and to elect to the chief authority such individuals as were deemed worthy of trust. This assembly, afterwards celebrated in our annals by the derisive name of the *mad parliament*, went very expeditiously to work in the business of reformation. Twenty-four barons were appointed, with supreme authority, in order to reform the abuses of the state; and Leicester was placed at their head. Twelve of these barons were chosen by the king's council, and twelve by the parliament. Their first step was to order four knights to be chosen out of each county, who should examine into the state of their respective constituents, and attend at the ensuing parliament to give information of their complaints. They ordained that three sessions of parliament should be regularly held every year; that a new high sheriff should be elected annually; that no wards nor castles should be entrusted to foreigners, no new forests made, nor the revenues of any counties farmed out. Thus far these provisions were good, and an approximation to popular representation, although some modern writers have designated the whole transaction as a revolution.

The twenty-four barons continued to conduct the affairs of government for several years; but they at last began to quarrel amongst themselves. The Earls of Gloucester and Leicester pursued opposite interests, and formed opposite parties, who eyed each other with mutual jealousy. Leicester, perceiving that his rival was likely to gain the ascendency, retired to France; but the balance was again restored in his favour by the union of Prince Edward with his friends. A short time after this event, the rival parties seem to have assumed, if not the reality, at least the appearance of unanimity. In 1262, Henry made a fruitless attempt to escape from the authority of the barons; but his son Edward remained firm to their cause, on account of his having sworn to observe the provisions of Oxford. After other ineffectual attempts upon the part of the king, he agreed that the twenty-four noblemen should continue to govern, not only during his own reign, but also during that of his successor. By this stipulation, Edward joined his father, which restored vigour to the royalists, and more equally balanced the power of the parties. It was proposed that the differences between them should be submitted for arbitration to Louis IX., and both swore to abide by his decision. That excellent monarch enjoined the restoration of all castles, possessions, and royal rights enjoyed by the crown before the parliament of Oxford, upon condition of universal amnesty, and of the full enjoyment of all the privileges and liberties granted by the charter. The award was confirmed by the pope, who empowered the Archbishop of Canterbury to excommunicate all who refused to submit to it.

The moment the decision was made known to the barons, they declared it to be contrary to truth and justice, and immediately took the field. The contest was at first favourable to the royal prerogative; but in 1264 Prince Edward lost a great battle by his impetuosity in pursuing too far one of the wings of the enemy's army, which he had defeated. His father and uncle were taken prisoners, and placed in the castle of Lewis, where he contrived to join them. They acceded to the propositions submitted to them, and the administration of the kingdom fell into the hands of the Earls of Gloucester and Leicester, and the Bishop of Chichester.

History. 1265.

The situation to which the kingdom was now reduced proved at last the means of settling the government upon a more proper foundation. Leicester, in order to secure himself, was obliged to have recourse to an aid, till now entirely unknown in England, namely, that of the body of the people. He called a parliament, where, besides the barons of his own party, and several ecclesiastics who were not properly tenants of the crown, he ordered returns to be made of two knights from every shire; and also deputies from the boroughs, which had been hitherto considered as too inconsiderable to be allowed any share in the legislation. This parliament was called on the 22d of January 1265; and here we find the first outline of an English House of Commons; an institution which has ever since been considered, and justly, as the bulwark of British liberty.

The new parliament was far from being so compliant to Leicester as he had desired or expected. Many of the barons who had hitherto stedfastly adhered to his party were disgusted with his boundless ambition; and the people, who found that a change of masters was not a change of circumstances, began to wish for the re-establishment of royal authority. Leicester at last, making a virtue of necessity, released Prince Edward from his confinement, and had him introduced at Westminster-hall, where his freedom was confirmed by the unanimous voice of the barons. But though Leicester had all the popularity of restoring the prince, he was yet politic enough to keep a strict watch over him. Edward was nominally free, but in reality a prisoner. At last, however, he found means to effect his escape. The Duke of Gloucester, being disgusted with Leicester, left the court, and retired to his estates upon the borders of Wales. His antagonist pursued him thither, and, in order to give the greater authority to his arms, carried the king and Prince Edward along with him. This afforded young Edward an opportunity which he had long desired of making his escape. Being furnished by the Earl of Gloucester with a horse of extraordinary speed, he took leave of his attendants, or rather his guards, under pretence of trying the mettle of his steed. He was hotly followed; but an end was put to the pursuit by the appearance of some of Gloucester's troops.

No sooner was the prince at liberty than the royalists joined him from all quarters, and an army was soon assembled which proved more than sufficient to meet the forces of Leicester. The latter now found himself in a remote quarter of the kingdom, surrounded by his enemies, and shut out from all communication with his friends by the river Severn, the bridges on which Edward had broken down. In this extremity he wrote to his son to hasten to his assistance from London, with a considerable body of troops which the latter had under his command. With this view his son advanced to Kenilworth; but here he was surprised by Prince Edward, and the greater portion of his followers were made prisoners. The young prince immediately advanced upon Leicester himself, whose last anchor had given way with the defeat of his son. He was by no means able to cope with the royalists; his men were inferior both in numbers and resolution to their antagonists. In the battle which ensued, the royalists gained a signal victory over their opponents, defeating them with great slaughter. Leicester himself was slain, together with his eldest son Henry, and about a hundred and sixty knights and other gentlemen. The body of the fallen earl was mutilated in a frightful manner, and portions of it sent to various places. His memory was long revered by the people, who looked upon him as a martyr to the liberties of the realm. But a vigorous reign ensued, and the national feeling was suppressed, or directed to other objects. He left, however, an imperishable name, as the first who had called together a parliament of which the lower house composed part.

History. 1286.

The victory of Evesham restored the fortunes of the royalists. The followers of Leicester were proscribed, and their lands distributed amongst the victors. With the death of Montfort the spirit departed from the baronial party, whose members hastened to give in their submission, and to open the gates of their castles to the king. Several places, however, still held out; but by the activity and valour of Prince Edward they were all finally reduced. The country submitted, and the royal authority was completely re-established throughout the realm. The good sense of Edward, however, infused a wiser and more popular spirit into the conduct of government. So judicious appears to have been his administration, indeed, that, in a few years after the battle of Evesham, he felt himself in a capacity to take the cross, and enlist under the banners of the crusaders. This step of the heir apparent to the crown of England may appear somewhat extraordinary, when we consider the advanced period of life to which his father had now attained, and the civil commotions from which he had so recently emerged. But in an age when it was common to ascribe any sudden transition of fortune from one extreme to another, to the immediate interposition of providence, it is less to be wondered at. The recent deliverance of himself and his father from their enemies had incurred a debt of gratitude to heaven which it was now his desire to pay off. His expedition to the Holy Land was of little importance, and was moreover in no way connected with the history of his country, although it was distinguished by those romantic adventures and chivalrous feats of arms peculiar to the age, and more especially to the wars in Palestine.

The remaining events of Henry III.'s reign afford no materials for history. He died on the 16th of November 1272, in the fifty-seventh year of his reign. The character of Henry is not strongly marked either by good or by evil. During its long continuance we see no premeditated crime, no deep laid plot involving the liberties of his subjects, with which to impeach his memory. The evils which grew and prospered whilst he held the sceptre did not arise from vices in the sovereign, but from the unsettled state of society and the turbulent spirit of the times. His virtues, however, were not very conspicuous; they were rather of a passive than of an active kind; rather the negative of vice than positive moral greatness. With regard to intellect, he appears to have been below mediocrity; and it is usual with historians to describe him as deficient in capacity to govern. This was probably the case, but it was productive of inconvenience to himself rather than misery to his subjects. Under his pacific rule, as we have already observed, the nation grew more rapidly in wealth and prosperity than it did under the more dazzling sway of his military progenitors.

Edward, upon hearing the news of his father's death, and feeling himself secure of the throne, returned slowly from the Holy Land. He arrived in England in August 1274, and was crowned at Westminster on the 19th of the same month. Two years afterwards he undertook an expedition against Lewellyn, prince of Wales, who had refused to do homage for his crown. The conquest of that country cost him some trouble, and was not completed until the year 1283. After this period the principality of Wales was annexed to the crown of England, and thenceforth conferred a title upon the king's eldest son. In 1286, Wales had been so entirely broken into subjection, that Edward undertook a journey to the Continent for the purpose of mediating a peace between Alonzo of Aragon and Philip the Fair of France. These two monarchs had differed

History. 1286.

about the kingdom of Sicily: but a negociation was effected, and the king of England returned to his country after an absence of three years, during which period much disorder had been introduced into his dominions. Robbery and violence had become frightfully prevalent, and the corruption of the judges had poisoned the fountains of justice. In order to remedy these evils, Edward summoned a parliament, and cited the delinquents to appear and take their trial. All of them, except two clergymen, having been convicted of flagrant acts of corruption and bribery, were accordingly fined, and deposed from their office.

The next great event of Edward's reign was an attempt to subjugate Scotland. This he never altogether effected, although he succeeded in reducing the country to great distress, and in even nominally attaching it to the English crown as a conquered province. For an account of these transactions, see the article SCOTLAND. Edward was at the same time engaged in expensive contests with France; and these multiplied wars, by obliging him to have frequent recourse to parliamentary supplies, became the remote causes of great and important changes in the government. The parliament was modelled into the form which it has ever since retained. As a great part of the property of the kingdom, by the introduction of commerce and by improvements in agriculture, was transferred from the barons to the lower classes of the people, so their consent was thought necessary in order to raise the supplies. For this reason the king issued writs to the sheriffs, enjoining them to send to parliament, along with two knights of the shire, two deputies from each borough within their county; and these, too, provided with sufficient powers from their constituents to grant such demands as they should think reasonable for the safety of the state. The charges of these deputies were to be borne by the boroughs which sent them; and so far were they from considering this deputation as an honour, that nothing could be more displeasing to any borough than to be thus obliged to send a deputy, or to any individual than to be thus chosen. The authority of these commoners, however, increased in course of time. Their union gave them weight; and it became customary among them, in return for the supplies which they granted, to prefer petitions to the crown for the redress of grievances. The more the king's necessities increased, the more he found it necessary to give them an early hearing, until, from requesting, the commons proceeded to demanding; and having all the property of the nation, they by degrees began also to be possessed of a considerable share of the power.

Edward I. died of a dysentery, near Carlisle, on the 7th of July 1307, as he was leading a great army into Scotland, against the inhabitants of which he had vowed the most dreadful vengeance. Edward ranks amongst the greatest monarchs of England. In military talents, in sound judgment, in vigour, decision, irascibility, and vindictiveness, he bore some resemblance to the Conqueror. Like him too he possessed an unsatiable ambition, and his unholy crusade against the independence of Scotland must be regarded as an indelible blot upon his memory. He was succeeded by the eldest of his surviving sons, who bore his father's name, but inherited nothing of his capacity, and who was crowned on the 8th of July 1307, with great magnificence. His father had charged him upon his death-bed to prosecute the war against Scotland until he had finally subdued the kingdom; but war had few attractions for Edward II., and he withdrew his army ingloriously from the country which his father went to subjugate. The first years of Edward's reign are distinguished for nothing but bickerings with his barons, who finally extorted from him a reformation of abuses in full parliament. The Scots in the mean time gradually recovered their power; and Edward having invaded their country with a prodigious force, was met by Robert Bruce at Bannockburn, near Stirling, who totally defeated the puissant army of the English on the 24th of June 1314. See SCOTLAND.

History. 1326.

The reign of Edward II. was one continued series of quarrels with his turbulent subjects. His favourites were the most general causes of discontent. The first of these was one Pierce Gaveston, the son of a Gascon knight of some distinction. The latter had honourably served the late king, and, in reward for his services, had obtained an establishment for his son in the family of the Prince of Wales. To be the favourite of any king whatsoever is no doubt in itself a sufficient offence to the rest of the courtiers. Numberless faults were therefore found with Gaveston by the English barons. When the king went over to France to espouse the Princess Isabella, to whom he had been long contracted, Gaveston was left guardian of the realm, with more ample powers than had usually been conferred in such cases. But upon the arrival of the queen, who was of an imperious and intriguing spirit, Gaveston had the misfortune to fall under her displeasure, on account of the ascendency he had acquired over the king. A conspiracy was soon formed against the favourite, at the head of which was the queen and the Earl of Lancaster, a relation of the king's, and the most powerful nobleman in England. Edward found himself unable to protect his favourite against such a formidable combination, and was compelled to banish him. His recall some time afterwards again spread alarm over the country, and kindled a civil war. The nobility were successful in obtaining possession of the obnoxious Gaveston; and, in order to free themselves for ever from uneasiness on his account, they put him to death.

After the defeat of Bannockburn, King Edward chose a new favourite named Hugh le Despencer. He was a young man of a noble English family, and possessed some merit, and engaging accomplishments. His father was a person of apparently unimpeachable character, but he also enjoyed the king's favour, and that was a sufficient crime. The king imprudently dispossessed some lords of their estates, in order to bestow them upon young Despencer. This afforded a sufficient pretext to the barons for openly attacking both the father and son. The Earls of Lancaster and Mortimer, chief of the Welsh marshes, flew to arms; and sentence of perpetual exile against the two Spencers, with a forfeiture of all their estates, was procured from parliament. At last the king took the field, and obtained a signal victory over the other party at Boroughbridge. The Earl of Lancaster was made prisoner, and beheaded a few days afterwards at his own castle of Pomfret. This individual was canonized in 1389. Many other noblemen suffered the same punishment without having the same respect paid to their memory, whilst Mortimer was condemned to perpetual imprisonment.

The triumph of the Spencers was now complete; but the partiality with which the king regarded his two favourites had the effect of alienating not only the affections of his subjects, but also those of his queen. Other charges are brought against Edward as having contributed to effect this estrangement, and Isabella sought an opportunity of escaping from her husband. The palace of her brother at Paris was her natural place of refuge. A rupture having commenced between England and France, the queen proceeded to the court of the latter as negociator, and concluded a peace humiliating to her husband. But she had another object in view in visiting her native country. Her residence became a sanctuary for the English malcontents, who flocked to her in great numbers; and

History. 1326.

amongst these came Mortimer, who had contrived to effect his escape, and for whom she has been charged with entertaining a stronger passion than that of friendship. The cause of quarrel between the two powers was the county of Guienne, for which the monarch of France required Edward to do homage and fealty. The disputed territory was resigned to the young Prince of Wales, who joined his mother, and made the necessary submissions. When Isabella considered that matters were sufficiently matured for executing her purpose, she landed in England on the 22d of September 1326, where she was universally welcomed, and immediately joined by the most potent barons. The unfortunate king found that the spirit of disloyalty had spread over the whole kingdom. Some dependence was placed upon the garrison of Bristol, which was commanded by the elder Spencer; but the soldiers rebelled against their governor, and delivered him into the hands of the barons, by whom he was cruelly put to death. Young Spencer did not long survive his father. Along with some others who had followed the fortunes of the wretched king, he was made prisoner in an obscure convent in Wales; and the queen having no patience to wait the formality of a trial, gave orders for his immediate execution.

In the mean time the king was discovered and delivered up to his adversaries, who loaded him with insults. He was conducted to the capital, and consigned to the Tower. The charge against him exhibited no other crimes than his incapacity to govern, his indolence, his love of pleasure, and his accessibility to evil counsel. His deposition was quickly voted by parliament; he was assigned a pension for his support; his son Edward, a youth of fourteen, was appointed to succeed him, and the queen was nominated regent during the minority. But the deposed monarch did not long survive his disgrace. He was at first put into the custody of the Earl of Lancaster; but this nobleman having shown some marks of respect and pity for the misfortunes of his sovereign, the latter was taken out of his hands and delivered over to the Lords Berkeley, Maltravers, and Gournay, who were entrusted alternately, each for a month, with the charge of guarding him. Whilst he was in Berkeley's custody, he was still treated with some degree of humanity; but when the turn of Maltravers and Gournay came, every species of indignity was practised upon him, as if they had designed to accelerate his death by accumulating his mental sufferings. As his persecutors, however, saw that his death might not speedily arrive, even under every cruelty which ingenuity could devise, and as they were daily afraid of a revolution in his favour, they determined to put their fears to rest by destroying him at once. Mortimer, therefore, secretly gave orders to the two keepers to dispatch the king; and these ruffians contrived to render the manner of his death as barbarous as possible. Taking advantage of Berkeley's sickness, in whose custody he then was, and who was thereby incapacitated from attending to his charge, they came to Berkeley Castle, and obtained possession of the king's person. They threw him on a bed, and held him down with a table which they had placed over him. They then ran a horn pipe into his bowels, through which they conveyed a red-hot iron; and thus deprived him of life without disfiguring his body. The murderers fled on the perpetration of this horrible enormity; for the dying agonies of the king created suspicions which ended in the discovery of the crime. One of the fugitives was taken at Marseilles, and beheaded on his way to England. The other concealed himself for some years in Germany; but having found means of rendering some services to Edward III. he ventured to approach the person of that monarch, and by his humiliating submission received a pardon.

History. 1327.

By the death of Edward II. the government fell entirely into the hands of the queen and Mortimer, who had now the disgraceful pre-eminence of royal paramour. The parliament, which had raised young Edward to the throne, had indeed appointed twelve persons as his privy council, to direct the operations of government. Mortimer excluded himself, under a show of moderation; but at the same time secretly influenced all the measures which came under their deliberation. As this influence began very soon to be perceived, and the queen's criminal attachment to Mortimer was universally known, the administration soon became obnoxious to the people. It had continued four years, when a circumstance occurred which added greatly to its unpopularity. The Scots having made an irruption into England, were met by an overwhelming force under young Edward, or rather Mortimer. The results of this mighty expedition were most ludicrous. By their superior skill and activity, the Scots foiled the English commanders, and made their escape into their own country. Soon after this inglorious campaign, a solemn treaty of peace was concluded, in which Edward, for a sum of money, renounced every claim of superiority over Scotland. This, although a commendable act of moderation, was not calculated to propitiate the favour of the English people. It was not long before another stroke of Mortimer's power and policy startled the nation from its propriety, and paved the way for his own destruction. Amongst those who began to betray indignation against the encroaching spirit of Mortimer, was Edmund earl of Kent, who, deceived into a belief that his brother Edward II. was still alive, wrote a letter to that prince, which was betrayed into the hands of Mortimer, now Earl of March, by the individual who had undertaken to deliver it. The writer of the epistle was immediately tried for high treason, condemned, and executed. There is little doubt that the whole affair of the letter was a plot laid for the destruction of Kent, not only to get him out of the way, but to show that there was no one too high not to be struck down by the vengeance of Mortimer.

Edward finding the restraint under which he was retained becoming irksome, resolved to shake it off, and to rid himself and the nation at once of an authority which had now become alike odious to both. The queen and her paramour had repaired to Nottingham, where a parliament was then held. They had chosen the castle as a place of residence, and taken every precaution to ensure their safety; for fear follows guilt like its shadow. The enemies of Mortimer, however, found means to obtain admission at dead of night; and having seized him as he lay in an apartment adjoining to that of the queen, he was taken prisoner to London, tried before his peers for various crimes, convicted, and executed.

The queen, who was perhaps the most culpable of the two, was screened from capital punishment by the dignity of her station, but stripped of all power, and confined for life to the castle of Risings. From this imprisonment she was never liberated, but during her life the king paid her an annual visit of ceremony.

Edward III. proved one of the greatest warriors who had ever sat on the English throne. His first attempts were to raise Edward Baliol to the throne of Scotland: this however he failed in effecting. But his mind now began to be diverted to loftier and more ambitious speculations. The crown of France became the object of contest between Edward, the son of Philip the Fair's daughter Isabella, and Philip of Valois, the son of the brother of Philip. The question was, whether the crown was descendible only through males, or whether it might be claimed by the nearest male although his descent was by females. Charles the Fair died in 1328, and left the crown of France with-

History. 1327.

out direct male descendants to inherit it. The three last kings were the sons of Philip the Fair, and they all reigned successively, but died without issue. According to the English law, the son of the daughter precedes the nephew in inheritance; but the French Salic law excluded females. Edward contended that the feudal laws of France forbade females to inherit who could not perform the feudal duties, yet that their male heirs were not debarred by the spirit of this law, because they were competent to discharge all the military services required. On the other hand, it was insisted by the French advocates for Philip de Valois, that the exclusion of the female in the first instance was an exclusion of all the descendants of either sex. If it had been a question of succession to the English crown, it would have been rightfully determined by the parliament and law of England; but as it concerned the crown and law of France, it was clearly a matter for the French state and lawyers to decide. They decided in favour of Philip de Valois, and he was accordingly crowned king of France. In this decision they displayed the soundest principles of national policy, and Edward ought undoubtedly to have acquiesced.[1] The king of England, however, thought otherwise, and accordingly began to make preparations for an invasion of France.

By doing homage to Philip for the duchy of Guienne, Edward gained time to collect such an army and treasure as were necessary for the enterprise. Two powerful continental allies appeared in his favour; namely, Robert of Artois, who had been excluded from the county to make way for his aunt Matilda, a nearer relative by blood to the preceding count; and James von Artaveldt, a famous brewer of Ghent, and leader of the democratical party among the Flemings. It was at the suggestion of the latter that Edward assumed the title of king of the French, as a pledge that he would pursue his undertaking with inflexibility of purpose. The king of England landed at Antwerp in July 1338; but it was not until more than a year thereafter that he reached the confines of France. His first campaign was unimportant, but in the second he achieved a considerable naval victory on the 22d of June 1340. Flushed with this success, he marched to the siege of Tournay at the head of 100,000 men. Near this town the king of France had encamped himself in a situation so strong as to bid defiance to attack. Edward challenged him to single combat, but this was refused; and the English were at last compelled to raise the siege, and to retire sullen and discontented from the place.

The efforts of Edward began now to be much crippled for want of money. The exchequer of England was unable to satisfy his demands, and his allies had become clamourous for their arrears. Some of his courtiers having instilled into his mind suspicions of the fidelity of his ministers, he suddenly returned to London, where he landed about midnight at the Tower. Next morning he displaced the chancellor, treasurer, and master of the rolls, confined three of the judges, and ordered the arrest of most of the officers employed in the collection of the revenue. Archbishop Stratford, however, boldly opposed his career of resentment and cruelty, and vindicated the cause of the ministers. The king was compelled at last to abandon his process against the primate, for the urgency of his wants admitted of no delay.

The failure of his first two campaigns did not wean Edward from his attachment to foreign alliances. By a disputed succession to the duchy of Brittany, in which he took the part of the individual who opposed Philip of France, a new road was opened up to him into that country. He collected a vast army, with which he landed near Cape la Hogue about the end of July 1346. His career in France was a series of triumphs most glorious to the English arms. On the 26th of August 1346 was fought the decisive battle of Cressy, which is still memorable after the lapse of many centuries. In this celebrated conflict, Edward the Black Prince, a youth only sixteen years of age, gained unfading laurels. The siege of Calais followed, and the place was reduced after an obstinate defence. The first fruit of the reduction of this place was a truce, which lasted till 1355, when Edward the Black Prince, who governed his father's dominions in France, undertook an expedition into the neighbouring provinces, and in the following year carried his arms into the heart of France. The victory of Poitiers was another mortifying humiliation to the French. John their king was taken prisoner, and treated with noble hospitality and respect by his renowned conqueror. He was conveyed to England, where his reception resembled rather the return of a victorious prince than the humiliation of a captive monarch. For a particular account of these and other transactions of the English in France, the reader is referred to the article France.

History. 1376.

During the absence of the king of England on the Continent, his country was harassed by the Scots, who invaded it, but experienced a defeat at Nevelles Cross. In 1355, Edward himself invaded Scotland; and the havoc caused by this expedition was long remembered by the natives. The death of Edward Baliol in 1364 left David Bruce without a rival to the Scottish throne; and the pretensions of the Plantagenets to Scotland were terminated by Edward III.'s recognition of his brother-in-law. See Scotland.

In the mean time Edward the Black Prince, after a Spanish campaign, in which he gained the celebrated battle of Navarete, returned to England in pursuit of health and quiet. But thirty years of toil and war had exhausted his robust frame, and he expired at Canterbury on the 8th of June 1376, in the forty-sixth year of his age. He left behind him a lofty reputation for bravery and skill as a commander, generosity as a knight, and wisdom and vigour as a statesman. His father Edward III. did not long survive his loss. He died on the 21st of June the year following. The reign of this monarch is generally considered by Englishmen as the most illustrious period of their ancient annals. "The victories of Cressy and Poitiers," says Mr Turner, "may have produced the popular sentiment; but the reflective mind will adopt the opinion as steadily, when it observes, during this reign, that our navy established its preponderance over the most celebrated fleets that were then accustomed to navigate the British channel; that our parliament enjoyed, in full and upright exercise, those constitutional powers which the nation has long learnt to venerate as its best inheritance, but which weaker sovereigns have too eagerly contested; that our manufactures and commerce began to exhibit an affluence and an expanding growth, and to be conducted on the true principles of public improvement; that our clergy evinced a disposition to emancipate themselves from the papal despotism, and some to exercise a just freedom of thought on the most important of all human concerns; that the lineaments of our prose literature became distinctly discernible; that the pursuit of the mathematical and natural sciences, and of the art of reasoning, at one or both of our venerable universities, was ardent and successful; that our poetry assumed the attractive form with which its life, sympathy, utility, and immortality are most surely connected; and that our manners displayed a moral sentiment, which, though somewhat fantastic, and al-

[1] Turner's *History of England*, vol. ii. p. 144.

History. 1377. ways pure, yet contributed to soften the horrors of war, and has led to that more cultivated feeling which, continually increasing and refining, has made Englishmen distinguished for their generosity, magnanimity, and honour." It may be added, on the authority of Sir Mathew Hale, that during this reign the law was greatly improved, and nearly attained its meridian. The monarch himself kept pace with the progress of the time, and his reign was sufficiently protracted to afford opportunities for the development and consolidation of all improvements. He left his country ennobled in the eyes of Europe, and possessed of gigantic energies capable of realising the glorious destinies which awaited her.

Edward III. was succeeded by Richard II. son of the beloved Black Prince. He commenced his reign, being only eleven years of age, on the 22d of June 1377, with many expressions of congratulation from his subjects. His coronation took place on the following year, and parliament was opened with a speech from the Archbishop of Canterbury, which, being "soothing and gracious," was meant to propitiate the favour of the representatives of the nation in behalf of the young sovereign. The Dukes of Lancaster, York, and Gloucester, uncles to the king, with some other noblemen, were appointed regents during Richard's minority. The war, which was still prosecuted in France on a small scale, and the expenses necessary for retaining the towns already taken, required supplies of money, which could not be raised without additional taxation; and this gave rise to much discontent amongst the people. An imposition of three groats upon each person of both sexes and every condition who had passed the age of sixteen, particularly excited the minds of the common people against the government. The manner, too, of collecting this tax, soon furnished an occasion of revolt. The insurrection began in Essex, where a report was industriously spread that the peasants were to be destroyed, their houses burned, and their farms plundered. At Dartford, an individual, well known by the name of *Wat Tyler*, was the first who excited the malcontents to arms. The tax-gatherers proceeded to this man's house whilst he was at work, and demanded payment for his daughter. He refused to comply, on the ground that she was under the age stipulated in the act; upon which one of these fellows offered to prove the contrary in a very indecent manner, and for this purpose laid hold of the maiden. Such insolence, however, roused the spirit of the father, and with one blow he laid the ruffian dead at his feet. A shout of applause burst from the bystanders, who declared themselves prepared to protect Wat from the vengeance of his enemies. The cry of the men of Kent was responded to by those of the neighbouring counties, and Wat soon found himself at the head of an enormous body of insurgents. They advanced to Blackheath in the month of May 1381, and proceeded to enforce their counsels by an attack upon London, in which they succeeded. The king, finding that resistance was vain, agreed to listen to their demands. On this they made a very humble remonstrance; requiring a general pardon, the abolition of slavery, freedom of commerce in the market-towns, and a fixed rent instead of those services required by the tenure of villenage. The king granted all these requests; and charters were made out by which the grant was ratified. In the mean time, another body of these insurgents had broken into the Tower, and murdered the chancellor, the primate, and the treasurer, with some other officers of distinction. They then divided themselves into parties, and took up their quarters in different parts of the city. At the head of one of these was Wat Tyler, who led his men into Smithfield, where he was met by the king, who invited him to a conference, under pretence of hearing and redressing his grievances. Tyler ordered his companions to retire till he should give them a signal, and boldly ventured to begin a conference with the king in the midst of his retinue. His demands were, that all slaves should be set free, that all commonages should be open to the poor as well as to the rich, and that a general pardon should be granted for the late outrages. During the interview, the rebel kept playing with his dagger, and at last he is said to have laid his hand on the bridle of his sovereign's horse; upon which Walworth, lord mayor of London, alarmed for the king, plunged a basillard in the throat of Tyler, and at the same moment another esquire dispatched him with his sword. This is the tale told by the writers of the victorious party, for the partizans of Wat Tyler had no historian to give their version of the story. The insurgents who witnessed the fall of their leader bent their bows with the design of revenging his death. But Richard, though only sixteen years of age, with admirable presence of mind galloped up to them, exclaiming, "What are you doing, my lieges? Tyler was a traitor. Follow me, and I will be your leader." With sullen and wavering discontent they followed him into the fields at Islington, where a body of troops had been collected for the protection of the young king. The insurgents were ordered to return to their homes instantly, and under the penalty of death they were forbidden to skulk about the city during night. But the whole of the rebels did not thus escape, and the revolt was not finally extinguished without much bloodshed and cruelty.

History. 1386. The courage, address, and presence of mind which the king had discovered in quelling such a dangerous tumult, gave great hopes to the nation: but, in proportion as Richard advanced in years, these hopes began to wither; and his want of capacity, or at least of solid judgment, appeared in every enterprise which he attempted. The king had unluckily lost the favour of the common people after the insurrection just mentioned. He allowed the parliament to revoke the charters of enfranchisement and pardon which had been granted; some of the ringleaders in the late disorders had been severely punished, and others were put to death without any form or process of trial. Thus the popular leaders were greatly exasperated by this cruelty, though probably the king did not in this follow the dictates of his own mind so much as the advice of his counsellors. But having thus lost the favour of one party, he quickly afterwards fell under the displeasure of the other also. Conceiving himself to be in too great subjection to his uncles, particularly the Duke of Gloucester, he attempted to shake off the yoke, by raising others to an equal share of rank and favour. Accordingly one of his favourites, Michael de la Pole, was created Earl of Suffolk, and raised to the chancellorship; whilst another, Robert de Vere, earl of Oxford, a young man of an agreeable person, but dissolute in his behaviour, soon acquired an absolute ascendency over him. This nobleman was first created Marquis of Dublin, and afterwards Duke of Ireland, both preposterous and invidious titles. The duke having soon become the dispenser of all the king's favours, a conspiracy was formed against him by some of the most powerful nobility in the kingdom. The Earl of Suffolk was impeached in parliament, and, being convicted of certain charges brought against him, was condemned to pay a suitable fine. Soon afterwards the king was prevailed upon to vest the government in the hands of eleven commissioners along with the three great officers of state. This measure was carried into effect by the Duke of Gloucester, who stood at the head of the committee; and the king could not without regret perceive himself thus totally deprived of authority. He first endeavoured to gain over the parliament to his interests, by

History. 1386. influencing the sheriffs of each county, who were then the only returning officers; and this measure failing, he next applied to the judges, who declared that the commission which had deprived the king of his authority was unlawful, and that those who procured or advised it deserved condign punishment; but their sentence was quickly opposed by declarations from the lords. The Duke of Gloucester armed his partizans, and appeared at the head of a body of men sufficient to intimidate both the king and his adherents. These insurgents, sensible of their own power, began by demanding of the king the names of those who had advised the adoption of the late rash measures. A few days afterwards they appeared armed in his presence, and accused by name the Archbishop of York, the Duke of Ireland, the Earl of Suffolk, and Sir Robert Tresillian, one of the judges who had declared in his favour, together with Sir Nicholas Brembre, as public and dangerous enemies to the state. The parliament which met on the 3d of February 1388 condemned the five accused persons to suffer the death of traitors. The Duke of Ireland escaped to Flanders, where he expired four years afterwards; De la Pole died at Paris in the same year; Tresillian and Brembre were put to death, and the Archbishop of York became a Flemish curate, and died in that humble capacity. The other individuals who had subscribed the bold opinion were condemned to perpetual imprisonment; with the exception of Black, who had drawn up the questions, and Usk, appointed under-sheriff to arrest the Duke of Gloucester, who were both executed.

But the king became restive in the traces with which his uncle restrained him. In a meeting of parliament he declared himself competent to manage his own affairs, as he had by this time attained his twenty-second year. This bold announcement was followed by his ordering Thomas Arundel, whom the commissioners had recently appointed chancellor, to give up the seals, which, on the following day, he delivered into the hands of William Wickham, bishop of Winchester. The council was next cleared of the Duke of Gloucester, the Earl of Warwick, and other opposition lords; and the great officers of the household, as well as the judges, were changed for more pliable instruments.

Being now his own master, Richard notified by proclamation that he had taken the reins of government into his own hands; and, whether it was owing to the king or his ministers, it must be owned that for some years his administration was tranquil and happy. During this halcyon period he made a journey into Ireland, in order to divert the melancholy with which he was afflicted on account of the loss of his wife Anne. Soon afterwards he espoused Isabella, a princess of France, then in her eighth year, which contributed to an armistice with that kingdom for twenty-five years.

This alliance with the royal family of France encouraged Richard to execute a scheme of vengeance which he had long nourished in his bosom against Gloucester and others who had been instrumental in the punishment of his favourites. The duke, with the Earls of Warwick and Arundel, were appealed for treason; in consequence of which the former was sent prisoner to Calais, and the two latter committed to the Tower. Here the head of Arundel was shortly after struck off, and Warwick was banished; but the fate of the Duke of Gloucester is involved in some obscurity. On the 21st of September 1397 a writ was issued to Thomas Mowbray, earl marshal, governor of Calais, commanding him to bring the body of his prisoner, the Duke of Gloucester, to answer before the king in parliament to the appeal of treason against him. The reply of the governor of Calais was, that the prisoner had died in his custody. At a subsequent period circumstances transpired which indicate that the duke perished by the foulest murder, doubtless at the instigation of his own nephew. It remains to be mentioned, that at the meeting of parliament, in which these noblemen were impeached, all the acts in which Gloucester had taken a share were annulled, the commission of government was cancelled, the opinions of the judges were declared to be legal, and the judgment against Michael de la Pole was reversed. History. 1399.

After the destruction of Gloucester and the heads of his party, a misunderstanding arose amongst the noblemen who had joined in the prosecution. The Duke of Hereford, son to John of Gaunt, appeared in parliament, and accused the Duke of Norfolk of having uttered treason in a private conversation. Norfolk denied the charge, and offered to establish his innocence by single combat. The challenge was accepted; but the king interrupted the duel, and commanded both the parties to leave the kingdom. The Duke of Norfolk was banished for life, but the Duke of Hereford only for ten years. The former retired to Venice, where he died shortly afterwards. Hereford displayed so much resignation to the will of his sovereign, that the latter commuted the period of his exile to four years. The king had obtained the object of his wishes, namely, the civil destruction of those whose power he dreaded. Even his uncles, either through affection or fear, seconded all his measures, which were now deeply tainted with despotism. On the death of John of Gaunt, "time-honoured Lancaster," the crown claimed his immense estates, to the exclusion of the banished Earl of Hereford, who was pronounced incapable of inheriting them after the judgment which had been pronounced against him in parliament.

By these and other impolitic acts, the king overstrained the bow, and excited a spirit of discontent, which finally hurled him from the throne. The resentment of Hereford had been inflamed by the injury which he had received, and he only waited for a favourable opportunity of retaliation, which soon afterwards occurred.

The Earl of March, presumptive heir to the crown, having been appointed the king's lieutenant in Ireland, was slain in a skirmish with the natives of that country; and Richard, regardless of his precarious situation at home, went over to Ireland with a considerable army, in order to revenge the death of his relative. Hereford, now duke of Lancaster, took advantage of the king's absence. Solicited by the discontented lords, and aware of the alienation of the people from Richard, he embarked at Nantes, and, with a retinue of only sixty persons in three small vessels, landed at Ravenspur in Yorkshire. The Earl of Northumberland, who had long been a malcontent, together with Henry Percy, his son, surnamed *Hotspur* on account of his impetuous valour, immediately joined him with their forces; and the people flocked to him in such numbers that in a few days he found himself at the head of sixty thousand men.

Richard in the mean time continued in fancied security in Ireland. Adverse winds for three perilous weeks together prevented his receiving any news of the rebellion which had broken out in his native dominions; but when the intelligence arrived he was overwhelmed with dismay. Some advised him to sail immediately and face the danger; others recommended that he should first send over the Earl of Salisbury, for the purpose of collecting all who were disposed to support his interests, which plan was adopted. A numerous army joined the earl, but the king protracted his stay in Ireland so long, that on his arrival the whole of this force had melted down to less than an hundred men. To take the field against Henry of Lancaster was consequently out of the question. He therefore proceeded in disguise to the fortress of Conway, where

History. 1399.

Salisbury had taken up his quarters. It was the policy of Henry to show symptoms of negotiation, in order to allure the king into his own hands. This he effected in a very deceitful manner. The Earl of Northumberland was dispatched to Richard with a thousand men, who concealed themselves at some distance, whilst the earl proceeded to the fortress where the king was lodged, and by fair promises induced him to quit his stronghold and go along with him to Henry for the purpose of effecting a reconciliation. But during the journey Richard was made prisoner, and finally committed to the Tower to await the judgment of parliament. On Monday the 29th of September 1399, a deputation of lords and commons waited upon the king, and having reminded him of a declaration which he had formerly made at Conway Castle, of his unfitness to govern, and readiness to resign the crown, required his resignation of the regal power. To this he consented, according to the ancient chroniclers, "with a cheerful countenance." During his whole reign, Richard held the sceptre with a wavering grasp, and in the paralysis with which he was now stricken, he as it were unconsciously relinquished it. He likewise recommended Henry his nephew as a fitting successor to the throne.

Before proceeding with the reign of Henry IV. we shall follow the deposed monarch through the few sad weeks of his unhappy life. By parliament he was adjudged "to a perpetual prison, to remain there *secretly* in safe custody." Richard was accordingly consigned to close confinement, and shortly afterwards came to his end, there can be little doubt in an unnatural manner. His fate seems to have been accelerated by a conspiracy amongst his friends to restore him to the throne. The Earls of Kent, Huntingdon, and Salisbury, laid a plot for the destruction of King Henry; but the secret was betrayed, and the confederated noblemen were executed. The death of Richard seems to have immediately followed this unsuccessful enterprise, but the manner of it is involved in impenetrable mystery. According to some chroniclers, several ruffians were sent to the castle of Pomfret, where he had been removed, for the purpose of dispatching him. They rushed unexpectedly into his apartment; but he succeeded in wresting a pole-axe from one of the murderers, with which he killed several of them, but was at length overpowered and slain. Others relate that he was starved in prison, and that he lingered fifteen days before he expired.[1] According to some accounts, he was condemned to suffer this miserable and protracted death; whilst others state that it was a voluntary abstinence, to which he was impelled by despair. He died in the thirty-fourth year of his age, and twenty-third of his reign. It was during the life of Richard II. that Wickliff, the celebrated reformer, promulgated his doctrines in England. See WICKLIFF.

After the throne had been vacated by its legitimate occupant, Henry duke of Lancaster stepped forward and claimed it in right of his being a descendant of Henry III. He was descended from this monarch both by father and mother, but he could not claim by the father's side, because the young Earl of March was sprung from the Duke of Clarence, the elder brother of John of Gaunt, nor by the mother's side, because she was sprung from Edmund of Lancaster, a younger brother of Edward I. It was pretended that Edmund was the elder brother, but it was never proved. By the law of succession it belonged to the descendants of Lionel, the third son of Edward III. That prince died without issue male, and his possessions and pretensions descended to his daughter Philippa, wife of Roger Mortimer, the male representative of the powerful baron who was attainted and executed for the murder of Edward II. the grandfather of the Duke of Clarence. The son of that powerful delinquent had been restored to his honours and estates at a late period of the reign of Edward III. The fourth in descent from the regicide was Roger Mortimer, lord-lieutenant of Ireland, who was looked upon as heir to the crown during the early part of Richard's reign; but his son Edmund Mortimer was only ten years of age when Richard was deposed, so that his claim was easily set aside. Mortimer died in 1425 without male issue, and the pretensions which he inherited through the Duke of Clarence fell to his sister Anne Mortimer, who espoused Richard of York, earl of Cambridge, the grandson of Edward III. by his fourth son Edmund of Langley, duke of York. But from the foregoing pedigree it is clear that during the life of the Earl of March no right to the crown had descended to any branch of the house of York. Henry, however, notwithstanding the inferiority of his title, was unanimously acknowledged by both houses, and was crowned within a fortnight after the deposition of his predecessor. He was the idol of the populace, the master of parliament, and the heir of the fame and possessions of John of Gaunt.

History. 1402.

The reign of Henry IV. was little else than a continued series of insurrections. In the very first parliament which he assembled, a great number of challenges were given and accepted by different barons; and though Henry had ability and address enough to prevent these duels, it was not in his power to avoid continual combinations and revolts against himself.

The most formidable of these disorders was that under the Earl of Northumberland. Various causes are assigned for this insurrection. One is, that the resentment of the Percies had been excited by the king denying them the privilege to liberate or ransom their prisoners; for at the battle of Homildon, where the Scotch suffered a defeat, a number of noblemen had fallen into the hands of Hotspur, who commanded the English. The insurgents themselves assigned another cause for the quarrel, and this was probably the real one. In the course of a war with the Welsh, the Lord Grey of Ruthyn and Sir Edmund Mortimer had both fallen into the enemy's hands. The former being a friend to the king, was allowed to be ransomed by his relations; but the latter, who was uncle to the young Earl of March, the lawful heir to the throne, and of course an object of jealousy to Henry, was denied the privilege of being liberated. This fired with resentment the inflammable spirit of Hotspur, who had married the sister of Sir Edmund; his father the Earl of Northumberland, and his uncle the Earl of Worcester, shared his discontent; and amongst them they projected nothing less than the dethronement of the king.

With this view they formed an alliance with the Scots and Welsh, who were to make an irruption into England, at the same time that the Percies were to raise what forces they could in order to join them. The Earl of Northumberland, by a sudden fit of illness, having been incapa-

[1] It was at first believed that Richard had effected his escape into Scotland, and that he lived there twenty years. This ancient tradition has been revived by Mr Tytler, in his *History of Scotland*, and he supports his views with considerable ingenuity. The chief evidence upon which he relies consists in charges made by the regent of Scotland for the expenses of the king of England. But Sir James Mackintosh, in a note at the end of the first volume of his *History of England*, gives several cogent, and we think unanswerable reasons for differing from Mr Tytler upon this point, and adhering to the common narrative. Those who feel an interest in this subject are referred to the work above mentioned, and to the appendix to the third volume of Mr Tytler's *History of Scotland*.

History.
1403.

citated for active warfare, young Percy took the command, and marched to Shrewsbury for the purpose of joining the Welsh. But the king had assembled a small army, with which it was his intention to act against the Scots; and, knowing the importance of celerity in civil wars, instantly hurried to meet the rebels. He approached Shrewsbury before a junction could be effected with the Welsh; and by his headstrong impatience Percy was impelled to risk an engagement, which at that time he ought to have declined. The evening before the battle he sent a manifesto to Henry, in which he renounced his allegiance, set the king at defiance, and enumerated all the grievances of which he imagined the nation might justly complain. Amongst the charges with which he reproached the king, were those of perjury, murder, and usurpation of rightful property. All this vituperation was productive of no other effect than that of exasperating to the utmost both the king and his adherents.

The armies were fairly matched, consisting of about fourteen thousand men each, and both leaders were men of approved valour. The action, which took place on the 21st of July 1403, was obstinate and bloody. After a chivalrous display of his characteristic valour, Percy was slain by a random arrow, and with his fall the courage and the confidence of his followers evaporated. They were completely routed, and driven from the field with great loss. Lord Worcester and two other conspicuous individuals were beheaded on the field. The Earl of Northumberand, however, notwithstanding his connection with the rebels, was mercifully treated by Henry. But this lenity does not appear to have quieted the country; for various insurrections, particularly amongst the Welsh under the celebrated Owen Glendower, disturbed the remaining years of Henry's reign. Owen, under the title of Prince of Wales, gained so many remarkable successes over the royal troops, that the king himself publicly attributed them to necromancy. The unconquerable spirit of the Welsh leader actuated all classes of his countrymen, who flocked to his standard from every part in England where they had taken up their abode. Owen remained free and unsubmissive to the English yoke till the close of his career, and the last glimpse which history affords of his patriotic course is as bright as the first.

The reign of Henry was much disturbed, and the language which our great dramatist makes him employ, "uneasy lies the head that wears a crown," is remarkably appropriate from the lips of such a monarch. The swell with which the nation heaved when he ascended the throne never subsided during his lifetime. The position in which he stood with regard to the succession seems to have caused him much concern; for the case was a difficult one. In his first parliament his eldest son Henry was created Prince of Wales; and in 1404 the right of that prince's brothers to reign, in the event of his dying without issue, was recognised by parliament. The most disgraceful feature of Henry's reign was his deadly persecution of those who entertained the new religious doctrines. In his second year was passed that sanguinary act, the first that stains the English statute-book on the subject, which orders heretics to be burned; and many an unfortunate Lollard suffered for his faith during the sway of the Bolingbrokes. A remarkable circumstance occurred in 1405, namely, the capital punishment of a clergyman of the highest rank. Scroop, archbishop of York, was an enthusiastic defender of the claims of the Earl of March, and, being taken in arms against his sovereign, was beheaded without trial, conviction, or defence.

Notwithstanding the act against the Lollards, the doctrines of Wickliff gained ground; and the support which Henry gave the hierarchy did not preclude his parliament from attempting its reformation, and even from despoiling it of part of its possessions.

History.
1413.

In 1405 the Commons, who had been required to grant supplies, proposed to the king to seize all the temporalities of the church, and employ them as a perpetual fund to meet the exigencies of the state. When this address was presented, the Archbishop of Canterbury, who then attended the king, objected that the clergy, though they went not in person to the wars, sent their vassals and tenants in all cases of necessity; whilst at the same time they themselves who staid at home were employed night and day in offering up their supplications for the success of the enterprise and the prosperity of the state. The speaker answered with a sarcastic smile, that he thought the prayers of the church but a very slender supply. The archbishop, however, prevailed in the dispute; the king discouraged the application of the Commons, and the Lords rejected the bill which the lower house had framed. The Commons were not discouraged by this repulse; in 1410 they returned to the charge with renewed zeal and determination.

A Lollard had been burnt, and the lower house of parliament, as if in retaliation of this atrocity, presented a schedule to the king, showing that he might have from the temporal possessions of the bishops, abbots, and priors, that were then uselessly wasted, 15 earls, 1500 knights, and 6200 esquires. But the reply of the king was severe, and he forbade them to discuss such topics for the future. They then petitioned that the clergy should be subjected to the civil tribunals, but this was also refused; and a request that the statute against the Lollards might be mitigated shared the same fate.

The reign of Henry was now drawing towards a termination. The last years of his life were darkened by disease, and undistinguished by vigour. He had been subject to eruptions in his face and to attacks of epilepsy. By one of these he was carried off, at Westminster, on the 20th of March 1413, in the forty-seventh year of his age and fourteenth of his reign. Henry owed the English sceptre, not, in the first instance, to his own plotting or ambition, but to a popular revolution against the authority of his predecessor. He landed in England for the avowed purpose of only seizing his own possessions, of which he had been most unwarrantably deprived; but finding Richard a most unpopular sovereign, and his own reputation very high, whilst his affinity to the blood royal was, though not so near as that of the Earl of March, sufficiently so to give him a plausible pretext for standing forward as a candidate for the crown, he accordingly did so, and proved successful. He united in a high degree watchfulness and circumspection, with a bold and decisive policy. For his arbitrary measures he brought forward the plea of necessity, "which," says Sir James Mackintosh, "prevented them from growing into precedents subversive of the constitution." As he owed his throne to popular revolt, so he was in some measure compelled to adopt popular principles. Under his reign the House of Commons advanced with a steady pace towards importance and authority. It assumed a higher and more decisive tone than had hitherto characterized its proceedings, and pushed its inquiries into all the affairs and departments of government.

Henry of Monmouth, eldest son of the preceding monarch, ascended the throne immediately after the death of his father. With the early life of Henry V. we usually associate acts of frivolity, insubordination, and even low vice. But to the creative genius of a powerful poet must in a great measure be attributed this almost universal impression. That he was guilty of delinquencies beneath the dignity of the heir apparent to the English throne, may be true; but there is no satisfactory evidence

History. 1413.

either to confirm or refute the traditionary stories which are told of him. At an early age he discovered talents of no common order. He was only sixteen years of age when the battle of Shrewsbury was fought, and on that occasion he displayed equal firmness and ability. Afterwards, when intrusted with the guardianship of the Welsh marches, he conducted himself in a manner so highly creditable, that he more than once received the thanks of the House of Commons for his conduct. On his accession to the throne, he made himself popular by several wise and generous measures. He liberated his cousin the Earl of March from the constraint under which that prince, undoubtedly the heir of Edward III., had been held by the jealousy of Henry IV. The Percies, who were exiles in Scotland, he restored to their possessions, and even to a command over their martial vassals. Those ministers of his father who had recommended themselves by their uprightness and decision, were retained in the offices which they held. The chief justice, in particular, who had formerly imprisoned the king, whilst Prince of Wales, for his misconduct, was not only pardoned, but received into high favour. He expressed deep regret for the fate of Richard II., and performed his funeral obsequies with becoming pomp and solemnity. That Henry had a mind which towered above the level of his contemporaries, his remarkable triumphs in France are evidence: but that in some respects he was not in advance of his age, the severities which he practised against the Lollards afford ample proof. The head of that party was Sir John Oldcastle, an individual alike distinguished for his valour and military talents, and who had acquired the esteem both of the late and present king. His high character pointed him out as a proper object of ecclesiastical fury, and he was accordingly denounced to Henry, who, at a private interview, attempted to make him recant his faith; but in vain. Oldcastle was therefore condemned to suffer the death of a heretic; but having effected his escape, he raised an insurrection, which was soon crushed. He succeeded however in eluding pursuit for four years, but he was at last taken and executed as a traitor. After the suppression of the revolt, the most severe laws were passed against the unfortunate Lollards. It was enacted, that whoever should be convicted of Lollardy, besides suffering capital punishment according to the laws formerly established, would also forfeit his lands and goods to the king; and the officers of government were likewise bound by oath to use their utmost endeavours to extirpate the heresy.

The restoration of tranquillity afforded Henry an opportunity of turning his attention to France, the miserable condition of which offered a fair prospect of success to his arms. The claim of his family to the crown of that country was revived; and on the 15th of April 1415 he assembled a great council at Westminster, to whom he announced his determination of making a "voyage in his own proper person, by the grace of God, to recover his inheritance." He appointed his brother, the Duke of Bedford, lord lieutenant of the kingdom during his absence. When about to set sail for Normandy, a rash conspiracy broke out, which detained him for a little time; but it was soon suppressed, and Henry embarked at Southampton with an army of about thirty thousand men, the greater proportion of whom were archers. He entered the Seine, and having reduced Harfleur, he challenged the dauphin to meet him in single combat, and decide the contest for the crown of the country which he had invaded. But this was destined to be competed for on a far wider arena than that which two combatants could occupy. Henry crossed the Somme, and was proceeding on his road towards Calais, when he came up with the enemy at a small village, called by the French Azincourt, and by the English Agincourt. Here was fought a great and decisive battle, which ended in the total defeat of the French army, estimated at not less than four times the strength of that of the English. (See Agincourt.) Henry did not immediately pursue his victory, and returned to England, where he was received with the utmost enthusiasm; but he soon afterwards rejoined his troops in France. The claimants for the crown of that kingdom were so numerous, that had he boldly prosecuted his own schemes, the opposing factions might have leagued together against him as a common enemy. It was therefore his policy to remain inactive, and, by tampering with them separately, to foment the discord which prevailed amongst the French leaders. On the 21st of May 1420, a treaty was at length concluded at Troyes, which promised to crown the hopes of the Plantagenets with success, and establish them on the throne of France. The principal articles stipulated the marriage of Henry with Catherine, daughter of the French king; that Henry should be regent of France whilst Charles remained alive; and that he should succeed that monarch after his decease. Henry accordingly espoused the French princess; but he was not long permitted to enjoy his connubial happiness or his good fortune. A fatal malady seized him at Paris; and having been conducted by his own orders to Vincennes, he expired there on the 31st of August 1422, in the thirty-fourth year of his age, and the tenth of his reign.

History. 1422.

The name of Henry V. is adorned with all the splendour of brilliant conquest and successful ambition. By a single victory he brought the crown of France within his reach, if not within his grasp. But he had other qualities besides those of a warrior; he was a statesman of consummate skill, as his conduct after the victory of Agincourt sufficiently testifies. His mind was altogether of a superior order, and there seems nothing to prevent his being ranked with the greatest of English monarchs, except the countenance which he gave to ecclesiastical persecutions.

By Catherine of France Henry had a son who succeeded him when not yet a year old. The whole of his long reign is occupied with a war for the French crown, and a disastrous civil war in England between the houses of York and Lancaster. At the accession of Henry VI. parliament ordered a new royal title, in which he was recognized as king of France and England, and lord of Ireland; appointed his father's eldest brother, the Duke of Bedford, protector, defender, and chief counsellor of the kingdom and of the English church; and in his absence invested the Duke of Gloucester, his younger brother, with these honours. A council was named, and certain articles enacted, for the purpose of limiting the power of the protector. The kingdom of France was now in the most deplorable situation. By the solemn investiture of the infant king of England with the royal prerogative in that country, Charles VII. succeeded only to a nominal kingdom; for the greater portion of it adhered to the interests of Henry. But notwithstanding all these advantages, the English daily lost ground, and in the year 1450 they were finally expelled from the country. See the article France.

It may be easily conceived that such a train of bad success was likely to be productive of discontent at home. Continual animosities were kept up amongst the king's counsellors during the first thirty years of his nominal rule. This tended to plunge the nation in convulsions, and prepare it for becoming the theatre of a sanguinary civil war. Humphrey duke of Gloucester was envied by many on account of his high station. Amongst these was Thomas Beaufort, bishop of Winchester, afterwards cardinal, the legitimate son of John of Gaunt, brother to

History. 1424.

Richard II. This prelate, to whom the care of the king's education had been committed, was a man of some capacity and experience, but of an intriguing and restless disposition. He had frequent disputes with the Duke of Gloucester, over whom he gained several advantages. The Duke of Bedford employed both his own authority and that of parliament to reconcile them, but in vain; their mutual animosities served for several years to embarrass government, and to lay it open to its enemies. The sentiments of the two leaders were particularly divided with regard to France. The bishop laid hold of every prospect of accommodation with that country; and the Duke of Gloucester was for maintaining the honour of the English arms, and regaining whatever had been lost by defeat or delay. Both parties, therefore, called in all the auxiliaries they could command. The bishop resolved to strengthen himself by procuring a proper match for Henry, at that time twenty-three years of age, and then by bringing over the queen to his interests. Accordingly, the Earl of Suffolk, a nobleman whom he knew to be stedfast in attachment to him, was sent over to France, apparently to settle the terms of a truce which had then been contemplated, but in reality to procure a suitable consort for the young king.

The bishop and his friends had turned their attention to Margaret of Anjou, daughter of Regnier, titular king of Sicily, Naples, and Jerusalem, but who was destitute of either real power or possessions. She was looked upon as the most accomplished princess of the age, both in mind and person; and it was thought the abilities which she possessed would supply the want of them in her husband, to whom maturity of years had brought no maturity of understanding. He was a child from the cradle to the grave. The treaty was therefore hastened on by Suffolk, and soon afterwards ratified in England. Previously to the king's marriage, however, a conspicuous blow was struck at the protector's greatness. In that age a charge of sorcery was capable of blasting any character, however spotless or pure; and even of throwing odium upon all who were related to the individual accused. It was an irresistible weapon made use of by churchmen for the destruction of their enemies, and it was wielded by the prelate against his political opponent with tremendous force. He brought forward an accusation of sorcery and treason against Elinor Cobham, wife or concubine of the Duke of Gloucester. She was charged with having made an image of the king in wax, which being placed before a gentle fire, gradually dissolved; and it was expected that as the wax wasted away, the strength of the king would also disappear, and that his death would take place when the whole of the image had melted. Three other individuals were implicated in this accusation, which was readily believed. The prisoners were pronounced guilty; the duchess was condemned to do penance and suffer perpetual imprisonment; one priest was hanged, and another died in prison; whilst, to consummate the affair, Margaret Jourdemayn, a reputed witch, was burnt at Smithfield.

The Bishop of Winchester was resolved to carry his resentment against Gloucester to the utmost. He procured a parliament to be summoned, not at London, which was too well affected towards the duke, but at St Edmundsbury, where the prelate's adherents greatly preponderated. As soon as Gloucester appeared, he was accused of treason, and thrown into prison. On the day appointed for him to make his defence, he was found dead in his bed, though without any signs of violence upon his body. This, however, is no proof that he came not by a violent end.

The death of the Duke of Gloucester was universally ascribed to the cardinal of Winchester, who himself died six weeks thereafter, without leaving behind him so good a name as his political adversary. The Lancasterian party was thus deprived of its chiefs: no male Plantagenet of that lineage remained except the king, who was at best but an apology for one.

History. 1449.

After the demise of the cardinal of Winchester, Suffolk governed with uncontrolled sway. But his conduct was obnoxious to the rest of the nobility, who now concerted measures for his destruction. In the year 1447 he was impeached of high treason on various charges. He was accused of exciting the French to invade England, in order to depose Henry and place on the throne De la Pole's son, who was to marry Somerset's daughter, considered by the Lancasterian party as the next in succession to the crown. He was also charged with the loss of France by his negotiations in that country, and with revealing state secrets to the French ministers. Other illegal acts were ascribed to him in the bill of impeachment; and so strong did the current of opinion run against him, that, whether guilty or not, the king was compelled to banish him from the kingdom. But this did not satisfy his enemies, who looked upon expatriation as a sheltering from justice rather than as a punishment. The captain of a ship was therefore employed to intercept him in his passage to France; and, having been seized near Dover, his head was struck off in a small boat, and his body consigned to the waves.

The complaints against Henry's government were heightened by an insurrection, headed by an individual of equivocal descent, but who has been transmitted to posterity by the name or nickname of Jack Cade. He assumed the honourable name of John Mortimer; and having assembled a great body of the peasantry of Kent, he marched to Blackheath. A message was sent to him by the king, demanding the cause of the insurrection. The audacious Cade answered in the name of the community, that their purpose was to punish evil counsellors, and to obtain a redress of grievances. Henry assembled a force; but part of it having been defeated, the remainder refused to fight, and the king retired from the field. Lord Say, the treasurer, was committed to the Tower, in order to satisfy the revolters. In the mean time, the citizens of London opened their gates to the victorious rebel, who made a triumphant entry into the city arrayed in the shining armour and gilt spurs of a knight. For some time he maintained great order and regularity amongst his troops. He always led them out into the fields in the night-time, and published several edicts against every kind of plunder and violence. His followers, however, were not to be thus restrained. Lord Say, without any trial, was beheaded; and soon afterwards, the insurgents, having committed some irregularities, were shut out of the city by the inhabitants. Cade endeavoured to force his way back to his quarters, when a bloody scuffle ensued, which was only terminated by the approach of night. The Archbishop of Canterbury, and the chancellor, who had taken refuge in the Tower, hearing how matters stood, drew up an act of amnesty, which was privately circulated amongst the rebels. This had an electrical effect upon them, and in the morning Cade found himself totally abandoned by his followers. He effected his escape, but was afterwards captured and slain. A number of circumstances now contributed to revive the long dormant pretensions of the house of York to the throne. France had been lost; the arms of England had been disgraced; Margaret the queen, by violence and arrogance, was most unpopular; the king himself was a perfect cipher; whilst, in strong contrast to him, appeared the Duke of York, a man of popular virtues, and the legitimate heir to regal power, according to the English laws of real inheritance. All the males of the house of Mortimer were now extinct; but Anne, the sister of the last Earl of March, having

History. 1449.

espoused the Earl of Cambridge, who had been beheaded for treason in the reign of Henry V. had transmitted her latent but unforgotten claim to her son Richard. This prince, descended by his mother from Philippa, only daughter of the Duke of Clarence, third son of Edward III. stood plainly in order of succession before the king, who derived his descent from the Duke of Lancaster, fourth son of that monarch. The duke was a man of valour and abilities, as well as of some ambition; and he thought that the weakness and unpopularity of the present reign afforded a favourable opportunity for asserting his title. The ensign of Richard was a white rose, and that of Henry a red one; circumstances which gave names to the two factions who were now about to deluge the kingdom in blood.

The Duke of York was in Ireland during the proceedings against Suffolk and the sedition of Cade. In September 1450 he returned to England, a circumstance which excited considerable alarm at court. He advanced upon London; and, proceeding to the palace at Westminster, knelt before the king, and, deploring the state of the kingdom, entreated him to summon a parliament. The queen appears to have evinced her usual arrogance upon this occasion; but York succeeded in extorting a promise from the king that he would comply with his request, upon which he retired to his castle at Fotheringay. He was scarcely gone, however, when the Duke of Somerset returned from France, and was chosen favourite adviser of the king. The session of parliament proved unquiet and stormy. York presented a complaint against the administration of Somerset, and in the year following exhibited several articles of impeachment against him. But the power and influence of the queen rendered his efforts fruitless. Legal prosecutions became thus inadequate to suit the feelings of the enraged York, and he accordingly assembled an army. The king, doubting his ability to triumph by opposing force to force, affected to acquiesce in the demands of the duke, and put Somerset under restraint. Upon this York disbanded his troops, and retired unattended to the royal pavilion, where he was immediately made prisoner, and compelled to take an oath of allegiance to the king. Somerset rose higher in favour than ever, and completed his ascendency in the government by obtaining the entire confidence of the king and his consort.

On the 13th of October 1453 Queen Margaret presented her husband with a son and heir, the ill-fated Edward prince of Wales. Not long afterwards the king sunk into a state of mental as well as bodily incapacity, and the star of York again appeared above the horizon. The total imbecility of the king having been ascertained, the Duke of York was chosen protector and defender of the kingdom. Previously to this event Somerset had been removed from the palace of the queen to the Tower. The king's malady was not permanent, and on his recovery he put an end to the protectorate, released Somerset from his confinement, and reinstated him in his honours. This was a mortal blow to the peace of York; and having conferred with the powerful Earls of Warwick and Salisbury, who united themselves to his interests, he took the field with the declared intention of only expelling Somerset from the government. But this nobleman's fate involved that of the house of Lancaster. It was in vain that the king attempted a reconciliation of interests; he was compelled to have recourse to arms, and meet the Yorkists in open warfare. A battle took place at St Albans, in which the royalists were totally defeated; Somerset, the immediate cause of the conflict, having fallen in the action.

The king relapsed into his former state, and the Duke of York was a second time chosen protector; but the queen, who could not brook the idea of his continuing at the head of government, procured his dismissal. She is even charged with having conspired his destruction, and that of his most conspicuous adherents. A temporary reconciliation was effected, but discord was again introduced; and the parties having irrecoverably lost confidence in each other, prepared for the deadly struggle of arms.

History. 1460.

The forces of the Duke of York under the Earl of Salisbury gained an advantage over the royalists at Bloreheath; but a fatal desertion on the part of York's troops at Ludlow turned the balance in favour of the king; and York fled to Ireland, where he was joyfully received.

But this disaster, though in appearance it suppressed the party of York, was far from being fatal to its power. The snake was scotched, not killed, and it only waited a favourable opportunity for darting on its victim. This soon presented itself. Warwick, who had retained the government of Calais, landed in Kent, and, being joined by a number of barons, advanced upon the capital, which he entered amidst the acclamations of the people. The number of his troops had now so much increased that he found himself in a condition to encounter the royal army. Early in July 1460 he came up with them at Southampton, and a bloody battle ensued, in which the king was taken prisoner, and his army utterly dispersed. Meanwhile the Duke of York having returned from Ireland, openly laid claim to the crown. In the House of Lords the cause of Henry and the Duke of York was solemnly debated; and the latter, though a conqueror, did not absolutely gain his cause. It was determined that Henry should possess the throne during his life, and that the Duke of York should be appointed his successor, to the utter exclusion of Henry's offspring.

Though the royal party now seemed destitute of every resource, the queen still retained her intrepidity, disdaining every arrangement which implied the dethronement of her child. Wales seemed the natural place of refuge for the mother of him who was called its prince, and thither accordingly she fled. This warlike dame assembled a considerable army to rescue her pusillanimous husband, and marched to the northern provinces, where Northumberland and Clifford joined her with their borderers. This union having alarmed the victorious party, York and Somerset hastened to anticipate their designs, and, having assembled a sufficient force, succeeded in reaching the strong castle of Sandal before Christmas. Actuated by the pride of prowess and the impatience of inaction, York engaged the queen's army with one of inferior force. The conflict took place at Wakefield on the 30th of December 1460, and terminated in the total defeat of the Yorkists. The duke himself was either slain in the action, or put to death after it; whilst the Earl of Salisbury was taken during the night, and decapitated next day. But no one was so much lamented as the young Earl of Rutland, the son of York, a boy in the twelfth year of his age. He was made prisoner, and coolly stabbed to the heart by Clifford, in revenge for the death of his father, who had perished at the battle of St Albans.

After this victory Margaret marched towards London, in order to set the king at liberty; but the Earl of Warwick, who had now put himself at the head of the Yorkists, led about the captive king in order to give a sanction to his proceedings. Except by the countenance which his presence seemed to give to the transactions of the Yorkists, he was as inert an instrument in their hands as the royal standard which waved above their lines. Warwick engaged the queen's forces at St Albans; but, through the treachery of Lord Lovelace, who deserted with a considerable force during the heat of the action, Warwick was defeated, and the pageant king fell once more into the hands of his own party.

History. 1460. The submission of the city of London seemed now to be all that was wanting to complete the queen's success; but Warwick had secured it in his interests, and the citizens refused to open their gates to the royal victor. In the mean time, young Edward, eldest son of the late Duke of York, put himself at the head of his father's party. He was now in the bloom of youth, remarkable for the beauty of his person and for bravery; and he was, moreover, a very great favourite with the people. He defeated Jasper Tudor, earl of Pembroke, at Mortimer's Cross in Herefordshire; the earl himself being taken prisoner, and immediately beheaded by Edward's orders.

Meanwhile he was joined by the remainder of Warwick's army, and the united forces entered the metropolis amidst the applause of the people of the city and of the surrounding provinces. Edward laid his claim before a council of lords, and on the 4th of March 1461 he was proclaimed king by the style and title of Edward IV.

But notwithstanding all her disasters, the queen remained inflexibly devoted to her purpose. She retired to the northern counties, where such numbers flocked to her standard that her army very soon amounted to sixty thousand men. Edward IV. was a voluptuary, but he never allowed his activity and vigilance to slacken. With Warwick and an army of forty thousand men he commenced his march to the north. The hostile forces met at Towton, in the county of York, on the 29th of March 1461, and an obstinate engagement ensued, which continued during the night, and was renewed with the utmost fierceness on the following morning. The queen's army was totally defeated, and, as quarter was given on neither side, the slaughter was dreadful. Between thirty and forty thousand persons perished in these two bloody days. After this disaster the queen with her husband took refuge in Scotland, whilst Edward returned to the metropolis, where he was crowned on the 29th of June 1461. For three years Edward IV. possessed the throne without any serious insurrection having taken place on the part of the Lancasterians. But during this period Queen Margaret was making strenuous exertions both in France and Scotland to raise a force capable of taking the field against Edward. Having collected a small army, she made an inroad into England, but after several indecisive skirmishes she was totally defeated at Hexham, in Northumberland, on the 17th of May 1464. The Duke of Somerset, who commanded for her, was beheaded; and a number of gentlemen were also executed at York, with little form of law or justice.

By these repeated misfortunes the house of Lancaster became so effectually reduced that Margaret was obliged to separate from her husband, and both were compelled to seek their safety in individual flight. The king was still protected by some of his friends, who conveyed him to Lancashire, where he was at last discovered, and consigned to the Tower as a prisoner. The queen made her escape through Scotland into France, along with her son, and his famous preceptor Sir John Fortescue.

In the mean time King Edward vigorously applied himself to the affairs of government. Feeling secure on the throne, he now also began to give way to the gratification of his amatory passions, to which he was exceedingly prone. In order to divert his mind from such debasing indulgences, the Earl of Warwick, hitherto his steady friend, advised him to marry. Edward consented, and the earl was appointed to negotiate a match with the Princess Bonne of Savoy. He was successful in his mission, but before the conclusion of the marriage treaty the king privately espoused a lady of whom he had become enamoured, and who resisted all his efforts to form an illicit connexion. This lady was Elizabeth, daughter of Sir Philip Woodville, and relict of Sir John Grey, a Lancasterian, who had fallen at the second battle of St Albans. The parties were solemnly united in marriage on the 1st of May 1464, and the bride was acknowledged and in due time crowned. This transaction highly displeased Warwick, who afterwards became still more disgusted at the favour shown to the queen's party, his own and his sovereign's natural enemies. A plan of revenge was therefore set on foot, and a most powerful conspiracy was also formed against Edward. To accomplish his aim, Warwick not only employed his own influence, which was very extensive, but likewise that of the Duke of Clarence, Edward's brother, on whom the earl had conferred the hand of his daughter without the king's permission. The effects of Warwick's secret combination with Clarence, his own brother Montague, and the discontented nobility and gentry, soon began to appear. Sedition was fomented throughout the country, and a popular insurrection at last broke out in Yorkshire, where Robin of Redesdale, a hero amongst the moss troopers of the border, appeared at the head of sixty thousand men. The articles of their manifesto were principally directed against the king's counsellors and the church.

History. 1469. Henry earl of Pembroke was sent against them with a body of seven or eight thousand men. He was joined by Lord Stafford with five thousand more troops, and the two commanders prepared to meet the insurgents. They at first received a repulse, but it was of no material importance. An unfortunate dispute, however, between Pembroke and Stafford, caused the latter to march off the field with his troops; and in a battle which immediately afterwards ensued, the royalists were cut to pieces, and their commander taken prisoner and beheaded.

The king, enraged at this, caused Stafford to be executed in a like summary manner. This event completed the disaffection of the king's followers, who now deserted him in thousands; and he himself was at last taken prisoner by Warwick and his friends; but this conquest embarrassed the confederated nobles. The detention of the king was not popular; and the military refused to act until he was released, which took place accordingly, and a reconciliation was effected. The truce was, however, of short duration. A new insurrection broke out in Lincolnshire, in which Warwick and Clarence were deeply involved. The rebels were commanded by Sir Robert Welles, son to a nobleman of the same name. Under an alleged charge of treason, the latter was beheaded by the king, who marched against the insurgents with his usual celerity, and gave them a total overthrow at Erpingham, in Rutlandshire, on the 12th of March 1469. Warwick and Clarence again attempted to entrap Edward, but having failed of success, they escaped to France.

Louis XI. openly espoused the cause of the malcontent barons, and effected a reconciliation between them and the fugitive Queen Margaret. Their mortal enmities were reconciled in common hatred of the king of England. A treaty was concluded, which stipulated that Edward should espouse Anne Neville, Warwick's daughter, and that they should combine their efforts to restore Henry to the throne of which he had been deprived. It was likewise agreed upon, that in case of failure of issue by the prince, the crown should descend to Clarence. After these preliminary arrangements, Warwick assembled a small force, and set sail for England, where he landed whilst Edward was in the north suppressing an insurrection which had there broken out. This seems to have been an artifice practised by a brother-in-law of Warwick's, who thus drew the incautious monarch to a distant part of the kingdom, and left the southern counties open to the invader. Warwick was a great favourite with the people, the subject of

History. 1469.

popular ballads, which resounded his praise throughout every town in the kingdom. Thousands having flocked to his standard, he advanced upon London, and there proclaimed Henry VI. The usual activity of Edward seems to have forsaken him, or else his pernicious frivolities had alienated the affections of his troops, whose fidelity towards him likewise decreased as Warwick drew near to them. Edward was compelled to fly to Holland, Clarence and Warwick made their triumphal entry into the capital, and Henry was formally restored to regal authority. But those who had reinstated him had placed only a barren sceptre in his grasp, for the real power resided with them. Edward was pronounced an usurper, and all acts passed under his sanction were repealed. The crown was settled on the male issue of Henry VI., and in default of such issue, on the Duke of Clarence and the heirs of his body. But Edward's party was not yet destroyed. After an absence of nine months, he, seconded by a small body of troops granted him by the Duke of Burgundy, made a descent at Ravenspur in Yorkshire. At first he met with little success; but his army increasing on his march, he was soon in a condition to appear before the capital, which instantly opened its gates to receive him.

The unfortunate Henry was thus again plucked from the throne; and the hopes of Warwick were almost totally blasted by the defection of Clarence, Edward's brother. He however advanced to within about ten miles of London, resolving to wait the approach of Edward, and took a position at Barnet, where, on the 14th of April 1471, a battle was fought, more remarkable for its consequences than for the number of the slain or the obstinacy of the combatants. Considering the animosity existing between the parties, the general slaughter was unusually small; but amongst the fallen were Warwick and his brother Montague; and the death of the first of these individuals was of far more importance to Edward than the victory which he had gained. It broke the charm which associated with his name the certainty of victory and success to the cause which he espoused. On account of the remarkable transactions in which he had been engaged, he received the appellation of "the king-maker." His death also destroyed the greatness of the house of Neville.

At this time the queen had just returned with her son from France, where she had been soliciting supplies. She had scarcely time to refresh herself from the fatigues of the voyage, when she received the fatal news of the death of Warwick, and the total destruction of his forces. All her resolution was unable to support her under this calamity, and she sunk to the ground in despair. Upon recovering herself, she took sanctuary in the Abbey of Beaulieu in Hampshire, where she still found friends ready to assist her. Tudor earl of Pembroke, Courtenay earl of Devonshire, the Lords Wenlock and St John, with some other men of rank, encouraged her yet to hope for success, and promised to stand by her to the last. On this assurance she resumed the undaunted bearing which was natural to her, and, advancing through the counties of Devon, Somerset, and Gloucester, collected a considerable army. The hostile forces came in sight of each other at Tewkesbury on the 14th of May 1471, where a battle was fought, which decided this sanguinary war. The queen's army was totally defeated; the Earl of Devonshire and Lord Wenlock were slain in the conflict; the Duke of Somerset, and about twenty other persons of distinction, who had taken shelter in a church, were surrounded, dragged forth, and immediately beheaded; about three thousand of their soldiers fell in battle, and the rest were entirely dispersed. Queen Margaret and her son were taken prisoners, and brought to the king, who asked the prince how he dared to invade his dominions. The youth replied that he came hither to claim his just inheritance; upon which Edward struck him on the face with his gauntlet. The Dukes of Clarence and Gloucester, Lord Hastings, and Sir Thomas Gray, taking this blow as a signal for further violence, hurried the prince into the next apartment, and there, it is said, dispatched him.[1] Margaret was thrown into the Tower along with her husband Henry, who there closed his unhappy career a few days afterwards. The Duke of Gloucester has been charged with his murder, but there is no proof of the fact.[2] Margaret was ransomed by the king of France in 1475, for fifty thousand crowns. She survived her deliverance about seven years, during which time she lived in France, withdrawn from the tumults of state.

History. 1483.

Edward being now freed from all his enemies, began to inflict punishment on those who had formerly appeared against him. Amongst the cruelties which he committed, that on his brother the Duke of Clarence was the most remarkable. They had been formally reconciled to each other; but this hollow truce to fraternal animosity was broken by a singular incident. Whilst the king was one day hunting in the park of one Burdett, a servant of the duke, he killed a white buck which was a great favourite of the owner. Burdett, concerned at the loss, broke into a transport of rage, and declared that he wished the horns of the deer were in the belly of the person who advised the king to that insult. For this exclamation Burdett was tried for his life, and executed at Tyburn. Clarence exclaimed against this sentence as iniquitous, for which he was attainted of treason, and charged with sorcery, in order to give to Burdett's expressions the dignity of necromantic imprecation. Sentence of death was pronounced against him; but the king having some repugnance to order the public execution of a brother, he was dispatched in private. There was a rumour prevalent at the time that he was drowned in a butt of malmsey wine, to which he is said to have been very partial; but there is no proof that his murder was effected in this manner.

The remainder of Edward IV.'s reign is unimportant. A war with France, which followed the civil wars in England, terminated in 1475 without being characterized by any memorable events. But the foolish idea of aggrandisement in France was still popular with the people, and Edward employed a considerable portion of the latter years of his reign in making apparent preparations for reviving the pretensions of his predecessors to the crown of that country. It does not appear, however, that he ever had any intention of carrying his threats into execution. Edward died on the 9th of April 1483, in the forty-second year of his age and twenty-first of his reign, calculating from the period of his first assuming the crown. In the character of Edward IV. we see a combination by no means singular of great and vicious qualities. As a commander he possessed decision, promptitude, daring, and valour, in a remarkable degree; in these respects indeed he surpassed all his competitors. But the laurels which he won in the field were stained by many cool-blooded atrocities, which altogether deprive the individual who perpe-

[1] Such is the account commonly given of the death of this scion of the house of Lancaster. It is worthy of remark, however, that the Harleian manuscript not only gives no sanction to this popular tale, but expressly declares that the prince was slain in the field.

[2] A reader of the present day who can calmly dispossess his mind of the poetical associations with which the subject is invested, will probably agree with a historian who has minutely investigated the subject, that Gloucester is to be exculpated from the charge of murder in this case. (See Turner's *History of England*, vol. ii. p. 375.)

History. 1483. trated them of any claim to real greatness. He was cruel and faithless, and no barrier was capable of restraining him from indulging in sensual gratifications. Besides five daughters, he left two sons; Edward prince of Wales, his successor, then in his twelfth year; and Richard duke of York, then in his eleventh year.

On the death of Edward IV. the kingdom was divided into new factions; and those of the queen's family, who, during the last reign, had come into power, were obnoxious to the old nobility, who looked upon them as upstarts and inferiors. The king had endeavoured to prevent these animosities proceeding to any extent, by desiring on his death-bed that his brother Richard duke of Gloucester should be entrusted with the regency; and he recommended peace and unanimity during the minority of his son. But the monarch was no sooner dead than the former resentment between the two parties burst forth with violence; and the Duke of Gloucester, to whom it is customary to attribute every bad quality, resolved to profit by their contentions. As soon as he learned the tidings of his brother's death, he proceeded to Ludlow Castle, where Prince Edward then was under the charge of Lord Rivers, his uncle by the mother's side. This nobleman was charged by Gloucester with having instilled into the mind of his young ward unfavourable opinions of the protector, and under this groundless accusation he was put into confinement, along with others of the Woodville family. Gloucester, with Buckingham, his noted accomplice, marched to London with Prince Edward, and the other young prince's person having also been secured, both of them were consigned to the Tower, under the specious pretext that they would there be safe from the machinations of their enemies. The coronation was postponed from the 4th of May till the 22d of June, so that the secret purposes of the protector began to be unveiled; and it would seem probable that Hastings and Stanley, the friends of the late king, began to show some misgivings as to the designs of Richard. At a council held in the Tower on the 13th of June 1483, Hastings was seized, and soon afterwards executed upon a log of timber, without any form of trial. Stanley and other obnoxious lords were thrown into various dungeons; and on the same day Earl Rivers and some others were executed at Pomfret Castle, on the most unjust pretences of treason.

The protector now considered himself as in a situation to lay claim to the throne. He used his utmost endeavours to inspire the people with a notion of the illegitimate birth of the late king, and that his children were not only illegitimate on this account, but also because their father had been secretly wedded to Elinor Butler previously to the solemnization of marriage between him and Elizabeth Woodville. Shaw, a popular preacher, was hired to harangue the people to this effect from St Paul's cross. The number of Edward's amours gave some plausibility to these rumours, and prepared the minds of the people for the usurpation of the crown by Richard. Two days afterwards Buckingham harangued the populace in much the same manner as Shaw; and on the 25th of June 1483, that nobleman presented Richard with a parchment purporting to be a declaration of the estates of parliament in favour of the protector, as the only legitimate prince of the house of York. Richard, with his usual dissimulation, evinced some hesitation upon the point; but on the following day he took possession of the crown, and from the 26th of June 1483 is accordingly dated the commencement of his reign.

The only obstacles which now interposed between Richard and the peaceful possession of the crown were his two nephews, whom he still kept in the Tower, for the sake of safety, as he miscalled their imprisonment. During a progress through the kingdom a confederacy was formed against him, and meetings were held, which had for their object the liberation of the princes. But this was unnecessary, as they had been privately dispatched by the king's orders. The manner of their death was kept a profound secret, and it is very doubtful if even yet we are acquainted with the real facts. The most probable account, however, is, that Richard having tampered in vain with Brackenbury, the governor of the Tower, to put them to death, found a ready instrument for the execution of his diabolical purpose in Sir James Tyrrel, his master of the horse. This individual, with two other ruffianly associates, having obtained access during the night to the apartment of the princes, smothered them as they lay asleep, and buried their bodies at the foot of the staircase.

History. 1484. Richard having thus secured himself on the throne, attempted to strengthen his interest by means of foreign alliances, and also by procuring the favour of the clergy at home; but he found his power threatened from a quarter where he least expected an attack. The Duke of Buckingham, who had been so instrumental in raising him to the throne, either thinking his services inadequately rewarded, or for some other causes which cannot now be ascertained, instigated a revolt against Richard. The horror with which the intelligence of the midnight murder in the Tower was received prepared the public mind for seconding the designs of Buckingham, who, with several other leading individuals in the kingdom, now declared for Henry, the young Earl of Richmond, in opposition to Richard. The earl, at this period an exile in Brittany, was considered as the chief of the Lancasterian party. His right to the crown by succession was, however, very equivocal; but the cruel behaviour of Richard inclined the people generally to favour his pretensions; and, in order to give an additional strength to his title, a match was projected between him and the Princess Elizabeth, the eldest daughter of Edward IV., which, by uniting the two rival families, would put an end to those dissensions which had so long distracted the kingdom and deluged it with kindred blood. Messengers were accordingly dispatched to give him information of the conspiracy, which fortunately escaped the usual vigilance of Richard; and, in about a fortnight afterwards, Richmond returned an answer, which was no sooner communicated to his friends than it reached the ears of the king. The latter immediately summoned his adherents to join him with their retainers at Leicester; and after proclaiming Buckingham a traitor, he marched against him at the head of his army. In the mean time storms interrupted the voyage of Henry; and the army of Buckingham, dispirited by broken bridges and impassable currents, broke up and dispersed. A price was set upon the head of Buckingham, who fled, but was betrayed into the hands of Richard, and immediately put to death.

Richard, now emboldened by his success, employed every means of confirming his title to the throne, and destroying the plans of the exiles and malcontents. He summoned a parliament, the first which he had ventured to call together; and an act was passed declaring him undoubted king of the realm, and settling it upon his son Edward, prince of Wales. The marriage of Edward IV. with Elizabeth Woodville was declared null, and his son pronounced a bastard: then followed a severe bill of attainder, in which several noblemen, bishops, knights, and gentlemen, were deprived of their estates, honours, and rights.

But notwithstanding all the measures of severity adopted by Richard, he was seriously alarmed at the projected marriage between Henry of Richmond and the eldest

daughter of the late king. To defeat this project, therefore, now became the chief policy of the king. The princess was induced to quit her sanctuary and come under the protection of Richard, who probably had destined her for his son; but the death of that prince forced him to alter his plans, and secure her for himself. Lady Anne Neville, Richard's queen, was in infirm health, and this induced him secretly to make an offer of his hand to the young princess, which she agreed to accept. During the illness of Anne, Elizabeth discovered, it is said, an unnatural degree of impatience, and hinted her surprise at its duration; a most suspicious circumstance. Her apprehensions, however, were soon allayed. In less than a month the queen died; but her hopes of sharing the throne with Richard were not realized. The match was so very unpopular that the royal wooer was dissuaded from his purpose, and his attention was soon directed to another quarter.

The crimes of Richard had alienated the greater portion of the York party from his interests; and a union between Elizabeth and Henry, for the purpose of reconciling conflicting factions, became a topic of serious consideration. The latter prince again conceived the hopes of seizing the crown by another invasion of England; and having collected an army of three thousand men, he set sail from Harfleur early in August 1485, and landed at Milford Haven on the 6th of that month. Richard affected to hear the intelligence with joy; and displaying the vigilance and activity of his brother Edward, he marched from London on the 16th. His competitor had directed his march through the northern districts of Wales, a tract of country in the interest of the Stanleys. Both armies met at Bosworth in Leicestershire, on the 22d of August 1485, where a battle was fought, memorable for having restored tranquillity to the kingdom, which had so long been the theatre of sanguinary civil wars.

The army of Richmond amounted to about six thousand men, that of the king to nearly twice the number, and both prepared for the contest, equally confident of victory. For, notwithstanding the inferiority of Richmond's troops, he was secretly encouraged by the promises of Lord Stanley, who was hastening, with seven thousand men under his command, apparently to join the royalists, but really with the intention of siding with Henry. Stanley continued his march slowly; and on the morning of the battle he took up a neutral station on the wing of either host. The king entrusted his vanguard to the Duke of Norfolk, whilst that of Henry was assigned to the Earl of Oxford; and the two competitors for the crown placed themselves at the head of the main bodies of their respective armies. Richard, taking advantage of a marsh which covered his right flank, ordered a shower of arrows to be discharged into the adverse ranks, which for a moment threw them into confusion. He sent orders to Stanley to join him immediately; but the refusal of that nobleman to comply with his request shook his confidence and also that of his army, which now began to waver. To complete his dismay, he saw Stanley join the ranks of Henry, a circumstance which determined the fortune of the day. But, in order to retrieve it, Richard made a vigorous effort worthy of a better cause. Chancing to observe Henry in the midst of the conflict, he made a dash at him, determined to cut him down or perish in the attempt. He slew with his own hand Sir William Brandon, the bearer of the hostile standard, unhorsed Sir John Cheney, and was within a blow of his rival, when he was overpowered by numbers, struck to the ground, and immediately slain. After his fall resistance was hopeless, and his army broke up and dispersed. The crown which he wore on that day was taken up by Lord Stanley and placed on Henry's head, who was instantly greeted with shouts of "Long live King Henry." Of Richard's army a considerable number were killed in the battle and pursuit, and amongst these were the Duke of Norfolk, and Lords Ferrers, Radcliff, and Brackenbury. The victors lost but few, and none of any note except their standard-bearer. To enhance their triumph, Lord Strange, the son of Stanley, whom Richard had ordered for execution before or during the conflict, escaped in the confusion and rejoined his father. The body of the tyrant was thrown carelessly across a horse and conducted to Leicester, where it was interred with small ceremony.

Of Richard's character little remains to be said. The crimes of which he was undoubtedly guilty almost remove him from the ranks of mankind, and class him with the most ferocious animals. The arguments which have been brought forward in modern times to prove his innocence are inconclusive, and scarcely to be named, when confronted with the mass of evidence which may be arrayed against him. His fall excited no regret, except amongst a few of his partizans, the slaves of his despotic will. How could it? The death of his unoffending nephews must have still been fresh in the memory of his subjects.

The quarrel between the houses of York and Lancaster was now brought to a conclusion. In order to secure the blessings of peace and an undisputed succession, it was necessary for Henry at once to espouse Elizabeth, and, by so doing, to blend the white and the red roses together. There is no concealing the fact that his title to the crown was of a very ambiguous description. It rested on three grounds, first, his marriage with Elizabeth; secondly, his descent from the house of Lancaster; and thirdly, the right of conquest. According to the sagacious Bacon, "he rested on the title of Lancaster in the main, using the marriage and the victory as supporters." But this main support was not a valid one; for even allowing his descent from John of Gaunt to have been legitimate, he was not the nearest descendant of that prince's children. There were several who had claims superior to his; but the individual whom Henry looked upon with peculiar jealousy was Edward Plantagenet, son of the late Duke of Clarence. After the death of this prince's father, Richard sent for him to court, and created him Earl of Warwick, the title borne by his grandfather; but fearing that he might afterwards become a dangerous competitor, Richard had him conveyed to a distant fortress; and one of the first acts of Henry was to change his place of confinement, and put him in the Tower, as a prison of greater security. Elizabeth, who had been his fellow-captive, was ordered to be conducted to the house of her mother in London, whilst Henry himself leisurely followed her to the capital. He was received there with every demonstration of joy, and greeted by the inhabitants as the deliverer of his country. His coronation was delayed for a time, by the breaking out of a dreadful disease, called from its predominant symptom the sweating sickness. But at the end of a month its virulence began to abate, and Henry was crowned on the 30th of October 1485. To heighten the splendour of the ceremony, he bestowed the rank of knights-banneret on twelve persons, and conferred peerages on three. Jasper earl of Pembroke, his uncle, he created Duke of Bedford; Thomas, Lord Stanley, his father-in-law, Earl of Derby; and Edward Courtenay, Earl of Devonshire. At the coronation likewise appeared a new institution, which the king had established for personal security as well as pomp; a band of fifty archers, who were denominated yeomen of the guard. But lest the people should take umbrage at this step, as if it implied a diffidence in their loyalty, he declared the institution to be perpetual. The ceremony of the

coronation was performed by Cardinal Bourchier, archbishop of Canterbury. On the 18th of January 1486, Henry was united to the Princess Elizabeth; and his marriage was celebrated at London with even a greater appearance of joy than either his first entry or his coronation.

The reign of Henry VII. was for several years disturbed by plots and insurrections. The people, by a long course of civil war, had become so turbulent and factious, that no governor could rule, nor was any king likely to please them. The violent animosity expressed by this monarch, however, against the house of York, may justly be considered as one of the causes of the extreme proneness to rebellion which was manifested amongst his subjects. Instead of endeavouring to conciliate the affection of the opposite party, he invariably strove to quell them by force and violence. For this purpose, soon after his accession he took a journey to the north of England, where the Yorkists were very numerous, trusting that his presence might overawe them. On his way thither he received intelligence of an insurrection against him, headed by Viscount Lovel, with Sir Henry Stafford and his brother Thomas. The two latter had raised an army, and were marching to besiege the city of Worcester; whilst Lovel was hastening to their assistance with a body of several thousand men. But they were induced to disperse by the offer of a general pardon. Lovel withdrew from his troops, who immediately gave in their submission to the king. The Staffords took refuge in the church of Colnham, near Abingdon; but they were dragged from this sanctuary, as it was found not to possess the privilege of sheltering rebels. The elder brother was executed at Tyburn, but the younger one received a pardon.

Henry returned from his northern tour, and soon afterwards his queen presented him with a son, whom he named Arthur, in honour of the supposed progenitor of the house of Tudor, the renowned King Arthur; but Henry was not permitted to enjoy undisturbed security. He never was at any time popular except amongst his own party; and in the northern counties, particularly, the late King Richard was remembered and spoken of with regret. Henry was hated for his success, and even charged with having put to death the young Earl of Warwick, whom he had imprisoned, as has already been mentioned. It was necessary for the king to exercise extreme caution, on account of the dangers which surrounded him; and hence he is described as having been mysterious and impenetrable. Sir Thomas More remarks that one thing was frequently pretended whilst another was meant; and Bacon says that the king had a fashion rather to create doubts than assurance. The birth of his son seems to have roused his enemies to make some exertions against him; and being destitute of any chief of sufficient ability round whom insurgents might rally with any hope of success, they were urged to make one of the most extraordinary attempts recorded in history. One Richard Simons, a subtle priest of Oxford, took under his charge Lambert Symnel, the son of a tradesman belonging to the same town. The boy was about eleven years of age, comely, and not without dignity and grace in his person. With this individual, who was well tutored to perform the extraordinary part which was to be assigned him, the churchman landed in Ireland, and presented him to the lord-deputy of the county as Edward Plantagenet, earl of Warwick, who had made his escape from the Tower. It seems to have been at first the design of the fabricators of this singular deception to have presented him to the public as the younger of the princes who had been put to death by Richard in the Tower. In order to further this scheme, a report was circulated that one of these princes had made his escape from his assassins. Why this plan should have been changed, and the youthful impostor seduced to personate an individual still living, it is difficult to conjecture; but such is the fact. The Earl of Kildare, to whom he was presented in Ireland, swallowed the bait, and allowed the claims of Symnel without discussion. This nobleman was a zealous adherent of the house of York; and the little colony called the English Pale, long ruled by that party, retained all its ancient attachments. A belief in the identity of Symnel with the Earl of Warwick became universal, both amongst the nobility and the people. He was lodged in the castle of Dublin; the inhabitants universally took an oath of allegiance to him, as the true descendant of the Plantagenets; he was crowned with a diadem taken from the statue of the blessed virgin, and proclaimed king by the title of Edward VI.

Such an unexpected event so alarmed Henry that he would have gone over to Ireland in person to quell the rebellion, had he not dreaded the machinations of the queen dowager in his absence. To prevent any thing of this kind from occurring, it was resolved to confine her for life in a monastery, under pretence, however, that it was done on account of her having formerly delivered up the princess her daughter to King Richard. The royal dame murmured at the severity of her sentence; but the king persisted in his resolution, and she remained in confinement till her death, which did not take place till some years afterwards.

The next measure was to exhibit the person of Warwick to the people. That prince was accordingly taken from the Tower, and conducted through the principal streets of London; after which the procession moved to St Paul's, where great numbers were assembled to see him. Still, however, the fictitious Warwick prospered in Ireland, and being furnished by the Duchess of Burgundy with a body of two thousand veteran Germans, under the command of Martin Swart, a brave and experienced officer, the invasion of England was determined upon. He landed in Lancashire, whence he marched towards York, expecting that the country people would rally round his standard during his march. But in this he was disappointed; the people were unwilling to join a body of foreigners, and were besides kept in awe by the reputation of Henry. Lord Lincoln, therefore, who commanded the rebel army, determined to bring the matter to a speedy issue. Accordingly he met the royalists at Stoke, in the county of Nottingham, and an obstinate engagement took place, which terminated in Henry obtaining a complete victory. Lord Lincoln, with four thousand soldiers, perished in the action; and Symnel with his tutor Simons were taken prisoners. Simons being a priest, could not be tried by the civil power, and was only committed to close confinement. Symnel was pardoned, and made a scullion in the king's kitchen, whence he was afterwards advanced to the rank of falconer, in which capacity he died. Thus ended this most absurdly planned and injudiciously executed revolt; but it was not destitute of good results. It taught the king that the house of York was not to be trampled upon with impunity; for to such an extent had his antipathy to the branches of that family and its adherents been carried, that it was said his own queen was not exempt from the common odium which was thrown upon them. It was asked by the people, why was she, the rightful heir to the throne, not crowned, and invested with the usual insignia of royalty? Henry silenced these rumours by ordering her coronation; and from that period she shared with him the usual honours of royalty.

Having thus to a great extent established his authority at home, he thought of diverting the minds of his subjects from domestic insurrection to foreign enterprise. He

History. 1487. does not appear, however, to have had any intention of prosecuting a serious war in a distant country, but he used the pretext as a means of aggrandising himself. A parliament was summoned, which granted the king a considerable sum for prosecuting the war in Bretagne, the only great fief of the French crown which still retained its own prince and its ancient constitution; by force, by policy, or by good fortune, the French monarchs had obtained possession of all the others. But of the supply granted by parliament, only a small part could be raised. The northern counties not only refused payment of their proportion, but rose in revolt, and murdered the Earl of Northumberland, the king's lieutenant. The insurrection, however, was quickly suppressed by the Earl of Surrey. John a Chambre, one of the ringleaders, suffered at York; and Sir John Egremont, the other, escaped to the Duchess of Burgundy, where he had leisure to hatch new schemes of rebellion. The money which Henry by this means obtained, and also in consequence of another grant from parliament, was quietly deposited in his coffers. For although he collected a considerable army, with which he proceeded to Calais, the king had other objects than victory and conquest in view. Some months previously to his landing on the Continent, he had commissioned the governor of Calais to negotiate a peace and alliance with Charles of France, which was formally concluded. To the French monarch the possession of Bretagne was an important object; and Henry, naturally avaricious, agreed to accept about L.200,000 as a reimbursement for the expenses of the expedition. It was also stipulated that the king of France should pay to him and his heirs an annual pension of 25,000 crowns.

But Henry's hopes of a tranquil possession of the crown of England were doomed to perpetual disappointment. His reign was now to be disturbed by one of the most mysterious personages to be met with in English history. About the time when war was declared against France, a pretender to the regal dignity appeared in Ireland, which seems to have been the natural soil for these spurious shoots of royalty. This impostor passed under the name of Perkin Warbeck, but asserted himself to be Richard duke of York, the second son of Edward IV. who, it was alleged, had escaped from the Tower when his brother was murdered. Previously to his appearance in Ireland, he had been heard of at the court of Margaret, his supposed aunt, who interested herself to the utmost in his favour, and fondly styled him the White Rose of England. But he was compelled to quit Burgundy; for Henry had dispatched some ambassadors to the sovereign of that country, with secret instructions to demand either the person of the impostor, or his expulsion from the territories of the duke. Warbeck was received with open arms in Ireland, for the Irish were fanatically attached to the house of York. Several noblemen who had credulously believed in the fraud of Symnel, from which they had just escaped, gave countenance to his pretensions. A deputation was sent to Flanders to ascertain his history; but they had been corrupted by Henry before their landing in Burgundy, and they returned fraught with charges of treason against the disaffected nobility. Some of the most eminent malcontent Yorkists were put to death, and amongst the rest Sir William Stanley, lord-chamberlain, to whom the king had owed his life on Bosworth field. His fate was most mysterious, and the conduct of Henry upon this occasion is open to the most odious suspicions. Sir Robert Clifford, the individual whose information led to these executions, was a confidential Yorkist; and his behaviour towards his own party, so different from what might have been expected, tended to dissolve the ties which subsisted between it and the malcontent exiles.

Three years had now elapsed since the pretender had set forth his claim, and during that period he had never attempted to establish it by legal proof. He began to feel that he stood upon delicate ground, and resolved at once to enforce his pretended right by an appeal to the sword. With a small force collected in Flanders (for he had been for some time absent from Ireland) he made a descent in the neighbourhood of Deal; but the adventurers were attacked by the inhabitants, and all of them driven back to their vessels, or taken prisoners. Warbeck himself made his escape, and returned in despair to Flanders. From this country he was ejected at the instigation of Henry; and after vainly attempting to gain a footing in Ireland, he set sail for Scotland, where he was well received by the young king, who professed a conviction in the justice of his title. King James conferred upon him the hand of Lady Catherine Gordon, a near kinswoman of his own. The adventurer's fortunes being thus suddenly elevated, he, along with the king of Scotland, advanced into England; but not a native sword was unsheathed in favour of the White Rose. The enthusiasm which had been excited amongst the Scots by his first appearance in their country had begun to decline, and during a long truce, which served all the purposes of a treaty of peace between James and Henry, it was agreed to by the former that he should induce Warbeck to quit Scotland. The adventurer, with a few adherents, accordingly departed, and, after touching once more at Cork, and in vain soliciting the aid of Earl Desmond, steered for Cornwall, where he landed on the 7th of September 1497.

History. 1501.

His arrival in this part of the country was a politic step, for an attempt to raise a tax there some time before gave rise to an insurrection, which, although quelled, left behind heartburnings and discontent. A considerable body of Cornish men joined his standard, and before he reached Exeter his army amounted to six thousand men. But the king arrived, and preparations were made for a battle; the heart of the pretender, however, failed him at the sight of the royal standard, and instead of risking an engagement for the crown, he withdrew during the night, and entered his name in the sanctuary of Beaulieu in Hampshire. His followers laid down their arms to the king, and his wife also submitted to his authority, and was placed near the person of the queen. From his sanctuary the fugitive was removed by the king to London, where he was ordered to keep within the precincts of the palace. He contrived, however, to make his escape, but, despairing of getting out of the country, surrendered himself to the prior of the monastery of Shene. The monk contrived to prevail with the king to spare his life; but he was condemned to stand in the stocks and make a public confession of his imposture, after which he was committed to the Tower. In this fortress he met with a singular companion, the real Earl of Warwick, who had now been a prisoner for the period of fourteen years. His life had thus been passed in cheerless captivity, for no other offence than that of being the sole survivor of the male descendants of Edward III. The two contrived a means of escape, but they were discovered. Warbeck was executed at Tyburn; and the son of Clarence having been arraigned for high treason, was condemned to death and beheaded on the 28th of November 1499. This deed was worthy of Richard III. It was a cool-blooded murder, aggravated by circumstances; for the harmless and joyless victim was, from his long confinement, reduced to a state of idiocy. The human soul shudders to think of such atrocities, perpetrated in defiance alike of justice and humanity. From the guilt of shedding innocent blood it is impossible to purify the name of Henry VII.

In 1501, the king's eldest son Arthur was married to

History. 1501.

the Infanta Catherine of Spain; but he survived the marriage only a few months, having died on the 2d of April following. It was agreed upon a short while afterwards, by the parents of the parties, that the widow of the late prince should be espoused by Henry's next son, now Prince of Wales, and afterwards Henry VIII. The union was sanctioned by the pope, who granted a bull, dispensing with any impediment which their affinity might otherwise cause. The eldest daughter of King Henry was conferred upon James IV. of Scotland; an important union, as from this stock sprung all the sovereigns who have since reigned in Great Britain. King Henry, in his own time, was called the Solomon of England; and, without allowing him to possess undisputed claims to so high-sounding a title, the saying recorded of him regarding the Scottish marriage displays no common foresight and sagacity. When some of his counsellors objected to it, on the ground that the kingdom might thereby fall to the king of Scotland, he answered, " Scotland would then become an accession to England, not England to Scotland; the greater would draw the less; it is a safer union for England than one with France."[1]

In the latter part of this king's reign, his economy, which had always been very exact, degenerated into avarice, and his oppressions at last became severe. In Empson and Dudley he possessed two ministers, who did all that inventive minds could suggest, and hearts of stone perform, to gratify a rapacity, which fed with equal appetite on friend and foe. We are informed by one of the wisest of historians and of men, that these individuals had no reputation, otherwise than by servilely following his bent, and that they " shaped his way to those extremities for which himself was touched with remorse at his death."[2] The hoard which the king had amassed by their unjust extortions, and which was mostly kept in " secret places at Richmond," is said to have amounted to nearly L.16,000,000 of our present money. This amount of specie is so enormous as to warrant a conviction that it has been greatly exaggerated. It may be doubted whether the whole circulating medium of the country at that period amounted to the sum which the avaricious monarch is said to have accumulated.

Henry, who had enjoyed an uncommon share of health during his life, was at fifty-two years of age attacked by severe indisposition. He died on the 21st of April 1509, in the twenty-fourth year of his reign, which, although perpetually disturbed by domestic insurrections, was upon the whole prosperous. He was interred in the chapel at Westminster, which still bears his name; one of the noblest trophies of architectural genius produced in any age, and which confers peculiar distinction upon that in which it was erected. There are many acts of Henry's administration, and some of these have already been particularised, which cannot be related but to his discredit. He was mean, sordid, and unamiable in his nature. No tenderness softened his rigid nature, if we except that which he evinced towards his mother; a virtue, however, too common to be praised even in a king. We see no qualities about the man which inspires us with regard for him; but there are many virtues to admire in the ruler. He favoured every national improvement; and, though penurious to excess in ordinary or essentially private matters, he was munificent in public works. He greatly improved the laws of the realm. With respect to these, Lord Bacon remarks, with his usual clearness and sagacity, " his laws are deep, not vulgar; not made upon the spur of a particular occasion, for the present, but acts of prudence for the future, to make the estate of his people still more happy, after the manner of the legislators in ancient and heroical times." He manifested great regard for trade, as is evinced by his excellent laws for promoting it, and by the extended commercial intercourse of the country. He accepted the offer of Columbus to make that most memorable of voyages, in which he lifted the veil that covered a grand division of the globe, and would have patronized it if he had not been forestalled by Isabella. He gave his sanction to Cabot's celebrated voyage (see CABOT), and fitted out a ship to join the expedition. In fine, the country improved under his government, and became steadily attached to his family

History. 1512

Henry VIII. son of the preceding monarch, ascended the throne on the 22d of April 1509, being then in the eighteenth year of his age. He assumed the reins of government under most auspicious circumstances. His title was undisputed; his treasury was well stocked; commerce was in a flourishing condition; and the kingdom, which now may be supposed to have looked to the youthful monarch with hope and indulgence, was at peace with every foreign power, and quiet in itself. He was prepossessing in person, accomplished in mind, and adroit in every martial and fashionable exercise. But these advantages belonged to an individual whose heart was usurped by debasing passions, and whose mind was cast in the true mould of despotism.

On the 6th of June 1509, Henry and Catherine were finally united in wedlock, and on the 24th of the same month they were crowned with great splendour. One of Henry's first acts was to bring Empson and Dudley, the obnoxious ministers of his father, to trial. As a capital accusation could not be brought against them for merely executing the will of the late king, it was found necessary to indite them for a conspiracy to seize upon London with an armed force during the last illness of Henry. Of this charge, absurd and incredible as it appears to be, these individuals were convicted; and though it seems probable that the king would have been satisfied with imprisonment for life, yet so clamorous were the people for the blood of the culprits, that he was compelled to sign a warrant for their execution, which took place on Tower Hill.

In 1511, Henry entered into a league with Pope Julius II., Ferdinand king of Spain, and other continental powers, against Louis XII. of France. In this alliance the king of England was not a deeply interested individual; but his vanity was flattered with the idea of receiving the title of Most Christian Majesty, which was promised to him by the pope. The object which the confederates had in view was to wrest from Louis some valuable provinces which he had obtained in Italy; and although Henry had no hope of sharing the spoil with them in this quarter, yet the occupation of the French monarch in schemes of aggrandisement beyond the Alps afforded an opportunity to the English of invading France, and reviving the old chimera of conquering that country. The point, whether England should aim at continental dominions, was debated in parliament; and the arguments against it greatly preponderated. But the vanity of Henry was too much flattered to relinquish the scheme. He sent an ambassador to demand of Louis the ancient patrimony of the English crown in France, and this being refused, war was denounced. Parliament granted a supply, and an army was equipped and sent into Spain. But this expedition was attended with no success, and the troops, dispirited and mutinous, returned to England towards the close of 1512. On the north-western frontier of France, however, the arms of Henry were triumphant, and also in Scotland,

[1] Bacon, iii. 409.

[2] Ibid. iii. 379.

History. 1513. which had been tempted by French councils to invade England. James IV. with a considerable army under his command, was met by the Earl of Surrey at Flodden, where a bloody battle was fought, in which the Scots were totally routed, and their king, with the greater portion of his nobility, perished. (See SCOTLAND.) Henry received the news of this victory at Tournay, which he had invested, after having demolished Terouanne. The latter city opened its gates to him in eight days; but all parties being now disposed for peace, a general treaty was concluded in August 1514.

With regard to the administration of government in England, when Henry mounted the throne, the leading ministers in the cabinet were, Howard, earl of Surrey, lord treasurer; and Fox, bishop of Winchester, lord privy seal. Amongst the inferior dependents of the court there now appeared an individual, whose ambition and talent enabled him speedily to supplant every competitor. This was Thomas, afterwards Cardinal Wolsey, who, although only the son of a burgess of Ipswich, gradually raised himself to the first offices of state. (See WOLSEY.) His preferment had been rapid beyond all precedent, and this was not likely to be forgiven by an envious world. From the year 1513 to 1515, he had passed through the various gradations, from being bishop of Tournay, to the honours of the cardinalate, and he succeeded Archbishop Worham in the office of chancellor. With respect to the manner in which he executed his duty as a high public functionary, Sir James Mackintosh remarks, that "his administration of justice as chancellor has been celebrated by those who forget how simple the functions of that office then were; and his rigid enforcement of criminal justice appears only to have been a part of that harsh but perhaps needful process by which the Tudor princes rather extirpated than punished criminals, in order to reclaim the people from the long license of civil wars. As he was chiefly occupied in enriching and aggrandizing himself, or in displaying his power and wealth, objects which are to be promoted either by foreign connections, or by favour at court, it is impossible to determine what share of the merit or demerit of internal legislation ought to be allotted to him. His part in the death of the Duke of Buckingham was his most conspicuous crime; yet, after all, it is probable that he was no worse than his contemporary statesmen. The circumstance most favourable to him is the attachment of dependents."[1]

On the death of Maximilian, which happened towards the end of the year 1519, Henry, along with the kings of France and Spain, became a candidate for the imperial throne. The Spanish monarch was the successful competitor, and, to soothe the wounded pride of Henry, he paid him a visit of ceremony at Dover. His principal design in this was to persuade Henry to abandon a projected meeting which was to take place between him and the king of France, the wily emperor dreading that such an interview might be fraught with danger to himself. He was unsuccessful, however, and the two monarchs met between Ardres and Guines in 1520. The place where this meeting was held has been long celebrated under the name of the Field of the Cloth of Gold. The pomp and parade, the tournaments and other sports of the age, exhibited upon the occasion, were on the grandest scale, and peculiarly calculated to delight the young king of England, a creature of impulse, and one who sacrificed policy to temper, and interest to passion. It was thus that the continental monarchs flattered his foibles, and ingratiated themselves into his favour.

About the same time a crime was perpetrated, in the guilt of which both Henry and his minister Wolsey have been implicated; we mean the execution of Edward Stafford, duke of Buckingham. This nobleman was descended from the youngest son of Edward III.; and the principal accusation brought against him was, that he had tampered with a priest who laid claim to the gift of prophecy, and who had foretold that he would yet ascend the throne in virtue of his descent. Several other charges equally absurd, and not amounting to an overt act of high treason, were brought against him; he was tried by a jury of peers, condemned to death, and beheaded on the 17th of May 1521. Upon this occasion the populace vented their indignation against Wolsey, whose subtle policy had brought the sufferer to the scaffold, by loud cries of "the butcher's son." History. 1527.

Wolsey, however, continued to rule with unabated sway from 1521 till 1527. This period is not distinguished by any events of importance, if we except the opposition which the House of Commons offered to the minister in his attempts to raise supplies. That body obstinately disputed these grants, and attempts were made to raise money by the expedients of forced loans and pretended benevolences, which the legislature had already condemned. But these attempts produced a small supply and a great deal of discontent. Wolsey, notwithstanding his unwearied exertions in behalf of his master, never felt himself perfectly secure in his elevated situation. The capricious and tyrannical temper of Henry forbade his ministers to be at ease in any place of trust near his person. The fall of Wolsey seems always to have appeared to himself as an event of very likely occurrence, and these gloomy forebodings were at last realized. The cause of the rupture between the king and him was the divorce of Queen Catherine, which the former had begun to project. But the fall of Wolsey was not the only event connected with Henry's divorce; it ultimately led to one of the most memorable transactions in the history of England, namely, the separation of that country from the communion of the church of Rome.

The doctrines of the reformation, propagated by Luther in 1517, had gained considerable ground in England, and many professed a belief in them, notwithstanding the severe persecution which had been carried on against heretics during some of the preceding reigns. The papal authority, though still very great, had in the space of ten years declined considerably; but a detail of the circumstances connected with this subject is not required in this place. It may be noticed in general, that the reformation in England was facilitated by the undeniable corruption of the clergy, and the experience which many individuals had of, and the partiality which they entertained for, the doctrines of Wickliff. The seed sown by that divine had never been destroyed; and if it did not show itself above ground, it was extending itself underneath, perpetuating a sort of dormant existence, and ready to spring up on the first propitious occasion. Besides, the marriage of King Henry was looked upon by many as in itself illegal, and only sanctified by a dispensation from the pope.

Whether Henry himself, during the early years of his reign, felt any scruples about the validity of his marriage, may reasonably be doubted; for no trace of any thing of the kind can be discovered in his public conduct till the year 1527. The queen was some years older than himself, and was now past the meridian of life. Her personal charms had decayed, and the heart of the royal sensualist could not be attracted by beauty that belonged purely

[1] *History of England*, vol. ii. p. 121.

History. 1527.

to the mind. She had born him several children, all of whom died in infancy except the Princess Mary, who survived both her parents, and afterwards ascended the throne. It is reported of the inconstant monarch, that he attributed the mortality in his family to the curse of heaven, which blighted his unnatural alliance with Catherine, his brother's widow. But there was another and more powerful circumstance which led him to contemplate a divorce from his queen; this was the love which he had contracted for Anne Boleyn. The charms of this lady had touched his fiery but not unsusceptible heart; and as his passion could not be gratified except by means of an alliance sanctioned by law, he set seriously to work for the purpose of removing the amiable partner of his throne and bed, and placing the youthful beauty in her stead. The secret intentions of the king having become to some extent public, he ventured to ask the opinions of the most eminent ecclesiastics upon the point. The dangers of a disputed succession, if the king should die without male issue, were brought forward as an urgent plea for taking the step which he had in view. He had also recourse to his theological lore, and certain religious scruples connected with his first marriage helped to give a colour of principle to his real desires, and at the same time to impart to them life and warmth. Some of the divines whose counsel was asked declared that no dispensation could authorize a marriage with the widow of a brother; which they proved from a passage in the Pentateuch. Others, who also founded their arguments upon a portion of Scripture, contended that the prohibition referred to by the opposite party was not universal, and might be dispensed with in the king's case, where the first marriage had been unproductive of issue. Cardinal Wolsey, who had a hazardous game to play, coincided with the former, and gave Henry hopes that his petition to the court of Rome would be successful. But Anne was not the individual whom the prelate had in his eye as a wife for the king. He was desirous of wedding his master to a French princess, and, we are informed, threw himself on his knees before Henry, and entreated him to desist from a project so unworthy of his birth as an alliance with the Boleyn family. But the pliant mind of the cardinal yielded to the impetuosity of his master and to the force of circumstances; and he found it necessary to atone for his indiscreet zeal by displaying redoubled activity to promote the marriage with the lady upon whom the king had fixed his affections. The illustrious Sir Thomas More declined to support the divorce, and Fisher bishop of Rochester acted with the same integrity.

A deputation was sent to Rome by Henry for the purpose of sounding Pope Clement upon the subject of the divorce. The pontiff was in a situation unfavourable to the success of the application; and although he was bound to the English monarch by the ties of gratitude, he declined giving an immediate assent to the proposition, but appointed two legates to hear and determine the validity of the first marriage of Henry. He also gave a solemn promise not to recall the commission, nor to do any act which should annul the judgment or prevent the progress of the trial. The pontiff was at this period engaged in a contest with the imperialists; but he at last concluded a treaty of alliance with the emperor, who appeared the only potentate capable of shielding him from his other enemies. The forensic disputes respecting the divorce still remained unsettled, and, from the date above mentioned, Clement took his final part against the degradation of the queen of England, who was an Austrian princess. But still, by ingenious delays and plausible formalities, he contrived to amuse Henry, whose power it was not his interest to treat with direct contempt. The patience of the English monarch, however, was now completely worn out by these fruitless attempts at negotiation, and he redoubled his entreaties to the pope to comply with his demands. Clement, in order to show a willingness to acquiesce in the wishes of Henry, sent over Cardinal Campeggio, who, either separately or in conjunction with Wolsey, was empowered to hear and determine the matrimonial suit. The legate at first attempted to dissuade Henry from pursuing the divorce; but being unsuccessful with the monarch, he next tried to persuade Catherine to embrace a religious life, in which he also failed. The popular feeling was against Henry, and he felt himself compelled to remove Anne Boleyn from court, where she had for some time resided. At a great council which he convoked, he declared that in prosecuting this matter he was solely actuated by a desire to know whether or not his only remaining child Mary was the rightful heir of the crown. On this occasion he made an appeal to the feelings and consciences of his hearers which affected them much; and the perplexities consequent upon the late proceedings afforded Campeggio an opportunity for putting off the decision of the question until he had obtained further instructions from Rome. Meanwhile Clement was seized with a dangerous illness, which retarded his answer, and is said to have revived in the ambitious mind of Wolsey a hope which he had before indulged in, of obtaining possession of the tiara. This occurred in the spring of 1529; and although the pope recovered from his sickness, his legate contrived from time to time to postpone the trial. On the 31st of May, however, the court of parliament met, and summoned the king and queen to meet on the 18th of June. The latter obeyed, but protested against the judges, and appealed to the pope. At the next session, on the refusal of the cardinals to admit the appeal, she rose, and in a calm and dignified manner threw herself at Henry's feet, imploring him in a truly eloquent address to desist from his intended purpose of repudiating her. It made a profound impression upon the audience, and even touched the cold heart of her husband. The legates carefully prolonged the trial until July, when a vacation from July to October took place, during which time all courts were bound to suspend their sittings; and, notwithstanding the importunities of the king, Campeggio contrived to get the suit removed to Rome. Agreeably to the instructions of Clement, Campeggio quitted England, and the pope summoned Henry to appear before him in forty days.

History. 1529.

In these transactions Wolsey took no inconsiderable share, and the compliant manner in which he gave his consent to the suggestions of Campeggio excited the suspicions of the king, that his minister was playing a double game with him. The symptoms of approaching disgrace now became too palpable to escape the notice of the cardinal; for all parties joined either openly or privately to destroy him who had so long enjoyed the favour of the king. It was a singular coincidence that the friends both of Queen Catherine and Anne Boleyn were employed as instruments of his overthrow. On the 9th of October 1529 a prosecution was commenced against him for procuring bulls from Rome without the king's license. On the 17th of the same month the great seal was taken from him and given to Sir Thomas More. On the 1st of December the lords presented an address to the king, in which were embodied various articles of accusation against the cardinal; and notwithstanding that the more serious parts of the charge were refuted by his servant Thomas Cromwell, the court at last pronounced him to be beyond the protection of the law, and "that his lands, goods, and chattels were forfeited, and that his person was at the mercy of the king." Wolsey had confessed his offence against the statute of *præmunire*, of which he was technically guilty,

History. 1529.

inasmuch as he had received the bulls without a formal license. It is scarcely necessary to observe that the sentence pronounced was most unjust; for the bulls had been obtained with the consent and for the service of his ungrateful master, under whose eye they had been executed for years without a word being uttered as to the manner in which they had been obtained. But nothing could now save the cardinal. He was at once hurled from his place of pride and power, and fell, with his vast possessions, a helpless victim, into the hands of the king. But it would appear that, from habit perhaps, Henry still cherished a feeling of partiality for his old favourite, and sent him from time to time tokens of his esteem and regard. In February 1530 Wolsey was actually pardoned, and restored to his see of Winchester, and to some other emoluments. Even the great diocese of York was shortly afterwards restored; but at the moment when he was making magnificent preparations for his installation on the archiepiscopal throne, he was arrested at Cawood on a charge of high treason. His health was infirm, and during his journey from York he was seized with a dysentery, which confined him for some time at the seat of Lord Shrewsbury. As soon as he was able he mounted his mule and resumed the journey. But his strength rapidly declined, and he was compelled to take refuge in the abbey of Leicester, where he expired on the 30th of November 1530, in the sixtieth year of his age.

After the death of Wolsey, the king, by the advice of his ministers, had the legality of his marriage debated in all the universities of Europe. (See the article CRANMER.) By dint of money he succeeded in obtaining their votes in his favour, but not without a stubborn opposition. Backed by these judgments, Henry appealed to the pope; but Clement remained inflexible, and the king prepared to resist the papacy, though not yet to separate himself entirely from the church of Rome. In 1532 Cranmer was elevated to the archbishopric of Canterbury; and early in the following year Henry privately married Anne, and thus himself determined the long debated topic. A few months afterwards he openly solemnized his marriage with Anne, who went in state with him as queen. On the 23d of May Cranmer pronounced, not a divorce, but a sentence that the king's marriage with Catherine had been and was a nullity, because it had been contracted and consummated against the divine law; and not long afterwards he confirmed the marriage of the king with the Lady Anne, whose coronation was performed in the most gorgeous manner on the first of June 1533. (See BOLEYN.) The unfortunate Catherine, perceiving all further opposition to be vain, retired to Ampthill, near Dunstable, where she remained for the rest of her days in privacy and peace.

The pope was no sooner informed of these proceedings, than he passed a sentence declaring Catherine to be the king's only lawful wife; requiring him to take her again, and denouncing censures against him in the event of refusal. Henry, on the other hand, knowing that his subjects were entirely at his command, resolved to separate altogether from the church of Rome. In the year 1534 he was declared head of the church by parliament; the authority of the pope was completely abolished in England; all tributes formerly payable to the holy see were declared illegal; and the king was intrusted with the collation to all ecclesiastical benefices. The nation readily entered into the king's measures, and took an oath called the *oath of supremacy;* all the authority which the popes had maintained over England for ages was overthrown at a blow; and none seemed to repine at the change except those who, from their dependence upon Rome, were immediately interested.

History. 1535.

But though the king thus separated from the church of Rome, he by no means adhered to the doctrines of Luther which had been lately promulgated. He had himself written a book against this celebrated reformer, which the pope pretended greatly to admire, and honoured King Henry, on this account, with the title of Defender of the Faith. This character he seemed to be determined to maintain, and therefore persecuted the reformers most violently. Many were burnt for denying the Catholic doctrines, and some also were executed for maintaining the supremacy of the pope. The courtiers knew not which side to take, both the new and old religions being equally persecuted; and as both parties equally courted the favour of the king, he was by that means enabled to assume an absolute authority over the nation.

The established clergy co-operated actively in the revolution which was in progress. Six bishops sanctioned by their vote every blow which was struck at the power of Rome; and fourteen abbots were usually present when the number of temporal peers who attended were somewhat more than forty. "They did not shrink," says Sir James Mackintosh, "from the deposition of Catherine, by reducing her title to that of Princess Dowager of Wales. By ratifying the marriage of Anne Boleyn they adopted those parts of the king's conduct which most disgusted the people. The bill for subjecting the clergy to the king, as their sole head, was so favourably treated as in one day to be read three times and passed: no division appears to have taken place on these measures."[1]

The attention of the king was now turned to Elizabeth Boston, a nun in the priory of St Sepulchre at Canterbury, who believed herself endowed with the power of working miracles, and foretelling future events. Several clergymen and other gentlemen of Kent believed in her mission; and some individuals of the highest order, both of intellect and piety, gave credit to her pretensions. She was subject to convulsions; and in the trances into which she frequently fell, visions of a marvellous nature were vouchsafed to her, which turned of course upon the extraordinary events taking place around her. She was tried and executed for high treason, and her abettors were arraigned on the same charge. Fisher, bishop of Rochester, was attainted by the act against this modern Pythia; but by a separate statute he was afterwards attainted of misprision of treason, for not having taken the oath to the succession. He was eminent for his learning and virtue, and probably his life would have been saved had not the pope sent him a cardinal's hat while in prison, which roused the jealousy of Henry. The remorseless tyrant ordered him to be executed, at the same time remarking, with his usual heartlessness, that the pope might send him a hat, but that Fisher should have no head to wear it. Another deed of blood was perpetrated a short time afterwards, which alone is calculated to consign the name of Henry VIII. to the execration of all future times. Sir Thomas More, the first Englishman of his day, one who had exalted the nation in the eyes of Europe, and whose fame was universal, was tried and executed for misprision of treason, in not taking the oath to maintain the succession. The legal pretext, if there was any, for the accusation, was grounded on the obnoxious clause of a recent act, which made it treason "to do any thing by writing or act which was to the slander, disturbance, or prejudice of the marriage with the Lady Anne, or to the disherison or disturbance of the king's heirs by her." Both More and

[1] *History of England*, vol. ii. p. 175.

History. 1535

Fisher had abstained from either affirming or denying, first, that Henry's marriage with Catherine was invalid; secondly, that his marriage with Anne was valid; and, thirdly, they refused to disclaim all foreign authority in the kingdom. spiritual authority included. After his condemnation Sir Thomas avowed that he had studied the question for seven years, and could not escape from the conclusion that the king's marriage with Catherine was valid. For this scrupulous conscientiousness he expired upon the scaffold on the 7th of July 1535.

This wanton shedding of righteous blood excited the utmost indignation in foreign countries, particularly in Italy. Here Giovio, an historian, compared the tyranny of Henry to that almost preternatural wickedness which the Grecian legends had embodied under the appellation of Phalaris. Other individuals lashed the tyranny of the English monarch with the utmost rigour, and lamented, in strains of affecting eloquence, the fate of More, whom they designated the martyr of unshaken probity. Amongst the most eminent of these writers was Cardinal Pole, an Englishman, allied to the royal family.

Catherine, the former consort of Henry, expired at Kimbolton in the beginning of January 1536, having died as she had lived, mild, forgiving, and resigned. On her deathbed she wrote a most affectionate letter to her husband, whose iron nerves were touched by the perusal of it. His less prudent queen had the levity to express her satisfaction at the event. But if she expected that it would in any way be conducive to her further happiness, and a more devoted attachment on the part of her husband, she was most miserably disappointed. She soon after gave birth to a still-born child, and her brutal lord is said to have reproached her upon the occasion for the loss of his boy. His desire for male issue, and his repeated disappointments, seem to have at last weaned the affections of the fickle monarch from the idol whom he had worshipped with so much devotedness and ardour. A new passion had kindled in his breast, the object of which was Jane Seymour, a young lady of the queen's bed-chamber, which office Anne herself had held in that of Catherine. The circumstances connected with the queen's arrest may be briefly stated. On May-day 1536 a tilting match was held at Greenwich, in which her brother was the chief challenger, and Norris, groom of the stole, the opposing defendant. The queen having dropped her handkerchief, had it gallantly handed up to her by Norris, who was supposed to be her lover. The jealousy of the king burst out; he left the joust precipitately; and ere night his queen had passed through an examination, and was committed a prisoner. Such was the trifle "light as air," which to the jealous mind of Henry seemed a "confirmation strong as proofs of holy writ." By the researches of Mr Turner it has been discovered, that some days before the tournament certain individuals were appointed to inquire into the alleged misdeeds of Anne. The commission put their authority into execution upon the 10th of May, when a grand jury of Westminster was assembled. The charge against her was adultery, and its consequence in such a case, treason. Whether innocent or not, the unhappy Anne was deserted in her utmost need, and had not a friend to counsel her in this alarming emergency. On the day after the queen was committed to the Tower, Cranmer had written to the king imploring the king's mercy towards her, "his life so late, and sole delight;" but in vain. The archbishop had been forbidden to approach the court until desired by the king. The subsequent proceedings were as rapid as they were terrible. On the 12th of May, Norris, Weston, Brereton, and Smeaton, were tried in Westminster Hall for the crime of high treason. Smeaton pleaded guilty to the charge; the others resisted, but were convicted. Three days afterwards the House of Lords assembled for the trial of the queen. She was without counsel, and attended only by her ladies. Anne defended herself with modesty and firmness, but, upon evidence of which no traces now remain, she was condemned to suffer death. On hearing the sentence of her judges, she raised up her hands and exclaimed, "O Father and Creator! O thou who art the way, the truth, and the life! thou knowest that I have not deserved this death." It is difficult to reconcile such an ejaculation with a consciousness of guilt. She afterwards turned to her judges, and made a serious protestation of her innocence. On the 17th of May the other individuals who had been convicted were carried forth to execution. Smeaton, who had confessed to the guilt, probably from an erroneous impression that he would by this means save his life, was the last to suffer. Anne's brother Rochford was also tried and condemned on the same day with herself, and was executed with the others. The curtain dropped upon this horrible tragedy with the death of the queen, who was beheaded on the day after her supposed accomplices had suffered. For further particulars respecting this unhappy personage, see BOLEYN.

History. 1536.

That Henry sacrificed his queen in a fit of vindictive resentment against her, who, he too rashly believed, had dishonoured him, is all that can be urged in his favour That he really believed her guilty, must also in common fairness be allowed. To think otherwise would be to attaint his name with one of the most horrid enormities that ever disgraced the annals of crime. It seems very improbable that the violent attachment which he had all along entertained for her should have cooled so suddenly, and been supplanted by such deadly hate, without supposing that some levities in the conduct of Queen Anne had fired his jealous soul, and roused him to demand her blood as an expiation for the guilt imputed to her. But he was not content with taking away her life under the charge of adultery and incest; he deprived her of the name and the right of wife and queen, and bastardized the daughter which she had born him, even when he acknowledged that daughter to be his own. His contempt for her memory was displayed in a manner which could be believed of few other individuals. He dressed himself in white on the day of her execution, and actually married Jane Seymour next morning.

In bringing this tale of blood to a termination, we have unavoidably outrun several important events. When the news of Sir Thomas More's execution reached the court of Rome, a bull was prepared against Henry. In this extraordinary instrument were embodied all the offences of the English monarch against the papal see, and he was allowed ninety days, and his fautors and abettors sixty, to repent, and to appear at Rome either in person or by attorney. In case of default, he was to be excommunicated, and deprived of his crown; his children by Anne were to be rendered incapable of inheriting for several generations; his subjects were to be absolved from their allegiance to him; and all treaties and alliances between him and other powers were to be null and void. This thunderbolt, however, though forged for the purpose of punishing the king's apostacy, it was resolved should be suppressed for a time, and lodged in the papal armoury until a more favourable opportunity should occur for launching it at the royal culprit.[1] The election of Henry as supreme

[1] Thus far historians are perfectly agreed with regard to this bull. It is also certain, that in 1538 the suspension of the bull was revoked, and its publication ordered by the pope. But whether or not this really took place is a matter of doubt Dr Lingard ob-

History. 1536.

head of the church we have already noticed, and also some of the events which followed his assumption of that presumptuous title. Henry, however, at first assumed it with wariness, and the language in which the statute is couched shows that his supremacy might be reconciled with the papal authority, if the jurisdiction of that power were only of a spiritual nature. But by the statutes of later years, the revolution in church government had been consummated in England. The ancient doctrine of the Roman Catholic faith was acknowledged; but the king was placed as a sort of lay patriarch at the head of the ecclesiastical establishment. Thomas Cromwell, who had now become Henry's chief minister (see CROMWELL, THOMAS), was at this time raised to the new office of the king's vicegerent, and empowered to send commissioners into the several counties of England to inspect the monasteries, and to report, with rigorous exactness, the conduct and deportment of such as were found there This appointment, which had been made between the parliaments of 1536 and 1539, was confirmed by the recognition of the latter; and it was provided that the vicegerent should take his seat in the House of Peers before the Archbishop of Canterbury, and be ranked above all temporal lords, except some branches of the royal family. The first experiment which Cromwell made of his unlimited power was the gradual suppression of the various classes of religious houses, and the seizure of their possessions, at that time amounting to a large proportion of the landed property of the kingdom. This seizure of vested territorial possessions was, in a legal point of view, direct spoliation. But it was urged, on the other hand, that from the immorality, ignorance, and indolence in which those who enjoyed them indulged, they had forfeited their right, and might lawfully be deprived of these. By the inspectors of the religious houses, the public were informed of the existence of monstrous disorders in these communities. In 1536 the lesser monasteries were suppressed, amounting to nearly four hundred. Their revenues, computed at L.30,000 per annum, were confiscated to the king's use, besides their plate and other goods, estimated at L.100,000 more. The confiscation, however, was most unpopular, especially in those places where the ancient faith retained most sway, and occasional revolts broke out. Such a sweeping calamity must have brought ruin upon many innocent and even worthy and deserving persons. The spectacle of individuals, invested with the most sacred of all functions, expelled from their only habitations, where they had probably grown old, and were now unfit for bodily toil, was calculated to awaken feelings of sympathy for the sufferers, and probably of detestation for those who had driven them forth to perish in the wilderness. A disturbance broke out in Lincolnshire, where the first visitation of religious houses took place. But in the north a more serious affair, amounting to an insurrection, occurred. Between the Humber and the Tweed the people had rushed to arms, and they were joined by the inhabitants of Cumberland, Westmoreland, and a portion of Lancashire. This formidable body was led into the field by Robert Ask, a man of Yorkshire, and was preceded by priests bearing banners emblazoned with paintings of the sufferings of Christ. Several important towns fell into their hands; but the king met them with a superior force, which arrested their progress. They, however, succeeded in obtaining a general pardon, and then dispersed.

History. 1537.

A second visitation of the monasteries took place shortly afterwards. Various circumstances had occurred to exasperate Henry against the Catholic clergy; and the alarming revolts, at which priests had presided, and principally instigated the people by their inflammatory addresses, were of a nature to inflame such a combustible temper as his. In this second spoliation, the richest and most revered shrines were pillaged and destroyed, and the sacred relics, objects of so much superstitious veneration, were held up to the derision of the public. Various historians have enumerated a great number of these, and some of them are certainly calculated to excite surprise at the depth of that superstitious feeling which could induce a people to believe that the parings of St Edmund's toes, or the felt of St Thomas of Lancaster, or the shirt of St Thomas of Canterbury, were infallible recipes for certain disorders. On this occasion the shrine of the latter saint was demolished, and the wealth which it yielded was enormous. These shrines were pillaged, on the allegation, too often true, that they were the scenes of imposture, where miracles were pretended to be wrought. The king, on the whole, suppressed upwards of six hundred monasteries, above two thousand chantries and free chapels, and about two hundred colleges and hospitals. The confiscation was closed by a statute passed in 1539, which provided that "all monasteries, and other religious houses, dissolved, suppressed, surrendered, renounced, relinquished, forfeited, or by any means come to his highness, shall be vested in him, his heirs and successors, for ever." It must be owned, that although great abuses may have been detected, revenue not reformation, plunder not punishment, were the objects which the visitors had in view. With respect to the important question regarding property, involved in this measure, we shall avail ourselves of the remarks of Sir James Mackintosh on the subject.

"Thus was completed the confiscation of a fifth or a fourth part of the landed property of England and Wales within the space of five years. It may be a fit moment therefore to pause here, in order calmly and shortly to review some of the weighty questions which were involved in this measure. There is no need of animadverting upon the means by which it was effected, though we must assent to the affirmation of a great man, 'that an end which has no means but such as are bad, is a bad end.' But the general question may be best considered, keeping out of view any of those attendant misdeeds which excite a very honest indignation, but which disturb the operation of the judgment. Property is legal possession. Whoever exercises a certain portion of power over any outward thing in a manner which, by the laws of the country, entitles him to an exclusive enjoyment of it, is deemed a proprietor. But property, which is generally deemed to be the incentive to industry, the guardian of order, the preserver of internal quiet, the channel of friendly intercourse between men and nations, and, in a higher point of view, as affording leisure for the pursuit of knowledge, means for the exercise of generosity, occasions for the returns of gratitude; as being one of the ties which join succeeding generations, strengthening domestic discipline, and keeping up the affections of the kindred; above all, because it is the principle to which all men adapt their plans of life, and on the faith of whose permanency every human action is performed; is an institution of so high and transcendent a nature, that every government which does not

---

serves, "I cannot find any proof that it was ever published at all." Sir James Mackintosh is silent upon the point. Mr Turner, in his *History of the Reign of Henry VIII.* says, that in 1538 "it was given unblushingly to the world. This last order recites, that it had been suspended for three years on the persuasion of some princes. Cherubini, 623." In order to reconcile these conflicting statements, it may perhaps be supposed that it never was "published at all" in England, although it may have been "given unblushingly to the world" in other countries.

protect it, nay, that does not rigorously punish its infraction, must be guilty of a violation of the first duties of just rulers. The common feelings of human nature have applied to it the epithets of sacred and inviolable. Property varies in the extent of the powers which it confers, according to the various laws of different states. Its duration, its descent, its acquisition, its alienation, depend solely upon these laws. But all laws consider what is held or transmitted agreeably to their rules as alike possessing the character of inviolable sacredness. There may be, and there is, property for a term of years, for life, or for ever. It may be absolute as to the exercise of the proprietor's rights, or it may be conditional, or, in other words, held only as long as certain conditions are performed. There are specimens of all these sorts of property in the codes of most civilized nations. But in all these cases the essence of property is preserved, which consists in such a share or kind of power as the laws confer. The advantages may be extremely unequal. The inviolable right must, by the force of the terms, continue perfectly equal.

"The legal limits of the authority of the supreme legislature are not a reasonable object of inquiry, nor indeed an intelligible form of expression. But to conclude that, because the law may in some cases be said to create property, the law is to be deemed on that account as entitled rightfully to take it away, is a proposition founded on a gross confusion of two very distinguishable conceptions. It uses the word property in the premises for a system of rules, and in the conclusion for a portion of external nature, of which the dominion is acquired by the observance of these rules. It is only in the first of these senses that property can be truly called the creature of law. In the second sense it is acquired or transmitted, not by law, but by the acts of a man, when the acts are conformable to legal rules. It is impossible within our present limits to canvass the small or apparent objections which may occur to this scheme of reasoning. It is sufficient, perhaps, here to remark, that these are the generally acknowledged principles, and that deviations from them in practice are no more than partial irregularities, to which the disturbing forces of passion and interest expose human society.

"The clergy, though for brevity sometimes called a corporation, were rather an order in the state composed of many corporations. Their share of the national wealth was immense, consisting of land devised by pious men, and of a tenth part of the produce of the soil set apart by the customary law of Europe, for the support of the parochial clergy. Each clergyman had only in this case an estate for life, to which, during its continuance, the essential attribute of inviolable possession was as firmly annexed by law as if it had been perpetual. The corporate body was supposed to endure till it was abolished in some of the forms previously and specially provided for by law.

"For one case, however, of considerable perplexity there was neither law nor precedent to light the way. Whenever the supreme power deemed itself bound to change the established church, or even materially to alter the distribution of its revenues, a question necessarily arose concerning the moral boundaries of legislative authority in such cases. It was not, indeed, about a legal boundary; for no specific limit can be assigned to its right of exacting obedience within the national territory. The question was, what governments could do morally and righteously, what it is right for them to do, and what they would be enjoined to do by a just superior, if such a personage could be found among their fellow-men. At first it may seem that the lands should be restored to the heirs of the original grantor. But no provision for such a reversion was made in the grant; no expectation of its occurrence was entertained by their descendants; no habit or plan of life had been formed on the probability of it. The grantors or founders had left their property to certain bodies under the guardian power of the commonwealth, without the reserve of any remainder to those who, after the lapse of centuries, might prove themselves to be their representatives. It is a case not very dissimilar to that of an individual who died without discoverable heirs, and whose property for that reason falls to the state. It appeared, therefore, meet and righteous that in this new case, after the expiration of the estates for life, the property granted for a purpose no longer deemed good or the best, should be applied by the legislature to other purposes which they considered as better. But the sacredness of the life estates is an essential condition of the justice of such measures. No man thinks an annuity for life less inviolable during his life, than a portion of land granted to him and to his heirs for ever. That estate might, indeed, be forfeited by a misperformance of duty; but perfect good faith is in such a case more indispensable than in most others. Fraud can convey no title; false pretences justify no acts. There were gross abuses in the monasteries; but it was not for their offences that the monastic communities fell. The most commendable application of their revenues would have been to purposes as like those for which they were granted as the changes in religious opinion would allow. These were religious instruction and learned education. Some faint efforts were made to apply part to the foundation of new bishoprics; but this was only to cover the profusion with which the produce of rapine was lavished on courtiers and noblemen, to purchase their support of the confiscations, and to ensure their zeal and that of their descendants against the restoration of popery.

"It is a melancholy truth, and may be considered by some as a considerable objection to the principles which have been thus shortly expounded, that if in 'the seizure of abbey lands' the life estates had been spared, the monks, who were the main stay of papal despotism, and the most deadly foes of all reform, would have had arms in their hands which might have rendered them irresistible. It must perhaps be acknowledged, that it was more necessary to the security of Henry's partial reformation to strip the monasteries at that moment, than to dissolve communities which a better regulation might in future reconcile to the new system.

"We are assured by Sir Thomas More, 'that in all the time while he was conversant with the court, of all the nobility of this land he found no more than seven that thought it right or reasonable to take away their possessions from the clergy.' So inconsiderable was the original number of those who, not many years after, accomplished an immense revolution in property.

"To which it must be answered, that the observance of justice is more necessary than security for any institution; that many regulations might have stood instead of one deed of rapine; that the milder expedients would have provoked fewer and more reconcilable enemies; that if, on the whole, they afford less security, the legislature were at least bound to try all means before they who were appointed to be the guardians of right set the example of so great a wrong. Rulers can never render so lasting a service to a people as by the example, in a time of danger, of justice to formidable enemies, and of mercy to obnoxious delinquents. These are glorious examples, for which much is to be hazarded."

Henry had now so far separated himself from the communion of Rome, that it became in some measure necessary for him to concoct a creed of his own. The

History. 1539.

clergy were divided into two factions, denominated the men of the old and the new learning. The chief of the former was Gardiner bishop of Winchester, who was supported by Lee archbishop of York; Stokesly bishop of London, Tunstall of Durham, and Clarke of Bath and Wells. The latter acknowledged as leaders, Cranmer archbishop of Canterbury, Haxton of Sarum, Latimer of Worcester, and Fox of Hereford. These could depend on the powerful interest of Cromwell the vicar-general, and of Audley the lord chancellor; those on that of the duke of Norfolk, and of Wriothesley the premier-secretary. Various long debates took place upon the new creed, but it was neither completed nor sufficiently fenced round with suitable penalties, till an act was passed by the parliament, which sat in April 1539, entitled " an act for abolishing diversity of opinions." This convocation was opened by the chancellor informing the House of Lords that it was his majesty's earnest desire to extirpate from his kingdom all diversity of opinions with regard to religion; and as this enterprise was, he owned, difficult and important, he desired them to choose a committee from amongst themselves, who might frame certain articles, and communicate these afterwards to parliament. The lords named the vicar-general Cromwell, now created a peer; the Archbishops of Canterbury and York; and the Bishops of Durham, Carlisle, Worcester, Bath and Wells, Bangor, and Ely. But this small committee itself was agitated with such diversity of opinions that it could come to no conclusion. The Duke of Norfolk then moved, that since there was no hope of having a report from the committee, the articles of faith proposed to be established should be reduced to six, and a new committee be appointed to frame an act respecting them. As this peer was understood to speak the king's mind, his motion was immediately complied with; and, after a short prorogation, the bill of the six articles was introduced, and, having passed the two houses, received the king's assent. By this law the doctrine of the real presence was established, the communion in one kind, the perpetual obligation of vows of chastity, the utility of private masses, the celibacy of the clergy, and lastly, the necessity of auricular confession. The denial of the real presence was punishable with death by fire, and the same forfeiture as in cases of treason, and admitted not the privilege of abjuring; an unheard of cruelty, unknown even to the inquisition itself. The denial of any of the other articles, even though afterwards recanted, was punishable by the forfeiture of goods and chattels, nd imprisonment during the king's pleasure. An obstinate adherence to error, or a relapse, was adjudged to be felony, and subjected the delinquent to death. The marriage of priests was punished in the same manner. Their commerce with women was, for the first offence, forfeiture and imprisonment; and for the second, death. Abstaining from confession, and from receiving the eucharist at the accustomed times, subjected the person to fine, and to imprisonment during the king's pleasure; and if the criminal persevered after conviction, he was to suffer death and forfeiture, as in cases of felony. Commissioners were to be appointed by the king for inquiring into these heresies and irregular practices, and the criminals were to be tried by a jury.

Henry had now been a widower for above two years. In 1537 Jane Seymour, his third queen, had born him a son, afterwards Edward VI.; but she herself expired in less than a fortnight afterwards. The king afterwards made proposals of marriage to several foreign princesses, and others, without success. Under these repeated disappointments, he readily listened to the suggestions of Cromwell, who proposed to him Anne, sister of the Duke of Cleves, a considerable prince on the Lower Rhine, who had lately established Lutheranism in his principality. This choice showed the leaning of his secretary's mind, and the progress of men in general towards reformation. Henry had seen a painting by Holbein of this lady. The artist had invested her with fictitious charms, which captivated the sensual monarch, and inspired him with such eagerness to behold her, that he proceeded to Dover, where she was to disembark, his mind no doubt swelling with pleasing anticipations. But he was miserably disappointed, and could not conceal his chagrin. She was indeed of the standard dimensions, being large and tall as his heart could desire; for stature had now become an indispensable qualification in the individual who should aspire to gain the affections of the king of England. Without entering into the disgusting particulars connected with his marriage with Anne of Cleves, it is sufficient to state that the nuptials were solemnized, and that the lady was treated, not as a wife, but as a friend. The distress of Henry was great, and at last drew the attention of the House of Lords to the subject on the 6th of July 1540. These obsequious peers entreated him to make inquiry into the validity of his marriage with the Lady Anne of Cleves; and the Commons having concurred with them, the king granted their prayer. Of course this drama was all arranged, and the characters cast, some days before the meeting of parliament. The convocation appointed to examine into the matter declared the marriage to be null by the consent of Lady Anne herself, which was insured by the grant of an income of L.3000 annually; and the lady, it would appear, lived comfortably on her annuity for sixteen years in England. The bill for the nullity was passed by both houses, and received the royal assent on the 24th of July 1540. About a fortnight afterwards the king married his fourth wife, Catherine Howard, niece to the Duke of Norfolk. But let us look back upon the fate of Cromwell, who was instrumental in procuring the former union. It was indispensably necessary that the revolutions which took place in Henry VIII.'s palace and bed should in some way or another be marked with blood.

History. 1540.

The arrest, condemnation, and execution of Cromwell, is another of those cruel and tyrannical measures which have entailed accumulated odium upon the name of Henry VIII. A bill to attaint the vicar-general of high treason was brought into parliament in June 1540; and before the end of the month it had passed through both houses. He was charged with heresy because he had favoured the new doctrines, and with treason because he had performed several acts of royal authority without the warrant of the king. Cromwell was condemned unheard, and executed in about a month afterwards. This was an act of gross injustice, but it was far from being unpopular. The nobility were glad to be rid of an individual who had raised himself from the shop of a fuller to the highest offices of state; and the Roman Catholic party, who were the most numerous, and had regained much of their ascendency, rejoiced at the fall of one who was the active conductor of that system of confiscation which struck such a blow at their power in England. In that business he certainly must have connived at much rapine and robbery, which it was out of his power to prevent. He has also been charged with Machiavelian policy; but there is no satisfactory evidence that he was unfaithful to his sovereign. Like Wolsey, he seems to have served his king more faithfully than his God; and it is remarkable that he fell into his own snare, having repeatedly shown the example of attainder without trial.

At this period the act of the six articles was in the fullest vigour of its cruelty; and many iniquitous executions took place. One of the most horrid of these was that of Courtney marquis of Exeter, with Lord Montague and Sir Ed-

History. 1540.

ward Nevil. They were descended from Edward IV., and this seems to have constituted their only crime. Towards the close of 1538 they were first arrested and committed to the Tower; and shortly afterwards the Countess Margaret, the mother of the Poles, was also taken into custody. Exeter was charged with the offence of having conspired to raise Reginald Pole to the throne. This individual, best known as a cardinal, was the son of the above-named lady, who was daughter of the Duke of Clarence. Her son's life was principally passed in Italy, where he was much celebrated for his talents; and Henry appears to have been proud of him, for he munificently discharged his expenses. Their friendship, however, terminated with the king's divorce from Catherine, which the English monarch vainly besought Pole to sanction. The revenge of Henry, who seems now to have thought that without the shedding of blood there could be no remission of offences, fell upon the mother of the cardinal, and the last of the Plantagenets. She was attainted of high treason, and sent to prison, as above noticed. The noblemen committed about the same time were soon afterwards executed; but the lady lingered two years in confinement, and was at last conducted to the scaffold on the 27th of May 1541, where, to complete the horror of the transaction, from mismanagement on the part of the executioner, her neck was horribly mangled, and her grey hairs, clotted with blood, fell dishevelled over her face ere the bloody act was consummated.

To return to the domestic affairs of Henry, he had not been many months married to Catherine Howard before he received such information of her dissolute life before marriage as induced him to suspect that she might still continue it, and to cause a rigid inquiry to be made into her conduct. There was no doubt as to her vices previously to her union with the king; and some acts of infidelity after it were also brought home to her, but the details are too disgusting for human feelings. Cranmer was one of the individuals employed to communicate information to the king; and although there is no evidence that he was ever guilty of a malicious or vindictive act, yet he sometimes wanted the courage to resist crimes; and the slavish manner in which he, along with the rest of the ministers and parliament in general, bowed to the despotic will of the king, cannot be extenuated.

Two of Catherine's paramours were arrested, and confessed their crimes; and the queen herself acknowledged her guilt previously to the marriage, but denied having committed any act of infidelity subsequently thereto. This, however, was not believed; and on the 14th of February 1542 she was executed in the Tower, along with Lady Rochford, who in some way or another was implicated as an accomplice in the guilt of the queen.

To attaint without trial had now become fashionable; but to punish with death that which was not made criminal by any former statute, was altogether new. To countenance such severities as those which had lately taken place, it was enacted in the very bill of attainder, that every woman about to be married to the king or his successors, not being a maid, should disclose her unchastity to him, under the penalty of treason; that any person knowing the fact and not disclosing it, should be subject to the lesser penalty of misprision of treason; and that the commission of adultery by the queen or wife of the prince should be punishable with death.

These laws afforded some amusement to the people, who now said that the king must look out for a widow, as no reputed maid would be disposed to offer herself whilst such a dreadful statute was suspended over her head. This in reality took place, for on the 10th of July 1543 Henry espoused Catherine Parr, the widow of Lord Latimer, and a lady of mature age. She had read Lutheran books, and was inclined to support the doctrines of the reformers. She even went so far as to enter into controversy with her imperious lord, who valued himself not a little on his theological knowledge. He ordered Wriothesley and Gardiner to give orders for her imprisonment, and to prepare articles of impeachment against her. The third Catherine had very nearly been honoured with a place upon the list of victims which were sacrificed by this Blue Beard of the west, but she evaded the blow by her ingenuity and tact. During the remainder of her life, however, she never again ventured to provoke the vengeance of the royal polemic.

History. 1543.

As head of the church, the attention of the king was now principally turned to the management of its affairs. He enforced an observance of the six articles both by Protestants and Catholics, and any deviation from them was punished with tyrannical severity. He was very impartial in his distribution of what he called justice; and it was not uncommon for individuals professing opposite faiths to perish at the same stake. The Christian of those days had a difficult part to perform; for whilst the king renounced in one respeect the authority of the pope, he acknowledged it in another by his adherence to the doctrines of the church of Rome; so that it frequently happened that those who were against the head of it were burned, and those who were for him were hanged. In connection with church affairs, Henry effected a further dissolution of colleges, hospitals, and other foundations of that nature, with the spoils of which he enriched his treasury. He also extorted from many bishops a surrender of their chapter lands, and in this manner he succeeded in pillaging the sees of Canterbury, of York, and of London. Amongst the religious orders suppressed was that of the Knights of Malta, or, more properly, St John of Jerusalem. They obstinately refused to surrender along with the other monasteries who laid their rights at the feet of the king, and he was compelled to have recourse to parliament for the purpose of obtaining its authority for dissolving the order, which was very rich, and whose spoil was therefore precious in his sight.

For the purpose of maintaining a rigid purity in speculative principles, he nominated a commission of divines to make out a creed for the benefit of his subjects. In connection with this appointment a circumstance occurred which strongly marks the character of this reign, as well as of those who composed the council of the nation. Before the reverend conclave had made any progress in its arduous undertaking, the parliament passed a law which went to ratify all the tenets which the divines might establish in accordance with the king's consent. This clearly shows that the individuals composing that body, as well as the parliament, were merely ciphers, and that Henry was the initial unit which gave them value. A small volume was published under the title of *The Institution of a Christian Man*, which was made the infallible standard o. orthodoxy. But the king's inconsistency was as strikingly exemplified in his religion as in his morals. A new book was ordered to be composed, and three years were spent before it could be brought to that desirable state of perfection which the king wished. At length, however, it came forth under the title of *A necessary Doctrine and Erudition for any Christened Man;* and in order to distinguish it from the former work upon the same subject, it was called emphatically the king's book. It taught the same doctrines as the preceding compilation, with the addition of transubstantiation and the sufficiency of communion under one kind. The new creed was generally approved of, and all writings in opposition to it were prohibited. From the period of the publication of the "king's

History. 1543. book" until the accession of the next sovereign, it continued to be the only authorized standard of English orthodoxy. Henry had formerly sanctioned the publication of the Bible in English, and permission was granted to all his subjects to peruse it. But he afterwards retracted the liberty which he had vouchsafed them, and prohibited the reading of the Scriptures by the lower orders of the people under the penalty of imprisonment. The mass book was also examined, and some alterations were made upon it.

But to return to the political affairs of the nation; in the beginning of the year 1543 Henry renewed his friendship with the emperor, which had been suspended by the divorce question. They concluded an alliance against Francis; and on the 14th of July 1544 Henry crossed the seas in a ship furnished with sails of cloth of gold. The principal event of this war was the surrender of Boulogne, into which the English monarch made a triumphant entry on the 18th of September. But he shortly afterwards returned to England. On the 7th of June 1546 hostilities were concluded by a treaty, of which the principal stipulation was, that within eight years Henry should receive two millions of crowns, with arrears and costs, which are enumerated; and, on payment of these sums, Boulogne and its dependencies were to be restored to Francis. Henry's warlike propensities were also exercised in reference to Scotland and Ireland; but peace was finally restored after both countries had suffered considerably, especially the former. These wars, however, exhausted the treasury of the English monarch. He was compelled to extort money from parliament in his usual manner, and also to depreciate the coinage of the realm, which he had not scrupled to do before.

The cruelty of Henry continued conspicuous to the very close of his life. Disease made dreadful ravages upon his worn-out and unwieldy frame, so that he had to be moved from place to place by machines contrived for the purpose; yet even these unequivocal tokens of approaching dissolution had no effect in subduing the vindictive spirit or humanising the mind of the sufferer. It was in this pitiable state that he perpetrated an act which has become memorable from the fame of the illustrious victim. This was the execution of Henry Howard, earl of Surrey, so justly renowned for his poetical genius. There had for some time existed a spirit of rivalry between the Seymours and the house of Howard. The Duke of Norfolk was indignant at the ascendency of the former in the royal favour; and his son, the Earl of Surrey, could not forgive the Earl of Hertford, a member of the other family, for having superseded him in the command of the garrison of Boulogne; he had also been heard to predicate that the time of revenge was not far distant. The house of Howard alone stood in the way of the Seymours in the pursuit of their aggrandisement under the approaching minority; and they accordingly employed every means of drawing down the vengeance of the king upon their heads. Norfolk and Surrey were accordingly committed to the Tower on the 12th of December 1546. Surrey was tried on the 13th of January following, on a charge of having quartered on his shield the arms of Edward the Confessor. He vainly defended himself with his usual eloquence and spirit, and showed that he had worn the arms fourteen years without giving offence, and that they had been assigned to him by a decision of the heralds. But the fact being admitted, it was taken as sufficient evidence that he aspired to the throne, and the jury condemned him to suffer death. About a week after the sentence was pronounced, this gallant and accomplished nobleman expired upon the scaffold. His father was also tried and condemned to perish in the same manner on the 29th of January. But on the morning of the 28th the spirit of Henry VIII. followed that of Surrey to the judgment-seat; and Norfolk, after remaining in prison for several years, was at length set at liberty. History. 1547.

Henry VIII. is one of the most repulsive sovereigns to be met with in the list of English kings. There is a gross brutality about the man, and a remorseless tyranny and blood-thirstiness about the king, which totally obscure any human features which his character may have possessed. Some of his crimes are of so dark a dye, and so peculiarly diabolical, as to make the mind shudder at the very mention of his name. It is difficult to extend charity to, or rank with ordinary humanity, one who could repeatedly hurry from his arms to the scaffold those whom he had loved and embraced with passionate tenderness, if such language may be used in reference to any feeling which animated the breast of such a barbarian. It was after the fall of Wolsey that the prominent features of Henry's moral deformity fully developed themselves; and they are such as have attached to his name a degradation which can neither be removed nor palliated. For the good which he was the means of doing, in sanctioning a reformation in the affairs of the church, he deserves no credit; for it originated in a spirit of vindictive revenge, and was perpetuated by plunder and cruelty. Henry was not destitute of ability; and the esteem which we may infer he entertained for literature, since he patronised learning, is one of the few traits of his character which are not repulsive and odious.

Henry was succeeded by his only son Edward, a boy of nine years of age. He was proclaimed king of England on the 31st of January 1547, and crowned in the month following. The most remarkable transactions of his reign are those connected with religion. The restraint which Henry VIII. had laid upon the Protestants was now taken off; and they not only maintained their doctrines openly, but soon became the prevailing party. Henry had fixed the majority of his son at eighteen years of age; and, in the mean time, appointed sixteen executors of his will, to whom, during the minority, he entrusted the government of the king and kingdom. But the first act of the executors was to choose the Earl of Hertford, afterwards Duke of Somerset, protector of the realm; and in him was lodged all the regal power, together with a privilege of naming his own privy council.

The Duke of Somerset had long been numbered amongst the secret partisans of the reformers; and, immediately on his elevation to his high dignity, he began to express his intention of reforming the abuses of the ancient religion. Under his direction and that of Cranmer, therefore, the reformation was vigorously carried forward; persecutions under the act of the six articles ceased, prisoners were released, and exiles were recalled. Homilies were composed by Cranmer, and ordered to be read by parish priests to their congregations. Visitors were appointed to inspect ecclesiastical establishments, and see that four sermons were yearly preached against the papal authority; that the worship of images should be denounced, and those who were the objects of pilgrimages and offerings should be destroyed; that the English Bible, with Erasmus's commentary on the gospels, should be placed in every church for the use of the people; together with many other points, which, without being very important in themselves, were calculated to assure the people that the government was no longer neutral in matters of religion. The principal person who opposed these innovations was Gardiner bishop of Winchester; a man of great learning, abilities, and resolution, but one of Henry's devoted agents in the suit for a divorce from Catherine, his first queen. He made a manly and becoming resistance to these injunctions, from principles of civil liberty, as much as of ecclesi-

History. 1547. astical discipline. To the disgrace of their own principles, the reformers now displayed as virulent a spirit of persecution as the Catholics had formerly done. Gardiner was committed to the Fleet prison, where he was treated with great severity. He was afterwards sent to the Tower; and having continued there two years, he was commanded to subscribe several articles, amongst which was one confessing the justice of his own imprisonment. To all the articles but this he agreed to subscribe; but that did not give satisfaction. He was then committed to close custody; his books and papers were seized; all company was denied him; and he was not even permitted the use of writing materials. Bonner of London, more violent and more subservient, escaped protracted imprisonment by obsequious submission. Several bishops also screened themselves by sacrificing a considerable share of their revenues; others were deprived of their offices; and Tunstal bishop of Durham, an eminent prelate, was ejected from the privy council, in order to impress on the people by a strong example the disinclination of the protector to the ancient faith. In November 1547 a parliament was assembled, in which several bills were passed to promote and enlarge the reformation. The communion was appointed to be received in both kinds by the laity as well as by the clergy, without condemning the usages of other churches. Bishops were to be nominated by the king, and process was to run in the king's name in ecclesiastical courts. The statutes against the Lollards were repealed, as well as all the acts of Henry VIII. upon religious matters, excepting those directed against the supremacy of the pope; and other acts relating to civil affairs were also abrogated. In the next session uniformity in public worship was established, in which the use of the book of common prayer, as prepared by the primate and his brethren, was enjoined. This composition is the foundation of that which, having undergone various alterations in subsequent reigns, continues in use at the present day. By one law the observance of fast days and of Lent was enjoined under penalties; and by another the English clergy were emancipated from compulsory celibacy.

The rest of this reign presents little but the history of the intrigues and cabals of courtiers. There was a war with Scotland, which began with injustice and was conducted with inhumanity. Insurrections also took place in Ireland, where the reformation made no progress. The details of these transactions will be given in the articles SCOTLAND and IRELAND. The protector was first opposed by his own brother Admiral Sir Thomas Seymour, who had married Catherine Parr, the late king's widow. She died soon after the marriage; and the widower is said to have then paid his addresses to the Princess Elizabeth. His brother the duke, who was at that time in the north, being informed of his ambitious projects, speedily returned, had him attainted of high treason, and at last condemned and executed. The Duke of Somerset himself, however, became unpopular, and a powerful confederacy was formed against him, at the head of which was Dudley earl of Warwick. This nobleman succeeded in overthrowing the power of the protector, and getting him committed to prison on the 13th of October 1549, whilst he himself was installed in the office of lord high admiral. In the month of February following Somerset was released upon payment of a fine and ransom; but towards the end of 1551 he was again sent to the Tower, tried for high treason and felony, and condemned. He was acquitted of the first charge, but not of the second, as he ought to have been. He suffered upon the scaffold on the 22d of January 1552. Warwick, now duke of Northumberland, had thus the reins of government entirely at his own disposal. Not satisfied with the office of protector, he aimed at altering the succession, and placing the crown upon the head of his son. He represented to Edward, who was now in a declining state of health, that his sisters Mary and Elizabeth, who were appointed by Henry's will to succeed to the crown, in failure of direct heirs, had both been declared illegitimate by parliament; that the queen of Scots, his aunt, stood excluded by the king's will; and being also an alien, lost all right of succeeding. The three princesses being thus excluded, the succession naturally devolved upon the Marchioness of Dorset, eldest daughter of the French queen, Henry's sister, who had married the Earl of Suffolk after her first husband's death. The next heir to the marchioness was Lady Jane Grey, the wife of Northumberland's fourth son, Lord Guildford Dudley. The king, who was accustomed to submit to the politic views of this minister, agreed to have the succession altered, and sketched with his own hand a draft of the new destination of the crown, which was submitted to a council. The judges, however, were far from acquiescing in the proposal contained in this instrument; and they hesitated to sign it, because it would subject those who had drawn and those who had advised it to the penalties of treason. Their hesitation excited the rage of Northumberland, who threatened them with his authority, and, pronouncing them traitors, declared that he would fight in his shirt with any man in so just a cause as that of Lady Jane's succession. A new paper was drawn up, by which the judges were screened from any consequences which might have resulted from their signing of it. By the new patent for changing the succession, the princesses Mary and Elizabeth were set aside, and the crown settled upon the heirs of the Duchess of Suffolk, who was contented to forego her own claim.

History. 1553. For some time the king had languished under a pulmonary complaint, and symptoms of an advanced stage of consumption began to make their appearance. After the settlement of the crown, his health visibly declined every day, and little hopes were entertained of his recovery. The deathbed devotions of Edward bear testimony to his love for his subjects, and his zeal for what he believed to be the purest form of Christianity. "O Lord, save thy chosen people of England, defend this realm from papistry, and maintain thy true religion." Such is a specimen of the supplications which this pious and short-lived prince breathed forth. On the 6th of July 1553, Edward, being then in the sixteenth year of his age and seventh of his reign, breathed his last. Whilst he filled the throne of England, no Roman Catholic had suffered death on account of his religion. By his gentleness and docility he was indisposed to shed blood, and, on the whole, his reign was more free from religious persecution than any administration of the same length, in any great country of Europe, since the rise of protestantism. In abilities he was equal, probably superior, to most boys of his years; but the flattering praises lavished upon him by his panegyrists are to be received with abatements. It was his dying wish that Lady Jane Grey, the companion of his infancy, should be his successor.

The death of Edward was carefully concealed for two days; but on the 8th of July the event was communicated to the ambassadors, and the civic functionaries of London were ordered to make preparations for the coronation of Lady Jane Grey. The intelligence was transmitted to Mary by her friends at court, and on the 9th she wrote a letter to the privy council, expostulating with them upon their conduct; and, solemnly affirming her right, she tendered a pardon to them if they would order her immediate proclamation. The council, however, adhered to the interests of Jane, and both parties prepared to decide the contest by an appeal to arms.

History. 1553.

When Edward's death, and her own elevation to the throne, were announced to Lady Jane, she was thrown into a state of great agitation. The manner in which she was affected will be best understood from a passage in a letter of hers which she afterwards transmitted to Mary. "As soon as I had, with infinite pain to my mind, understood these things, how much I remained beside myself, stunned and agitated, I leave to those lords to testify who saw me fall to the ground, and who knew how grievously I wept." She urged the preferable claim of the princesses to inherit; but being pressed by the authority of the judges, she at length consented to accept of the royal dignity. She suffered herself to be conveyed to the Tower, and on the same day the heralds proclaimed the death of Edward and the succession of Jane. Mary was also proclaimed at Norwich, and it is somewhat singular that the populace took no interest in either of the proclamations. No shouts of applause or outward demonstrations of joy followed the announcement of the choice of a new sovereign. Northumberland was unpopular, a great part of the Protestants cooperated with the Catholic partisans of Mary, who were numerous and powerful; and the protector, by his supineness, allowed them to assemble in great force at Framlingham Castle, in Suffolk, where the princess had fixed her residence. Northumberland became alarmed, and although he had assembled a considerable army, his heart failed him when he saw the demonstrations which were made by the people in favour of Mary. He had taken the field in person, which was a fatal step; for his absence afforded an opportunity to the adherents of Mary who were in the council to make arrangements for exalting her to the royal dignity. It is sufficient to observe that they effected their purpose. Mary was proclaimed, and Jane, after a ten days reign, resigned the crown with a great deal more satisfaction than she had accepted of it. Northumberland had been compelled to proclaim Mary at Cambridge; but this did not prevent him from being led a prisoner to the Tower, which had lately been his palace.

Mary, accompanied by her sister Elizabeth, made her triumphal entry into London on the 3d of August 1553. Her attentions were first turned towards those who had suffered in her cause. She released several prisoners from the Tower, amongst whom were the aged Duke of Norfolk, and her kinsman Edward Courtenay, whom she soon afterwards created Earl of Devonshire. On the 18th of August the Duke of Northumberland, the Marquis of Northampton, and the Earl of Warwick, were tried for high treason; and on the following day Sir John Gates, Sir Henry Gates, Sir Andrew Dudley, and Sir Thomas Palmer, were tried for the same offence. Of the culprits who were condemned, three were selected for execution, Northumberland, Sir John Gates, and Sir Thomas Palmer, who suffered upon the scaffold on the 22d of August.

The mind of Mary now became solicitous about the affairs of religion. All the deprived Catholic bishops were restored. The acknowledged abilities of Gardiner soon raised him to the post of prime minister. He early received the custody of the seals, and not long afterwards he was appointed chancellor. The Protestant bishops, in the eyes of their Roman Catholic brethren, had incurred deprivation by marriage, or still more severe penalties by preaching heresy. On the 2d of September Cranmer was committed to the Tower, and on the 13th Latimer followed him into the same captivity. The latter, in point of moral heroism, was the antipodes of Cranmer, who was gentle and kind, timid and pliant. Latimer was brave, sincere, and inflexible. As he passed through Smithfield on his way to the Tower, he remarked, "Smithfield has long groaned for me." By an early proclamation Mary had declared that "she could not hide her religion, but that she mindeth not to compel any of her said subjects thereunto, until such time as a farther order by common consent shall be taken therein." The "farther order" did take place, although not in accordance with "common consent." On the 5th of October 1553, parliament assembled, and, in a session of nineteen days, passed only three acts; one for the abolition of all the treasons and felonies of Henry VIII.; another for the restoration in blood of Gertrude marchioness of Exeter; and a third for the like restitution of that lady's son, Edward Courtenay, now Earl of Devonshire. But on the 24th of the same month, several important acts were passed, by which the road was paved for the re-introduction of the Roman Catholic faith as the creed sanctioned by royalty. By these acts Henry's divorce was declared void, and his first marriage pronounced valid; so that the claim of Elizabeth, on whom the Protestants had fixed their eyes with anxious hope, was virtually set aside. But the progress of the revolution in religious matters was slow; and before the perfect re-union with the Church of Rome was consummated, several events of considerable importance took place. Mary having been crowned at Westminster with the usual solemnity on the last day of September 1553, it now became the interest of the Catholic party to obtain a suitable marriage for her. Of natives only two were proposed to her choice, both descended from the house of York; these were Cardinal Pole, and Edward Courtenay, the individual whom she had released from confinement. But the Emperor Charles having heard of Mary's intention to choose a husband, proposed his son Don Philip. This Spanish match was so broad and decisive a step towards Rome, that the House of Commons took the alarm, and presented an address to the queen, in order to dissuade her from her purpose. She returned a haughty answer; and on the 30th of October, having conducted the imperial minister into her private oratory, she there solemnly called God to witness that she plighted her troth to Philip prince of Castille. To obviate all clamour, the articles of marriage were drawn up as favourably as possible for the interests of England. It was agreed that though Philip should have the title of king, the administration should be entirely in the queen; that no foreigner should be capable of holding any office in the kingdom, nor should any innovation be made in the laws, the customs, and the privileges of the people; and that Philip should not carry the queen abroad without her consent, or any of her children without the consent of the nobility. Sixty thousand pounds a year were to be settled upon her as a jointure, and the male issue of this marriage were to inherit Burgundy and the Low Countries as well as the crown of England; and in the event of the death of Don Carlos, Philip's son by his former marriage, without any heir, the queen's issue were also to inherit the rest of the Spanish dominions.

All these concessions, however, were not sufficient to quiet the apprehensions of the people. They were considered merely as words of course, which might be retracted at pleasure; and the nation murmured loudly against a transaction so dangerous to its ancient liberty and independence. The Duke of Suffolk, a zealous Protestant, attempted to excite his tenants in Warwickshire to revolt; but with little success. His followers were routed by Lord Huntingdon, and he himself was betrayed into the hands of his enemies. An insurrection was also raised by Sir Thomas Wyatt, a Roman Catholic, at the head of four thousand men, who set out from Kent to London, publishing a declaration against the Spanish match and the queen's evil counsellors. Having advanced as far as Southwark, he required that the queen should put the Tower of London into his hands; that she should

History. 1553.

deliver four counsellors as hostages; and that, in order to ensure the liberty of the nation, she should marry an Englishman. But his force was still by far too inconsiderable to support such magnificent pretensions, although it was afterwards augmented to fifteen thousand men; and he unluckily wasted so much time without attempting any thing of importance, that the popular ferment entirely subsided, his followers gradually abandoned him, and he was at last obliged to surrender himself near Temple-Bar to Sir Maurice Berkeley, who committed him to the Tower, where, in a short time, he was joined by the chief of the surviving conspirators. The nobility and gentry immediately repaired to St James's to congratulate the queen on the suppression of the rebellion. But two were excepted; Courtenay duke of Devonshire, and the young Earl of Worcester, who, on the first approach of the enemy, had turned their horses' heads and fled. On the 3d of November 1553, Lord Guildford Dudley and Lady Jane Grey had been convicted of high treason. Lady Jane and her husband were both only in their seventeenth year, and no time was fixed upon for their execution; but the revolt of Suffolk, Lady Jane's father, proved an incentive sufficiently strong to prevail over the slender pity of bigots and politicians, and the sacrifice was consummated.

On the 8th of February Mary signed a warrant for their execution, and on the 12th of the same month it was put in force. Lord Guildford Dudley had requested an interview with his beloved wife, who, however, declined the meeting, justly fearing that it might unfit them for the dreadful scene through which they were about to pass. She saw him issue through the gate of the Tower to the scaffold; and soon afterwards, in chancing to look from the same window, she saw the bloody carcass, half covered in the vehicle which bore it back from the place where vengeance and injustice, disguised under the name of law, had done their worst. Lord Dudley was beheaded on Tower-Hill; but his wife, on account of her royal descent, was spared the ignominy of a public execution. Lady Jane Grey is celebrated as exhibiting a matchless union of beauty with genius, and learning with virtue and piety. She astonished the learned of Europe by her talents and accomplishments, and will be recognised by all posterity as one of the purest and most amiable of historical characters. Were Mary chargeable with no other atrocity than that of putting Lady Jane to death for the crime of a father (for it was on his account that the daughter suffered), it were quite sufficient to cover her memory with irremoveable degradation. "It was a death," says Sir James Mackintosh, "sufficient to honour and dishonour an age." Suffolk, her father, perished in the same manner a few days afterwards. Sir Nicholas Throgmorton was tried, but the defence which he made was found so good in law, that the jury acquitted him. Above sixty others of the conspirators were condemned to the block, amongst whom were Lord Thomas Grey the brother of Suffolk, and Wyatt the principal mover of the rebellion.

This revolt had very nearly proved fatal to the Princess Elizabeth, who for some time had experienced harsh treatment at the hands of her sister. Mary, upon whom the mantle of Henry VIII. had descended, felt antipathy to her on account of the quarrel between their mothers. This circumstance, in the mind of one whose tender mercies were cruel, was sufficient to change the milk of sisterly affection into mortal venom; and a favourable opportunity was only necessary to make her feel its deadly effects. Nearly a month was spent in labouring to extract information against Elizabeth from Wyatt whilst he lay in prison. But the unfortunate gentleman honourably acquitted her, although he might, in all probability, have saved his own life by implicating her in the late rebellion. At Ashridge, whither she had retired to escape the constrained participation in a worship which she disapproved, overtures had been made to her by the chiefs of the revolters; but her acceptance or consent was neither shown nor seriously alleged. Immediately after Wyatt's discomfiture, she was conducted to London in a very infirm state of health. It was doubted whether she would reach her destination alive; but youth and strength triumphed over the malady with which she was affected. Courtenay earl of Devonshire was also arrested, and committed to the Tower. Two councils were held on the fate of Elizabeth, and the judges were divided in their opinions as to her guilt. Gardiner, although he professed to think Elizabeth deserving of death, yet considered her confinement at Ashridge, and Courtenay's residence at St James's, as irreconcilable with a just conviction of treason. The head and front of her offending seems to have been misprision, or concealment of projects of revolt, which was now not a capital crime. It was fortunate for Elizabeth that one of the first measures of her sister, when she ascended the throne, was to sweep away the odious heap of treasons raised up by her father, and the punishment of misprision with death was one of them. But Elizabeth, although absolved from a capital charge, was nevertheless committed to the Tower; and shortly afterwards she was put under the charge of Sir Henry Bedingfield, keeper of Woodstock. During her stay in the Tower, the princess had no other expectation than that of mounting the scaffold which had been trodden long before by her unhappy mother, at her father's stern behest, and on which the blood of Lady Jane Grey, the purest of the pure, was scarcely dry. When Bedingfield came with his soldiers to conduct her to Woodstock, she asked, with her usual quickness and poignancy, "Is the scaffold of Lady Janet taken away?" A few days later, Courtenay was transferred from the Tower to Fotheringay Castle.

History. 1554.

The rebellion had suspended for some weeks the proceedings relative to the queen's marriage. But in the beginning of March the English ambassador returned from the Continent with the ratification of the treaty; and Philip landed at Southampton on the 19th of July 1554, attended by a magnificent train of Spanish grandees and Burgundian lords. The marriage between him and Mary was solemnized by Gardiner in his cathedral at Winchester, before crowds of noblemen from all parts of Christendom, and with a pomp and splendour seldom surpassed. Philip was then in the twenty-ninth year of his age, and Mary in her thirty-eighth year. The countenance and form of the prince were far from being disagreeable; but the stately reserve of his Spanish manners was not calculated to lessen the repugnance of the English people to the union.

Soon after her marriage, Mary resolved to restore the religious polity of the kingdom to that state in which it had existed at the time of her birth. Accordingly, on the 12th of November a parliament was holden for this purpose, and a bill passed both houses "for the restitution in blood of the Lord Cardinal Pole." But a difficulty arose regarding the abbey lands; for it was feared that those who possessed them in spite of the indelible claims of the church might be called before the tribunal of the pious cardinal. However, on the 20th of November, Pole arrived at Dover, armed apparently with ample powers to do every thing necessary for the reconciliation of England with the church of Rome; and amongst these was full authority to do with the abbey lands as he thought fit. Nine days after his arrival, he made an oration to the two houses, exhorting them to return to the bosom of the universal church, at the same time absolving the kingdom from the papal in-

History. 1554.

terdict. The request was formally acceded to, and Pole was enabled to announce to the pontiff the success of his mission. In order to quiet the possessors of church property, the legate issued his dispensation, declaring that they should not be molested; and a statute passed confirming his sentence. By another, the acts which had abolished the papal supremacy were repealed. This new restoration of power to the papacy formed a sad and dark augury for the devoted Protestants. It was the first indication that the time approached when the fires of persecution were to blaze forth in every county of England, and when heaven was to be insulted by the profanation of its sacred name as sanctioning the foulest deeds of blood.

An act was passed by the parliament of 1554 for the revival of the statutes of former sovereigns against heretics, and especially against Lollards; which revival was to take effect from the 20th of January 1555. During the last reign, no Roman Catholic had suffered capital punishment on account of his faith, nor does there appear to have been any kind of jurisdiction or mode of procedure for the trial of heresy, although the law remained in full force against anabaptists and anti-trinitarians, whose doctrines were looked upon both by Catholics and Protestants as sapping the very foundations of Christianity. It has been alleged by the opponents of Protestantism, that in *The Reformation of Laws*, composed in the latter part of Edward's reign, there are indications of a preparation for lighting the faggot against the adherents of the ancient religion; and as the point is of some importance, we shall avail ourselves of the following observations by Sir James Mackintosh, which seem to put the matter in its true light. Referring to the allegation that severity against the adherents to Catholicism was about to be put in execution, he says,

"This statement is chiefly grounded on a text of that projected code, which directs that contumacious and incorrigible heretics, after all other means have been exhausted, shall be at length delivered to the civil magistrate to be punished. It is assumed that the punishment must be death. Yet in the very first article of the code, which relates to atheists and unbelievers in Christianity, death is denounced against them in express words.

"The admission of it into another article by mere implication is therefore unreasonable. It is too terrible an enactment to be admitted without express words. If punishment is held to be synonymous with capital punishment, by force of this clause death must be applied to all heresies. If it was intended to confer on the civil magistrate a large discretion in the infliction of inferior punishments for the enumerated heresies, the article is perfectly agreeable to the practice of the framers and the opinions of the times. It is incredible that capital punishment could be denounced against the whole of a long series of heresies, of which the catalogue nearly occupies twenty quarto pages, besides what is called a monstrous heap of other errors, less necessary to be specified, as being less prevalent in that age. Even admitting this unreasonable construction of the plan for a reformed code, it affects only the reputation of the projectors. It never was adopted by public authority. It was not laid before parliament. There is no reason to doubt that the Protestant parliament would have altered the very articles in question, if, when they were communicated to that assembly, they could be supposed to establish or countenance a practice perfectly at variance with that of the king and parliament of England in the reign of Edward VI. To hold that a few words in a Latin manuscript, of projected but not adopted laws, not printed till many years afterwards, could have been the incentive of those who kindled the fires of Smithfield under Mary, is one of the most untenable of all positions. Truth and justice require it to be positively pronounced, that Gardiner and Bonner cannot plead the example of Cranmer and Latimer for the bloody persecution which involved in its course the destruction of the Protestant prelates. The anti-trinitarian and the anabaptist, if they had regained power, might indeed have urged such a mitigation, but the Roman Catholic had not even the odious excuse of retaliation."

History. 1555.

The year 1555 opened with gloomy forebodings for the reformed clergy; and ere a month had expired, the lowering tempest burst upon them with unexampled fury.

On the 28th of January a commission, with Gardiner at its head as lord chancellor, assembled in the church of St Mary Overies, in Southwark, for the trial of Protestants. From the station which this individual held, and from his commanding talents, there appears to be little doubt that he was instrumental in pushing forward this bloody work, although some writers have attempted to remove this reproach from his character. Whether he was the main author or not, is a matter of comparatively little importance. As lord chancellor, and as head of the commission, he sanctioned the whole proceedings. He must therefore be held responsible for the deeds of those who acted under his authority, and suffer the lash of posterity, in the same way as Cromwell, on whom Catholic writers have poured out the vials of their wrath, from his having acted as captain of the banditti who plundered the holy places in the reign of the eighth Henry.

The first martyrs in this persecution were Hooper bishop of Gloucester, and Rogers, a clergyman of Essex, both eminent divines of the reformed cause. They died with feelings of triumphant piety in the midst of suffocating flames; and other victims were rapidly hurried to the stake. The principal were, Archbishop Cranmer, Ridley bishop of London, and Latimer bishop of Worcester. (See CRANMER.) These persecutions soon became odious to the whole nation, and the perpetrators of them were all willing to shift the blame from themselves upon others. Many of the Catholic prelates, to their honour, exercised occasionally an effectual and perhaps hazardous humanity in their favour. Gardiner himself withdrew from this unavailing slaughter, and his place was supplied by Bonner bishop of London, a less scrupulous dealer in blood. Even Philip himself was moved to pity, and discountenanced these diabolical proceedings. To describe the sufferings of those persons of eminence and distinction who perished, would fatigue the patience and harrow the feelings of the reader. For four years the persecution was carried on with unsatiated cruelty; and, keeping out of view those who perished in dungeons under every form of misery, and also those who expatriated themselves, nearly three hundred individuals are calculated to have expired at the stake. We are positively informed by Lord Burghley, that in this number of victims are comprised no less than one hundred women and children. The perpetrators of these "more than heathen cruelties" deserve no quarter from posterity; such deeds as those laid to their charge stamp infamy deep on their names, and hold them up to execration now and for ever.

The other events of this reign unconnected with religion are, with the exception of the loss of Calais, unimportant. The reduction of this town had cost Edward III. a siege of eleven months, and the English standard had waved over its battlements for above two centuries. It surrendered to the arms of France after a siege of only eight days, and its loss so affected the queen, that when lying on her deathbed she said, "If you open me you will find Calais written on my heart." Philip, her husband, appears to have treated her with formal but cold respect.

History. 1558. He had succeeded to the greatest monarchy then in the world, and had been some time absent from England in superintending its affairs. He returned again, but his departure a second time left Mary to brood over her fruitless barbarity alone. She had more than once entertained the nation with rumours of her pregnancy, and was herself cheated with the illusive hopes of offspring. But this Shiloh of the ancient faith, like that of a celebrated dreamer of after times, was the manifestation of a deadly disorder. She died of dropsy on the 17th of November 1558, to the unspeakable relief of the greater portion of her subjects.

History has loaded the memory of Mary with merited opprobrium. Some Roman Catholic writers have endeavoured to palliate her conduct on the plea that she acted under the influence of religious principle, and from a conscientious desire to suppress opinions which she considered very dangerous to her subjects, and not from a cruel and bloodthirsty disposition; but, in mitigating her atrocities upon this ground, what a fearful charge do they bring against the system of religion which could so deaden the feelings of humanity and mercy in the heart of a woman, and could incite to such deeds of cruelty as earned for her among the common people the title of the "Bloody Mary," and which, even in the most accurate and sober narrative, excite just detestation.

There was nothing attractive in the private life of Mary, for her nature was sour and unamiable, and almost destitute of that tenderness which peculiarly distinguishes the female character. Whether or not she was a tyrant like her father, she was at all events pre-eminently fitted for becoming the tool of tyrants. It has been said that she was not altogether remorseless, for she is reported to have suffered some compunction on account of her conduct towards the Protestants.

After the death of Mary, the Princess Elizabeth succeeded to the throne without opposition. She was at Hatfield when the news of her sister's death were brought to her, and hastening to London immediately, she was received there with great joy. For the preservation of her life this princess was indebted to Philip, the husband of Mary. The Spaniard was aware that her death would remove the only obstacle which stood between Mary of Scotland and the throne of England. That sovereign had been married to the heir-apparent of France, his great political enemy; and the balance of power which might thus be thrown into the hands of the latter would have endangered the stability of Philip's throne; a circumstance which induced him to this unusual act of liberal humanity. The first measure of Elizabeth was to assemble around her throne a body of counsellors who had recommended themselves to public notice by the power of their talents or the steadiness of their principles. Her state council was composed of both Catholics and Protestants, although her more confidential advisers were confined to a select portion of the latter, and amongst these was Sir William Cecil, whom she appointed her first secretary. Precautionary measures were taken to meet any invasion on the part of France in order to raise Mary Queen of Scots to the throne; for the government of that country had made demonstrations to this effect, by instigating Rome to hostilities against Elizabeth. Mary had left a vacant treasury, and one of the first cares of the new administration was to obtain pecuniary supplies; and, from the high character and popularity of the queen, these were immediately granted by the people. Her coronation was then celebrated with all possible splendour and festivity.

To establish the Protestant religion was Elizabeth's most ardent desire. With this view the statutes passed in the late reign for the support of the ancient faith were repealed; and the acts of Henry VIII. in derogation of the papal authority, and of his successor in favour of the reformed church, were for the most part revived. There were some deviations in the new book of common prayer from the liturgy of Edward VI., but of these only two are important. The first consists in the omission of a prayer to be freed from the "tyranny of the bishop of Rome and all his detestable enormities;" which certainly displayed a conciliatory spirit towards the Catholic church. The second was an alteration of the language which spoke of the sacrament as being only a remembrance of the death of Christ, and the substitution of words which indicate the real but not corporeal presence. Towards the middle of 1559 the Protestant liturgy was introduced, and the oath of supremacy administered. Strong opposition to it was evinced on the part of the clergy, especially amongst those of a dignified station; and out of sixteen bishops only one took the oath tendered to them. But the lower orders were less scrupulous; and it is probable that in many instances necessity induced them to make a compromise with their consciences. Those of the clergy who refused compliance with the new code of religious doctrines were deposed, and their places supplied by professors of the reformed religion. According to the standard of punishments which followed contumacy in these ages, the treatment of the bishops was mild. Bonner was imprisoned; but he was a man so empurpled with blood as to be odious to all parties. This was the highest degree of suffering to which any of the nonconformists were subjected.

History. 1569. During the time that the queen and her counsellors were thus settling the religious affairs of the nation, negotiations were carried on between England and France for a peace, which was at last concluded on the following terms, viz. that the French king should restore Calais at the expiration of eight years; that in case of failure, he should pay five hundred thousand crowns, and Elizabeth's title to Calais should still remain; that for the payment of this sum he should find the security of eight foreign merchants, not natives of France; and that until such security was provided he should deliver five hostages. If during this interval Elizabeth should break the peace with France or Scotland, she was to forfeit all title to Calais; but if the French king was to make war on Elizabeth, he was to be obliged to restore the fortress immediately.

The reign of Elizabeth for the first eleven years, that is, from the twenty-fifth to the six and thirtieth year of her life, was distinguished for the internal quiet and happiness of the country. During this interval she displayed the very best qualities of a sovereign; firmness, prudence, vigilance, activity, and foresight. These qualities were tempered with habitual amenity, and a rational piety. By her subjects she was admired, applauded, and imitated; and during this halcyon period her throne received an accession of strength which enabled it to stand unshaken amid the tumultuous storms with which it was afterwards assailed. She was repeatedly advised to engage in a matrimonial alliance, but uniformly declined to do so, declaring her resolution of remaining single for life. Amongst her suitors were various foreign princes, Catholic as well as Protestant; and some of her own subjects even presumed to intrude their offers upon her "maiden meditation," but without success. During the religious war which raged in France, Elizabeth, ever ardent in the cause of the reformation, assisted the Huguenots with arms and money

In the mean time the pretensions of Mary, queen of Scotland, to the crown of England, involved Elizabeth in transactions which have left a stain upon her name. Mary, who was espoused to the dauphin of France, had quartered

History. 1569. the arms of England with those of France and Scotland upon her escutcheon; and to this she was advised by the Catholics, who looked upon Elizabeth as a usurper, having been illegitimised in her youth by the cruel mandate of her father at the time when he consigned her mother to the block. The result of this appropriation of the armorial bearings of the English sovereign was a quarrel between the two princes, which only terminated with the execution of the unfortunate queen of Scotland. See the article SCOTLAND.

In 1569 Elizabeth was excommunicated by Pope Pius V. These anathemas, by absolving subjects from the oath and the duty of allegiance, and suspending the offices of religion, and even those of humanity, were sometimes most disastrous to a country, upon which they descended like a deadly epidemic. But the majority of the queen's subjects were of the same religion with herself, and had thrown off the papal yoke; so that it was in the present instance productive of no other effect than the publication of a severe act against all who held any communication with the bishop of Rome. Severe measures were also taken with the puritans and other dissenters. At this time the English nation was divided into three theological and political parties; the *Churchmen*, who considered the ecclesiastical revolution as already perfect; the *Puritans*, who sought further reformation by agitating the minds of the people; and the *Catholics*, who, supported by the great continental powers, did not yet despair of seating their religion upon the throne. But men of all these persuasions united in their abhorrence of anabaptists; and, in order to extirpate them, the fires of Smithfield were, after an interval of seventeen years, re-kindled. Fox the celebrated martyrologist dared to interfere in behalf of this hated sect; but his courageous humanity obtained for them only a temporary respite. Two men were burned, and numbers were imprisoned or otherwise corporally punished. These events took place about the middle of the year 1575, and this was the first blood spilt by Elizabeth on account of religion; it, however, forms a dark stain upon her government, which may be pronounced mild when compared with others of the same period. The blood of Henry VIII. was not yet sufficiently purified in this its first descent from the fountain-head.

Amongst the other domestic events connected with the history of England, was that of the rebellion of Percy earl of Northumberland, and Neville earl of Westmoreland. This revolt partook both of a civil and of a religious character, for the noblemen at its head were adherents of the ancient faith, and were encouraged to embark in their lawless enterprise by the Catholic states. But on the approach of the royal troops under Sussex, the insurgents broke up and fled. Northumberland was made prisoner in Scotland, and executed at York; and Westmoreland died in Flanders, in the humble capacity of commandant of a Spanish regiment. Other treasonable transactions originated with the Duke of Norfolk, whose vaulting ambition aspired to the hand of Mary queen of Scots. Indeed he and the two insurgents just named, together with several other nobles, united in a conspiracy against Elizabeth. The timely arrest of Norfolk, however, disconcerted the confederacy, of which the northern rising was merely a premature explosion. Mary of Scotland is positively asserted to have been a participator in the plot. Norfolk was brought to trial; and there seems little doubt that he had incurred the penalties of treason, by having had intercourse with Catholic princes who had undertaken to land in England with a hostile army, and by his clandestine renewal of negotiations for the delivery and espousal of Mary, at that time a prisoner in the hands of Elizabeth. He was condemned to death, and executed, after a great deal of hesitation on the part of the queen.

History. 1588. England now began to distinguish herself in her natural career of maritime enterprise. Amongst the most distinguished of the nautical adventurers of this age was Sir Francis Drake, whose exploits will be found related under the article DRAKE. A vague rumour had for some time pervaded Europe, of vast naval preparations by the king of Spain, for the invasion and conquest of England. In 1587 Sir Francis Drake having been dispatched with a fleet to attack the Spanish ships which lay in the bay of Cadiz, was completely successful in his enterprise, burning and destroying above one hundred vessels laden with ammunition and naval stores. The fruits of his expedition were of vast importance. Philip's preparations were disturbed, and his project of invasion put off for twelve months, during which period Elizabeth had time to make head against the storm which was gathering in that quarter. These were the obvious results of Drake's bravery; but who can estimate the moral effect which it had produced? It gave a heroic impulse to the nation, and inspired it with confidence in its own strength and resources. It taught English seamen to look without terror upon the towering bulk of the Spanish vessels; whilst the Spaniards themselves must have in a proportional degree lost the confidence of having an advantage over the enemy by means of their floating castles.

The king of Spain having once more completed his complement of vessels, manned them with the ablest seamen and soldiers, under the command of the most renowned leaders. This Armada was truly imposing and magnificent; it was baptized The Invincible, but not with English blood. Never before had the ocean borne a more splendid fleet than that which sailed from the Tagus on the 25th of May 1588. The ships and their equipments had been fitted out in every port of its king's dominions. In Flanders, the forest of Waes had been felled; the dockyards of Antwerp, Dunkirk, Newport, and Gravelines swarmed with artificers; and the rivers and canals were covered with boats adapted for the transport of soldiers destined to serve in the expedition. On the 20th of May the following enumeration of the vessels was made: "The general sum was 130 ships, of 57,868 tons; 19,295 soldiers and 8450 mariners, with 2088 slaves, and 2630 great pieces of cannon of all sorts; also twenty caravals for the service of the others, with ten salvers of six oars a piece." Towards the end of June another armament of eighty sail left Lisbon to join them.[1] To meet this overwhelming armament the royal navy of England mustered 181 ships, containing between seventeen and eighteen thousand seamen. There were only eight ships above five hundred tons burden, and the largest was only eleven hundred. The aggregate burden of the whole English fleet amounted to 31,985 tons, being little more than one half of that of the Spaniards. The preparations made on land displayed equal spirit and enthusiasm. A loyal patriotism and active magnanimity pervaded the whole kingdom. The city of London set a noble example. The lord-mayor, in the name of the metropolis, put at the disposal of his sovereign ten thousand soldiers and thirty vessels. The whole nation emulated this wise liberality; and every city, town, and hamlet poured forth its ardent patriots to take their stand upon the coast and repel the insulting invader. About fifty thousand men under the command of Earl Hunsdon, a brave and able general,

[1] Strype, p. 538–9, from the Spanish book, which rather styled the whole "Felicissima Armada."

History. 1588. guarded the queen's person. The Thames at Tilbury was watched by Leicester with a considerable force. Sir Walter Raleigh was stationed at Portland Castle, in Dorsetshire, and the Earl of Sussex at Portsmouth. In the other parts of the country the wisest measures of defensive warfare were adopted. At sea one division of the fleet under Lord Henry Seymour guarded the narrow seas; whilst the main body under Lord Charles Howard, the high admiral, was stationed in the Western Ocean. The gallant Sir Francis Drake and the able navigators Hawkins and Frobisher were in this division.

Under the Duke of Medina Sidonia, the Spanish Armada set sail for the invasion of England. It was for some time retarded by a tempest, which also harassed the English fleet; and news were brought to the queen of England that Medina's Armada had been so injured and scattered that the expedition was for the present abandoned. The English ships withdrew to various ports, where they might have been surprised and burned, had not intelligence accidentally arrived that the Spanish fleet was bearing down full sail upon the coast. On the 20th of July the English admirals came in sight of the enemy, and next day the first engagement took place. The plan of Lord Howard was to evade a direct attack; for his vessels being so much inferior in bulk and weight of metal to the enemy's ships, were incapable of grappling in close action with them; but being superior in mobility and expedition, he resolved to annoy their rear, and to cut off the sluggish sailers. In the first attack neither fleet suffered much. Early in the morning of the 23d the second conflict began, and both fleets fought with valour; but the advantage was at last on the side of the English, over whose smaller vessels the iron shower from the higher sides of the Spanish ships flew harmless, whilst their own took full effect. On the 24th a pause took place in the battle, which was, however, renewed next day; but the mighty armament forced its way unbroken to the vicinity of Calais. They were now prepared to act in concert with the Duke of Parma, who had completed his preparations. He possessed in the harbours of Newport and Dunkirk transports which carried about twenty-eight thousand men, and which waited the general's command to make the grand attempt.

The concentration of the Spanish Armada off Calais suggested to the English admiral the idea of employing fireships to destroy it. Eight vessels were thereupon hastily prepared for this purpose, and during the night of the 29th, which was cloudy and boisterous, they were sent down blazing with combustible materials into the heart of the Spanish fleet. A cry of horror burst from the Spaniards, and, seized with an irresistible panic, they cut their cables with the intention of standing out to sea. But in their terror and confusion they inflicted severe injury upon one another; and, to augment their distress, a fierce gale sprung up, which scattered the Armada along the coast from Ostend to Calais. Some struck on the shallows at Flanders, whilst others beat out to sea; the remainder, amounting to about forty sail, were assailed by Drake and the rest of the English fleet. This was the most severe engagement which had yet taken place, and was maintained with great bravery for a whole day. The Spaniards lost several of their best ships; and after vainly endeavouring to regain their position in the narrow strait, where Parma could alone join them, they resolved to return to Spain by making a circuit round Great Britain. The want of ammunition compelled the English to refrain from pursuing the invaders at a time when they might have annihilated them. But this was reserved for an enemy even more formidable than that before which they fled. A storm overtook them on their unfortunate voyage, and the coasts of Scotland and Ireland were strewed with the wrecks of the Invincible Armada, so that only a feeble remnant of that splendid fleet reached the shore from whence it had sailed, in all the pomp and circumstance of war, as if to an assured triumph.

History. 1596. The events of Elizabeth's reign which followed the discomfiture of the Spanish attempt to invade England may be briefly related. The Earl of Leicester, who had for a long time maintained an enviable place in the queen's favour, was invested with fresh honours. A new and unprecedented office was created for him, that of lord lieutenant of England and Ireland, which exalted him to an authority only a little lower than that of sovereignty. But the ink was scarcely dry upon the warrant which wanted but the royal signature to complete the triumph of the favourite, when he was cut off by a violent disease, which, whether it arose from natural causes, or from poison being administered, at all events speedily terminated his career. Of this nobleman little need be said. He is one of a numerous class of historical characters who possess a degree of notoriety, not on account of any brilliant endowments which they themselves possessed, but from their proximity to or connection with distinguished personages. He possessed no intellectual or moral qualities which, deprived of adventitious aid, would have thrown him into the foreground of his country's history; whilst, if we listen to the opinion of his contemporaries, he must be looked upon as dissolute and unprincipled, notwithstanding his affectation of piety. He is a satellite only conspicuous from the light which is reflected upon him by his sovereign.

The English navy, emboldened by its late triumph, now made several very successful descents upon the Spanish coast, not so much for the purpose of obtaining permanent conquest, as of harassing the enemy. These expeditions were conducted by the most able commanders, amongst whom were some of the brightest names in the history of maritime discovery and enterprise, such as those of Raleigh, Drake, Cavendish, Hawkins, and Howard. It was then that the English navy assumed the empire of the sea, which it has ever since maintained with triumphant heroism.

On the death of Leicester, the young Earl of Essex succeeded him as prime favourite of the queen. But the desire of glory or the hope of plunder induced this volatile young nobleman to join the armament preparing to sail for Spain. The expedition was unfortunate, and when Essex returned to England, he found two rival candidates for royal favour, Sir Walter Raleigh and Sir Charles Blount. By the superior influence of these noblemen, the former was driven to cultivate a portion of land which had been granted to him in Ireland; and with the latter Essex fought a duel, in which he was wounded. But by the queen's command they were reconciled to each other, and in process of time they became sincere and attached friends.

In the year 1596, a new expedition was fitted out for Spain, which was completely successful. The Spanish fleet was defeated, and lost thirteen men-of-war. Cadiz was taken, and its defences, which rendered the town the strongest fortress in the country, were razed to the ground. This was the severest blow which the king of Spain received from his daring enemy subsequent to the repulse of the Armada. Matters might have been still worse with him had not dissension sprung up amongst the English commanders, the majority of whom, against the suggestion of Essex, who was one of the leaders, declared for an immediate return to England. The town, with the exception of the churches, was reduced to ashes; and the troops, taking with them the most valuable portion of the plunder, re-embarked, and the fleet returned to Plymouth in less than ten weeks after it had set sail. Essex, on his arri-

Statistics. 1603.

val in England, was compelled to appear before the queen in council, and answer to several charges connected with the late enterprise. These charges merely related to pecuniary matters, and the favourite was acquitted; but this was the commencement of numerous subsequent quarrels which he had with his sovereign, none of which are important to history except the last. Having been appointed lord deputy of Ireland, he suddenly left his command in that country and returned to England. He was committed a prisoner, and called upon to account for his extraordinary conduct. The queen, however, was unwilling to carry matters too far against her favourite. He was allowed to go about as a prisoner on parole; but this high-spirited and aspiring nobleman could not remain content with the humiliating circumstances to which he was now reduced. He attempted to excite the city of London to revolt against the queen's authority; but the rebel was taken prisoner, tried for high treason, condemned, and executed. This proved a severe blow to Elizabeth, who was now tottering upon the brink of the grave. She had been all her life subject to fits of indisposition, which were occasionally violent; but it was not till the beginning of March 1603 that her mortal illness came on. Her mind became depressed with gloomy recollections, especially those connected with the shedding of Essex's blood; and her nervous melancholy and general decline increased, accompanied by symptoms which indicated a disease of the heart, and by a laboured and convulsive respiration. She was questioned by her confidential advisers as to her successor, and signified her desire that the king of Scotland should succeed to the throne. Her speech soon afterwards failed entirely, and all hope of her recovery vanished. She tranquilly breathed her last, about three hours after midnight, on the 24th of March 1603, in the sixty-seventh year of her age and the forty-fifth of her reign.

In the opinion of her contemporaries, whose judgment has been ratified by posterity, Elizabeth ranks amongst the greatest and the most fortunate of English sovereigns. The domestic tranquillity which signalized her rule during nearly half a century; her triumphant repulse of the Spanish monarch, and the severe retaliation which she inflicted upon that lord of empires; the spirit displayed by her navy in its numerous warlike expeditions by sea, and also by her army on land, are indications of uncommon vigour on the part of the sovereign, and of sagacity on that of her counsellors. She found England comparatively inferior to other nations of Europe, but she left it amongst the proudest and the most powerful. It was during her reign and that of her successor, that the human intellect sprung up at once to full maturity, and produced those works which are the peculiar glory of English literature. Hers was the Augustan age of poetry, the age of Spenser, Shakspeare, and others; and during her reign Bacon began to put forth those gigantic energies of mind which were destined to change the whole aspect of science, and even the condition of man as a civilized being. The human failings ascribed to Elizabeth are, excessive vanity, love of popularity which is part of it, parsimony, and a leaning towards despotism. But those whose interest it has been to vaunt the glory of her sister's reign, and the purity of her life, have not failed to charge Elizabeth with great personal depravity; yet if we discredit every defamatory story which can be clearly traced to her enemies, the imputations will not have much weight, or attach any grave stigma to her name.[1] She is not, however, free from the stain of blood, the shedding of which cannot be justified, however it may be palliated by taking into account the circumstances of the times, and the critical situation in which she stood; but in this respect her conduct is almost purity itself compared either with that of her sister or of her father. For an account of the private life and literary character of this great queen, see the article ELIZABETH; and Turner's *Elizabeth*, vol. iv., p. 564.

She was succeeded by James the Sixth of Scotland and First of England. From that period, the history of the countries is given under the article BRITAIN. (J. F. S.)

Statistics. 1603.

Chronological Table of the Monarchs of England from the time of the Heptarchy to the death of Elizabeth.

Monarchs before the Conquest.

	No.	Monarchs.	Began to Reign.	Reigned Years.
			A.D.	
Anglo-Saxons.	1	Egbert	827	10
	2	Ethelwolf	838	20
	3	Ethelbald	857	3
	4	Ethebert	860	6
	5	Ethelred I.	866	5
	6	Alfred	872	29
	7	Edward the Elder	901	24
	8	Athelstane	925	15
	9	Edmund I.	940	6
	10	Edred	946	9
	11	Edwy	955	4
	12	Edgar	959	16
	13	Edward II.	975	3
	14	Ethelred II.	978	37
	15	Edmund Ironside II.	1016	1
Danes.	16	Sweyn	1014	3
	17	Canute	1017	19
	18	Harold I.	1036	3
	19	Hardicanute	1039	2
Saxons.	20	Edward III., or the Confessor	1041	25
	21	Harold II., son of Godwin, Earl of Kent	1066	1

Monarchs since the Conquest.

	No.	Monarchs.	Began to Reign.	To whom Married.	When Married.	Reigned Years.
Normans.	1	William I.	1066	Matilda of Flanders	1053	21
	2	William II.	1087	Never married		13
	3	Henry I.	1100	Matilda of Scotland	1100	35
House of Blois.	4	Stephen	1135	Matilda of Boulogne	1135	19
Plantagenet Race.	5	Henry II.	1155	Eleanor of Guienne	1151	34
	6	Richard I.	1189	Berenguella of Navarre	1191	10
	7	John	1199	Earl Montague's daughter	1185	17
				Avisa of Gloucester	1189	
				Isabella of Angouleme	1200	
	8	Henry III.	1216	Eleanor of Provence	1236	56
	9	Edward I.	1272	Eleanor of Castile	1253	35
				Mary of France	1299	
	10	Edward II.	1307	Isabella of France	1308	19
	11	Edward III.	1327	Phillippa of Hainault	1328	50
	12	Richard II.	1377	Ann of Luxembourg	1382	22
				Isabella of France	1396	
House of Lancaster.	13	Henry IV.	1399	Mary Bohun	1317	13.
				Joanna of Navarre	1403	
	14	Henry V.	1413	Catherine of France	1420	10
	15	Henry VI.	1422	Margaret of Anjou	1444	38
House of York.	16	Edward IV.	1461	Elizabeth Woodville	1465	22
	17	Edward V.	1483	Never married		
	18	Richard III.	1483	Ann Neville	1471	2
House of Tudor.	19	Henry VII.	1485	Elizabeth of York	1486	23
	20	Henry VIII.	1509	Catherine of Arragon	1509	37
				A. Boleyn, 31, J. Seymour	1536	
				Ann of Cleves, C. Howard	1540	
				Catherine Parr	1543	
	21	Edward VI.	1546	Died young		6
	22	Mary I.	1553	Philip King of Spain	1554	5
	23	Elizabeth	1558	Never married		44

PART II.

STATISTICS.

I.—*Situation, Extent, Face of the Country, Soil and Climate.*

Situation and extent. England, the southern, and by far the most fertile division of Britain, corresponds in latitude with Holland and the north of Germany, extending from 50. to 55. 45. N. Its figure is nearly triangular, and its extent of coast is very great, both from being much indented, and from the sea bounding it on all sides except along a width of 70 miles on the Scottish border. The adjacent seas are the German Ocean on the east, St George's Channel on the west, and the English Channel on the south. No country can be more fortunately situated; its climate is temperate; its extent is sufficient for its political security; whilst its insular position not only presents the greatest capabilities of aggrandisement in a commercial sense, but has, by rendering a great military force unnecessary, in all probability been the chief cause of preventing the executive branch from usurping absolute power, as in the countries of the Continent.

Its superficial extent had long been a question of considerable doubt, and the different estimates varied no less than 10,000,000 of acres. Mr Pitt, on the authority of Arthur Young, assumed, in 1798, the superficial extent of England and Wales to be nearly 47,000,000 of acres; a later calculation by Dr Beeke, approaching more to accuracy than any preceding one, fixed it at 38,500,000 acres. But, according to the census of 1851, the area of the great territorial subdivisions of Great Britain is as follows, viz.: England, 50,922 sq. miles; Scotland, 31,324; Wales, 7398; and the Islands in the British Seas 394 sq. miles; making the area of England and Wales 58,320 sq. miles, or 37,324,915 imperial acres. The forms of the islands are irregular, and do not approach simple geometrical figures, if we except England, which was not inaptly compared by the ancients to a triangle. The area of Great Britain is equal to a square of 299 miles to the side; England to a square of 226 miles to the side; Scotland to a square of 177 miles to the side; Wales to a square of 86 miles to the side; the Islands in the British Seas to a square of 20 miles to the side. While the area is in the ratio of these squares, or as 51, 31, 7, and $\frac{4}{10}$, the population is nearly as 17, 3, 1, and $\frac{1}{7}$; England has, on an average, to a square mile 332 persons, Wales 136, Scotland only 92, the Islands in the British Seas 363 persons. While about 21,200,000 acres of territory lie north, and 36,400,000 acres south of the 55° of north latitude; the populations on the north and south side of the line are respectively about 3,173,000 and 17,787,000.

Face of the country. England is generally a level region, though it is traversed in different directions by ridges of considerable elevation, forming the watersheds of the country. The northern part

Statistics. of the kingdom (including Westmoreland, with portions of Cumberland, Lancashire, and Yorkshire) is mountainous; and a chain of hills, varying in elevation from about 1200 to 3000 feet, extends southward from the borders of Scotland to the middle of Derbyshire. A range of table-land (rising sometimes into hills, and attaining a height of 1500 feet) extends in a tortuous line through the East Riding of Yorkshire, and the counties of Lincoln, Northampton, Oxford, Gloucester, Somerset, and Dorset, where it terminates with the isle of Purbeck. It is chiefly composed of oolitic rocks, rising above the lias formation, and presents generally a bold escarpment to the west, with a regular slope to the east. The southern and eastern counties are traversed by ranges of chalk hills of small elevation, diverging from Salisbury Plain. One of these extends eastward through Hampshire and Sussex to Beachy Head, forming what are called the South Downs; a second extends through Hampshire, Surrey, and Kent, forming the North Downs; and a third passes north-easterly through the counties of Berks, Oxford, Bucks, Bedford, Cambridge, Suffolk, and Norfolk, where it forms the eastern border of the fens. Devon and Cornwall are occupied by mountains of granitic formation, and Wales by a series of high and rugged mountains, forming several groups and chains between the vale of the Severn and the Irish Sea. It would therefore appear that the highest and most rugged part of England is to be found near its western coast, while the principal plains and lowlands lie towards the German Ocean.

Geology. To the south-eastward of a line drawn from the isle of Portland, by Oxford, Northampton, Leicester, Nottingham, Doncaster, and York, to the vicinity of Scarborough, the whole of this district is composed of chalk, calcareous sandstone, and other secondary strata, or alluvial ground, in which there are no beds of workable coal or metallic veins. To the westward of the above line the country is composed of secondary strata of a different description, in many parts of which beds of coal and ironstone are found. To the north and west of this second district are found mountains of metalliferous limestone. Granite and granitic rocks are found in Cornwall, Devon, North Wales, Anglesea, the Malvern hills in Worcestershire, Charnwood forest in Leicestershire, and in Cumberland and Westmoreland. Primary stratified rocks are chiefly limited to the clay-slate, grauwacké, and silurian systems; the first two of which extend over the south of Cornwall and Devon, the northern part of Devon, a large portion of Wales, and nearly the whole of the lake districts of Westmoreland, Cumberland, and Lancashire. Gneiss and mica-slate are almost unknown, though traces of them are to be found in the Saddleback rocks in Cumberland, and in the Isle of Man. The secondary rocks commence with the carboniferous system, which is extensively developed in the northern counties and in South Wales, and the adjacent parts of England. Outlying groups of this system occur likewise in other places. Millstone-grit rocks, which prevail to a great extent in the north of England, are, however, little known in the southern carboniferous region; while, on the contrary, the old red sandstone, which is enormously developed in the latter, is limited in the north to a few inconsiderable traces. The saliferous or new red sandstone system commences at the Tyne, and skirts the northern carboniferous region to near Liverpool. It is found also near Carlisle, in the upper part of the estuary of the Severn, and in the valley of the Exe. The oolitic system, as already mentioned, forms a belt nearly 30 miles in breadth, extending from Yorkshire to Dorsetshire —supplying some of the best building materials in the kingdom. A fresh-water formation, called the Wealden, extends over a large portion of Kent and Sussex. The cretaceous system, or chalk formation, extends from Flamborough Head in Yorkshire (though interrupted by the Wash) to Sidmouth in Devonshire, forming the ranges already referred to. The tertiary strata consist chiefly of the argillaceous formations, abounding in organic remains, named the plastic clay and the London clay; extending over Middlesex, Essex, Suffolk, and portions of Kent, Surrey, and Norfolk. A variety of the same formation is found on the south coast, from Brighton on the east to Dorchester on the west. The localities of the post-tertiary or diluvial and alluvial formations are too numerous to admit of specification in such a sketch as the present.

Trap has found its way through all the stratified formations, but occurs in masses of varying dimensions in different places.

The coal-beds of England, contained in the carboniferous system, are found in Northumberland and Durham, south Yorkshire, Nottingham and Derby, south Lancashire, Staffordshire, Warwickshire, Anglesea, Flint, Salop, Worcestershire, Gloucestershire, and the northern part of Somerset, South Wales, and near Whitehaven in Cumberland. Iron is found in inexhaustible quantities in all the formations. Lead is found chiefly in the mountain limestone, copper in the granite and older primary stratified rocks, tin in Cornwall and Devon. Salt springs, yielding large quantities of salt, are found in Cheshire and Worcestershire.

Sea-coast. The sea-coast of England presents a very different aspect in different situations; in some quarters—as in Cornwall, Kent, part of Norfolk, and Wales—it is steep and elevated; in other parts it is low, sandy, or marshy; exhibiting, on the whole, a variety which hardly admits of being brought under a uniform description, and which, though partaking much more of a level than rugged character, still differs greatly from the opposite shore of Flanders, Holland, and Friesland, which is one continued flat for more than 300 miles.

Rivers. Of the rivers of England, the largest are the Thames, the Severn, and the Trent. The Thames has no pretensions to romantic effect in any part of its course, nor is its body of fresh water large; but it is navigable for more than 120 miles, and, in the approach to London from the Nore, presents to the admiring spectator a prospect which, whether we consider the quantity of shipping, the thickening population, or the high state of improvement of its banks, is wholly without parallel. The Severn, though not equal to the Tay in quantity of fresh water, is superior to the Thames, and during the first part of its course preserves the characteristics of a mountain stream, being clear, and at times bordered by picturesque scenery; but, on leaving Wales, and entering a more level country, it assumes a different aspect, and becomes a full slow-flowing river, admitting of easy navigation, and facilitating greatly the commerce of Shropshire, Worcestershire, and Gloucestershire. Towards its mouth it receives the Wye, a large navigable river from Wales. The Trent rises in Staffordshire, and—after a course often tortuous, but generally in a north-east direction—falls into the Humber, which soon after becomes a broad estuary. The Mersey, as a river, is of no great importance; but as an arm of the sea it affords from the west a very capacious inlet to the trade of Liverpool, and facilitates the conveyance of the produce of the interior. The Tyne is a large stream, having Newcastle on its banks, and Shields near its mouth. The Medway, as a fresh-water river, is small and sluggish, but acquires, by the influx of the tide, such a depth of water at Chatham as to adapt it to the reception of the largest men-of-war. It is only the rivers of Wales, Westmoreland, Cumberland, and a few mountainous districts, that are rapid or transparent; the great majority of English rivers, particularly in the eastern and central part of the kingdom, are slow in their course, and owe the degree of beauty which they possess less to the effect of the water or scenery than to the high cultivation and elegant disposition of the adjacent grounds.

Lakes and forests. A similar remark applies to the lakes of England. Nothing can exceed the beauty of Windermere, Keswick, and Ulleswater; whilst the unvaried and uninteresting collections of water, such as Whittleseameer and others in the fen district, are to be compared only to those in North Holland

Statistics.

or Friesland. In regard to wood, England is very well provided, without having many of those extensive forests which are met with on the Continent upon great mountain ranges, such as on the Jura ridge between France and Switzerland, and the Suabian Alps upon the Upper Rhine. It is in private plantations of limited extent, but of frequent occurrence, and sometimes of great beauty, that the chief stock of English timber is to be found. Several very extensive tracts—such as the New Forest in Hampshire, the Forest of Dean in Gloucestershire, and Sherwood in Nottinghamshire, belong to the crown.

Soil and produce.

The soil of England is suited to a great variety of products; but it has not the exuberant fertility of southern climates, much labour and vigilance being requisite to obtain from it a grateful return. The quantity of moisture makes it admirably adapted for pasture; a characteristic which does not particularly strike those whose travels have never extended beyond their own country, but is of the highest importance in the view of those who have visited the Continent, and have witnessed the parched and arid state of the richest plains in the months of autumn. In regard to husbandry, it happens, by a singular coincidence, that in England, as in Scotland, the best is practised in the east part of the island, particularly in Norfolk, Lincolnshire, and Northumberland. As to mineral treasures, the eastern counties of England, to the south of Yorkshire, are remarkable for containing no mines, either of coal or of metal; these valuable deposits are found in the more uneven districts of the north and west, viz., in Northumberland, Durham, Westmoreland, Lancashire, Shropshire, Worcestershire, Somerset, Devon and Cornwall, in Wales, and in the midland counties of Warwick, Stafford, and Derby. In the east, particularly in Lincoln and Cambridgeshire, vast improvements have been made in the present age by draining; but there are still the means of making further and valuable acquisitions. Much also remains to be done in bringing into culture extensive heaths and moorlands in almost every county in the kingdom. The soil of these is in general poor, but the tillage required would seldom be obstructed, as in many parts of Scotland, by the ruggedness of the surface. Comparing the soil of England with that of the adjacent countries, we find it greatly superior to that of Scotland, except along our eastern coast; it is perhaps better also than that of Ireland, fertile as the latter naturally is; nor needs it, on the whole, dread a comparison even with the soil of France, where, amidst districts of great beauty and luxuriance, the eye of the traveller is often struck with extensive tracts of heath or marsh.

Area in Square Miles; Houses; and Population, in 1851; *in Divisions and in Registration Counties.**

Divisions and Registration Counties.	Area in Square Miles.	Inhabited houses.	Population.
ENGLAND AND WALES	58,320	3,278,039	17,927,609
1 LONDON DIVISION..........	122	305,933	2,362,236
2 SOUTH-EASTERN DIVISION..	6,352	298,054	1,628,386
3 SOUTH-MIDLAND DIVISION..	5,002	246,422	1,234,332
4 EASTERN DIVISION...........	5,022	228,843	1,113,982
5 SOUTH-WESTERN DIVISION	7,804	338,986	1,803,291
6 WEST-MIDLAND DIVISION..	6,013	418,205	2,132,930
7 NORTH MIDLAND DIVISION.	5,527	246,645	1,214,538
8 NORTH-WESTERN DIVISION	3,144	435,987	2,490,827
9 YORK DIVISION..............	5,710	358,663	1,789,047
10 NORTHERN DIVISION........	5,457	164,694	969,126
11 WELSH DIVISION............	8,167	235,607	1,188,914
1.—LONDON DIVISION.			
Middlesex (*part of*)..........	51	213,279	1,745,601
Surrey (*part of*)..............	36	72,344	482,435
Kent (*part of*).......	35	20,310	134,200
2.—SOUTH-EASTERN DIVISION.			
1 Surrey (*extra-metropolitan*)..	744	36,839	202,521
2 Kent (*extra-metropolitan*).....	1,584	88,048	485,021
3 Sussex	1,484	59,173	339,604
4 Hampshire.......................	1,658	74,592	402,016
5 Berkshire.........................	882	39,402	199,224
3.—SOUTH-MIDLAND DIVISION.			
6 Middlesex (*extra Metropol.*)..	276	28,026	150,606
7 Hertfordshire....................	669	33,919	173,962
8 Buckinghamshire................	629	29,181	143,655
9 Oxfordshire......................	749	34,459	170,247
10 Northamptonshire..............	988	43,928	213,844
11 Huntingdonshire...............	321	12,464	60,319
12 Bedfordshire.....................	477	25,709	129,805
13 Cambridgeshire..................	893	38,736	191,894
4.—EASTERN DIVISION.			
14 Essex	1,536	68,375	344,130
15 Suffolk............................	1,454	69,324	336,136
16 Norfolk............................	2,032	91,144	433,716

Divisions and Registration Counties.	Area in Square Miles.	Inhabited houses.	Population.
5.—SOUTH-WESTERN DIVISION.			
17 Wiltshire..........................	1,216	49,007	240,966
18 Dorsetshire	962	34,721	177,095
19 Devonshire........................	2,671	99,288	572,330
20 Cornwall...........................	1,377	68,205	356,641
21 Somersetshire....................	1,578	87,765	456,259
6.—WEST-MIDLAND DIVISION.			
22 Gloucestershire..................	1,119	78,319	419,514
23 Herefordshire.....................	665	20,433	99,120
24 Shropshire.........................	1,413	48,792	244,898
25 Staffordshire	1,179	120,485	630,545
26 Worcestershire....................	678	51,943	258,733
27 Warwickshire......................	959	98,233	480,120
7.—NORTH-MIDLAND DIVISION.			
28 Leicestershire.....................	831	49,963	234,957
29 Rutlandshire	168	4,955	24,272
30 Lincolnshire........................	2,718	79,735	400,236
31 Nottinghamshire..................	937	59,533	294,380
32 Derbyshire	873	52,459	260,693
8.—NORTH-WESTERN DIVISION.			
33 Cheshire	1,083	79,829	423,526
34 Lancashire	2,061	356,158	2,067,301
9.—YORK DIVISION.			
35 West Riding........................	2,637	267,427	1,340,051
36 East Riding (*with York*)......	1,142	50,799	254,352
37 North Riding	1,931	40,437	194,644
10.—NORTHERN DIVISION.			
38 Durham	1,178	68,959	411,679
39 Northumberland..................	1,952	47,737	303,568
40 Cumberland.........................	1,565	36,763	195,492
41 Westmoreland......................	762	11,235	58,387
11.—WELSH DIVISION.			
42 Monmouthshire	676	32,880	177,130
43 South Wales	4,401	119,481	607,456
44 North Wales	3,090	83,246	404,328

* The counties of which the eleven statistical divisions of England and Wales are composed are not strictly identical with the counties proper, but are aggregates of entire registration districts or poor-law unions, and are called, for the sake of distinction, "*Registration Counties.*"

Statistics.

The total amount of real property in England and Wales, as assessed in 1843, was £85,802,734; of which—lands, £40,167,088; houses, £35,556,400; tithes, £1,960,331; quarries, £207,009; mines, £1,803,794; iron-works, £412,022; fisheries, £10,967; canals, £1,229,196; railways, £2,417,610. The following table gives the amount of property assessed under the different schedules of the Property and Income Tax Act in England and Wales, for the years ending 5th April 1814 and 1815, and 1843 to 1851.

Years ending 5th April.	Schedule A. Lands, Houses, Mines, Quarries, &c., in respect of Property.	Schedule B. Lands, Houses, &c., in respect of Occupancy.	Schedule C. Dividends from the Public Stocks, &c.	Schedule D. Profits derived from Trades, &c.	Schedule E. Salaries and Emoluments of Persons in Public Offices.	Total Amount of Property Assessed.
	L.	L.	L.	L.	L.	L.
1814 and 1815	53,495,375	36,260,565	30,048,610	34,287,685	14,142,573	168,234,808
1843	85,802,734	41,558,550	27,909,793	63,021,904	9,417,463	227,710,444
1844	85,700,123	40,442,128	27,340,052	56,627,161	10,992,253	221,101,717
1845	86,573,636	41,104,043	26,501,078	55,505,733	10,780,478	220,464,968
1846	88,724,253	41,661,575	25,585,579	60,888,094	10,993,631	227,853,132
1847	89,759,066	41,070,325	26,005,019	60,867,494	11,235,798	228,937,702
1848	91,172,471	41,086,413	26,132,625	60,068,090	11,408,627	229,868,226
1849	94,538,472	42,529,913	26,446,891	56,701,896	11,740,518	231,957,690
1850	94,217,979	42,516,450	26,310,990	54,977,566	11,203,964	229,226,929
1851	94,809,969	42,473,404	26,435,182	55,587,248	11,110,490	230,416,293

Climate.

The climate of England is that of an insular country of limited extent, subject in consequence to rain, and exempt from intensity of either heat or cold. Compared with the adjacent countries, it is less humid than Ireland, which, like Portugal, in a different latitude, is the first land to intercept the vapours of the Atlantic; but, on the other hand, the climate of England is less dry than the opposite shores of Holland and Germany, to which every wind but the west arrives across a tract of continent. The climate of the S. of England resembles much that of the opposite coast of Brittany, Normandy, and Flanders; whilst that of the N. is very similar to the temperature of Denmark, which, like the N. of England, is a narrow country inclosed on either side by the sea. In regard to the relative degrees of heat or cold, if England have not so much summer warmth as continental countries on the same parallel, she generally escapes in winter that intensity of frost, which in less than 48 hours of easterly wind so frequently seals up their harbours. On the other hand, our weather is much more variable than in the inland part of the Continent, and our sky is less clear; still it by no means follows that the balance of disadvantage is on our side. The moderate heat and frequent returns of rain preserve throughout the year that verdant pasture, which in autumn the Continent enjoys only in its maritime districts; whilst those droughts in spring, which are so noxious in the S. of France and in similar latitudes of the Continent, are hardly known among us. In point of salubrity, also, we may fairly stand a comparison with our neighbours; for, variable as is our atmosphere, no country perhaps exhibits a larger proportion of examples of longevity.

There exists, however, a considerable difference in the climate of different parts of England. The W., exposed to the Atlantic, and containing hills and mountains which intercept the clouds, is much more rainy than the E., where the aspect of the country is level, and the expanse of adjacent water much less considerable. Another and equally remarkable difference arises from latitude, the season being a fortnight or three weeks later in the N. than in the S. of England. Notwithstanding all the skill of the Northumbrian farmers, the traveller who leaves the harvest finished in the S. of England in the first week of September, and who sees the corn cut, if not carried, in the midland counties, will generally find it in the middle of that month untouched, and standing in most parts of the country to the northward of York. In winter this difference in the temperature of the N. and S. of England is less perceptible. As to the spring months, March is proverbially raw and cold, from the prevalence of easterly winds, particularly in that part of the kingdom adjacent to the German Ocean. April is in general wet and favourable to vegetation; but May, though a pleasant month, can hardly be said with us to bring more "indulgent skies." It is in June, July, and August, that our climate assumes a more settled aspect; whilst, at the same time, the power of taking exercise on almost any day is indicative of a very gratifying advantage over the sultry atmosphere of our southern neighbours on the Continent. November, though frequently wet and foggy, is only a prelude to winter; even December does not often bring intense frost, which is commonly reserved for January; and during the last 20 years we have been repeatedly without any frost of consequence, or heavy falls of snow, until a considerable time after the days had lengthened.

Variations of temperature.

During the six winter months, from October to March, the mean temperature of the central part of England is commonly between 42° and 43° of Fahr. In December, January, and February, it is generally below 40°; in July and August 62° to 65°. The variations of temperature within the space of 24 hours are felt most strongly in the equinoctial months, March and September. In these there is often a difference of 18° or 20° between the day and the night, whilst in the summer months this difference seldom exceeds 12° or 15°, and in December or January is only from 6° to 8°. The mean annual temperature, noon and night, of the central part of England, is about 50°. The greatest summer heat seldom exceeds 80°, and the cold of December or January is rarely below 20° or 25°. In mild situations in Devonshire and Cornwall, the winter temperature is 2°, 3°, 4°, and even 5° higher than in London. Penzance is the spot in England least visited by severe cold; and it is consequently much recommended in pulmonary cases.

Of rain, the largest proportion falls in the N.W. of England, particularly in Westmoreland and Lancashire, owing to the neighbourhood of the sea and the height of the mountains. There the average quantity is found to be 45, 50, and, in some situations, 60 inches, whilst the average of the kingdom at large is from 30 to 40 inches.

Prevailing winds.

The prevalent winds in England are W. and S.W. Our outward-bound merchantmen are often detained, from the want of a northerly or easterly wind; but it rarely happens that our homeward bound are kept beating in the channel by the want of a westerly breeze. In these respects, also, the case is the same on the opposite shores of the Continent; the Dutch and French outward-bound vessels often experiencing detention from the continuance of westerly winds.

Statistics.

II.—*Civil Divisions.*

Civil divisions.

The civil divisions of England are those of counties, hundreds, and parishes. The county divisions, like several of our national improvements, date from the reign of Alfred, and, though subsequently increased by the acquisition of the three northern counties from the Scotch, have not, in other respects, experienced much alteration since his time.

The 12 counties of Wales added to the 40 counties of England, make a total of 52. The name of "county corporate" is given to most of the cities of England, and to some of the towns; and this distinction, little attended to by the public, and seldom mentioned but in law papers, implies that the district in question is governed by its own sheriffs and other magistrates, to the exclusion of the officers of the county at large.

The counties of England and Wales have undergone considerable changes in the ancient territorial sub-divisions of the country.

The observance in Wales of peculiar laws and customs, combined with the use of another language by the people, naturally tended to maintain in a marked manner the distinction, which still exists in a less degree, between the inhabitants of the principality and those of England. Partly with a view to remove this distinction, an act was passed in the 27th year of Henry VIII. (A.D. 1535), declaring Wales to be for ever incorporated with the realm of England, and that all natives of Wales should enjoy the same liberty as the king's other subjects, with the like laws, justice, and customs of tenure. By this statute, all the marshes or border lands between England and Wales were either formed into new shires, or added to old ones. The new counties thus created were Monmouth, Brecon, Radnor, Montgomery, and Denbigh; Monmouth being named as an English county.

Few changes have been made in Scotland in respect of county limits; although the confused manner in which the component parts of some of the counties are scattered over the mainland and islands, and the frequent intermixture in others of detached parts of adjoining counties, must be productive of inconvenience.

Under the Reform Act, all the large and populous counties of England have been divided for the purpose of returning additional members to parliament.

Where portions of counties were detached from the main body of their respective counties, and locally situate in other counties, it was enacted that, for the purposes of elections, every such portion should be considered to be part of the county or division by which it was wholly surrounded, or, if bounded by more than one, of that county with which it had the longest common boundary. Some exceptions were, however, admitted; and the town of Dudley, with other portions of the county of Worcester, lying in contiguous counties, and certain portions of the county of Flint, were allowed to remain undisturbed.

A bill was subsequently passed, in 1844, under which every detached part of a county in England and Wales has become, since the 20th October 1844, *for all purposes* part of the county to which it had been annexed for parliamentary purposes.

About one-half of the English counties have thus been altered more or less. The only considerable changes, however, are those affecting the counties of Worcester and Salop, Durham and Northumberland. An addition of surface, amounting to 17,403 acres, with 20,401 inhabitants, has been acquired by Worcestershire, consisting chiefly of portions of the parish of Hales-owen lying in that county, but belonging to Salop, from which they have been severed. Northumberland has gained an additional area of 64,389 acres, containing 19,035 inhabitants, by the annexation of the districts of Islandshire and Norhamshire, and other parts of Durham which were locally situated either north of Northumberland or in the body of that county. The other counties which have increased are Oxford (by nearly 7000 acres), Sussex, Bucks, Devon, Hereford, and York.

Statistics.

Besides Durham and Salop, the English counties which have undergone some curtailment of territory are Hants, Berks, Hertford, Wilts, Dorset, Cornwall, Somerset, Gloucester, Stafford, and Monmouth.

Of the Welsh counties only four are altered, viz., Brecon, Radnor, Montgomery, and Denbigh; and these are affected to a very trifling extent.

Changes have also been made in the boundaries of many of the old corporate towns, while the limits of others equally requiring readjustment have been allowed to remain undisturbed. The obvious necessity, arising from the rapid growth of many of the boroughs, for an extension of their limits, in relation to the parliamentary franchise, was no less apparent with respect to municipal government; and it was deemed just and reasonable that all possessing a community of interest, as inhabitants of one town, should, while sharing many common advantages, also bear their due proportion of the burdens attaching to the corporate institutions. A general revision, and the extension where necessary of the boundaries of boroughs, was therefore deemed an essential part of the plan of reform, under the Municipal Corporation Bill. When that measure became law, the commissioners appointed to inquire into the municipal boundaries had accomplished only a small portion of their task. It was provided, therefore, as a temporary arrangement, that with respect to certain boroughs returning members to parliament, the *parliamentary* boundaries should be taken for municipal purposes until altered by parliament, and that, with respect to the remaining boroughs, their limits should remain unaltered, until parliament should otherwise direct.

In 1837 the commissioners made their report, and suggested, in numerous instances, new municipal boundaries for boroughs sending members to parliament, and for most of the unrepresented towns. The general effect of their recommendations was to extend the existing boundaries, so as to take in suburbs and localities immediately connected with the towns; in a few cases, rural parts included within the ancient limits were to be left out. Many of the proposed changes were, however, for various reasons, opposed by the inhabitants; and the municipal boundaries are suffered to remain in the state in which they were left by the act of 5th and 6th Will. IV., cap. 76. Of 178 boroughs in the schedule of that act, 60 were enlarged by the adoption of the parliamentary limits; but no extension of area has taken place in 118 boroughs—including the whole of those not possessing the parliamentary franchise—although no inconsiderable number of them has strikingly increased in population. As a consequence, it not unfrequently happens that the municipality scarcely represents the *town* any more than the *City* of London represents the metropolis of the British empire.[1]

By the enlargement of the 60 cities and boroughs referred to, contiguous parts, containing in 1851 a population of 510,852, have been brought within the pale of municipal institutions; the population within the old limits being 1,185,850, and within the present limits 1,696,702.

The Act for "the Amendment and Better Administration of the Laws relating to the Poor," empowered the Poor Law Commissioners "to declare so many parishes as they may think fit to be united for the administration of the Laws for the Relief of the Poor." The united parishes were designated *Unions.* The act also provided for the election of a representative board of guardians, and for the appointment of officers in every union, by whom the local rates for the relief of the poor, and for many other purposes, are collected and expended. The *Unions,* under the Act for Registering Births, Deaths, and Marriages in England, were subdivided into as many smaller districts as the Commissioners, subject to the approval of the Registrar-General, thought fit. The whole of England and Wales has not been placed under the Poor Law Amendment Act; but the Registration Act extends over all England and Wales, which is thus divided into 624 new districts. A district comprises on an average three or four *subdistricts,* to each of which there is a registrar of births and deaths. A subdistrict extends over a certain number of parishes or townships, except in those rare cases where the parish is large, and is itself made *one* or *more subdistricts.* The subdistricts contain on an average

[1] The borough of Stockton may be mentioned as an example. Its ancient limits, to which the present reformed municipal jurisdiction is confined, contained a population, in 1851, of only 1867; while the *town,* of which the borough forms but a fraction, contained 9808 inhabitants.

Statistics. seven parishes, townships, or places, of which the population is, in 16,008 cases, separately returned.

To the new districts a staff of officers is attached; and, where they are unions, there are the clerk to the Board of Guardians, relieving officers, medical officers, superintendent registrars, and registrars, whose duties are defined by the Poor Law Board and the Registrar-General. A system of rating is in operation; and the districts have practically been found useful for other administrative purposes besides those which were in contemplation at the time of their formation. Besides the subdivisions—ancient and modern—which have been described, others exist for a great variety of purposes: these are often of a complex character, and evidently made quite independently of each other, as the boundary lines cross in every direction. The late Mr Rickman noticed that "there are in England and Wales about *550 parishes* which are known to extend into *two counties*, or into more than one hundred, or other division;" and he pointed out "the scattered confusion of the component parts" of the ancient hundreds, as well as the irregularities in their size: "so irregular," he says, "is this distribution of territory, that while some of the southern hundreds do not exceed two square miles in area, nor one thousand persons in population, the hundreds of Lancashire average 300 square miles in area, and the population contained in one of them (Salford hundred) [in 1831] is 430,000."

The cause of these irregularities is evident. The division of England and Wales into hundreds, on the original plan, of which Kent and the counties in Wessex offer examples, was never carried out; and in the course of the thousand years that have since elapsed, the face of the country has undergone great changes: the distribution of the population—which from less than *four* millions has increased to *eighteen millions*—is no longer the same. A hundred no longer contains a hundred families. Bridges have brought into intimate union populations which rivers divided; villages have grown into vast cities; the mining and manufacturing industry of the last hundred years has covered the woodlands, wastes, and desolate lands of the midland and northern counties with people. The hundred courts, the manor courts, the shire motes, the burgh motes, have been superseded by the petty sessions, the county courts, the town councils, the boards of guardians; that discharge duties—such as the election of members of parliament, and the relief of the poor—never contemplated when the counties, boroughs, and hundreds were formed; while the system of *frank-pledge* in tythings has disappeared. For all the useful purposes of comparison and statistical inquiry, the old divisions in many parts of the kingdom are entirely unsuited. The legislature, then, without any settled plan, has in recent acts of parliament entirely disregarded the old divisions of the country into hundreds, and has changed in numerous instances the boundaries and divisions of counties as well as boroughs.

Counties.—The 40 counties of England, 12 of Wales, 32 of Scotland, making 84 counties in Great Britain, vary much in size and population. The English counties consist of a variable number of hundreds, and until latterly had detached parts within each other's limits.

The shire is an important subdivision of the kingdom, and each shire has numerous officers: (1) a lord-lieutenant, who is also (2) custos-rotulorum, or keeper of the archives, except in counties of cities; (3) a sheriff, who appoints (4) an under-sheriff; (5) justices of the peace, all appointed by the crown; (6) a county treasurer, and (7) a clerk of the peace, generally an attorney, who is appointed by the custos-rotulorum; (8) the county-coroners are elected by the freeholders, as (9) knights of the shires were formerly. The revenue of the shires is chiefly derived from rates which are struck by the justices of the peace in counties at quarter-sessions. The rates, which were formerly collected by the high constables, or constables of hundreds, are directed under 7th and 8th Vict. cap. 33, to be collected by the boards of guardians, and to be paid by them to the county treasurer. The county expenditure is chiefly incurred in maintaining bridges, gaols, police, prisoners, lunatic asylums, and the various county officers, some of whom are paid, although several of the offices are honorary, and are discharged gratuitously.

Hundreds.—Subdivisions of the shires have existed since the age of Alfred; and hundreds, tythings, and hides, are named in the early Saxon laws, charters, and other records. The notices are, however, by no means precise; nor are they all consistent, either with themselves, or with what is found to exist of the ancient divisions in later times. The simplest view may be thus stated: England was divided into hides—about 274,950 in number; and a hide of land, containing 100 or 120 acres, supported a free family: *ten* such free families constituted a *tything*; *ten* or *twelve tythings*, a *hundred*; an indefinite number of hundreds, a shire. The hundred is used in the Domesday return (1086) as a well-defined territorial division of the county.

The division of men into tens, twelves, hundreds, and thousands, on the basis of their system of numeration, is so natural, that instances occur of its use in the history of almost every nation; but it is not probable that Alfred, or any of his successors or predecessors, ever succeeded in organizing all the races, tribes, and states in England so simply as the above theory implies, without reference to other considerations than mere numbers. If the holdings were ever equal in extent, or the numbers of men in townships and hundreds the same, they could not continue unchanged: as the numbers and settlements of the people increased, and as the properties were so frequently won and lost by conquest, as well as the other mutations incidental to societies of men in the civilized as well as the barbarous state. Accordingly, it is found that the hundreds, in the survey after the Conquest, and the hundreds still remaining as constituent divisions of the country, differ to such an extent in area and population—not only in different, but in the same counties, and in similar situations—that it is difficult to conceive they could ever have been formed on a uniform scale of area, or of free population.

Sessional Divisions.—The divisions existing in all the counties of England and Wales for the purposes of special and petty sessions, are in general based on the *hundreds* and other ancient county subdivisions. By the authority of various acts of parliament the justices at quarter sessions may alter and rearrange these sessional divisions, and they are empowered to adopt the same limits as those of poor-law unions. The divisional meetings of the justices or petty sessions in 1831 amounted to 609 in England and Wales.

For the purposes of assize and gaol delivery, there are in England and Wales eight circuits of the judges, besides the jurisdiction of the central criminal court at London. The circuits are known as the Home, Midland, Norfolk, Oxford, Northern, Western, North Wales, and South Wales circuits, and include the counties situated in the parts of the country implied by their names.

Municipal Cities and Boroughs.—When the Anglo-Saxons first invaded England "the woods" were no longer "the towns" of the natives. The Britons had been collected in cities, polished but subjugated by the Roman legionaries, who lived in villas and towns, on taxes which their publicans collected. Unlike the adventurous colonists and "Pilgrim Fathers," who planted the British race in America, they did not find nations less civilized than themselves on the land, but more corrupted; less capable of freedom, and of political organization. As the Roman towns still existed, some of their forms and institutions may have remained; and have impressed on the populations of London, York, and other cities, some modification of the national institutions of the Anglo-Saxons and Scandinavians. Those modifications can, however, rarely be traced. The condition and circumstances were no longer the same in the fertile cultivated soil of England as they had been on the western shores of the continent, and the new races adapted themselves to the change; but their relations to each other, to their families, and to their princes, required free institutions of a character very different from the provincial organization of the declining Roman empire. The Saxon borough was a modification of the hundred; the burgesses were freemen bound to each other as neighbours, responsible for each other to surrounding communities, sharing common burthens; classified further in guilds of trades, or companies, which sprang up with the divisions of labour; and banded firmly together for the defence of their walls and dwellings.

The hundred necessarily underwent some modification in the towns; and in this as in other cases it soon ceased to designate a specific number of men. But it is of importance to observe, that in the early times the same principles of subdivision, organization, and government were applied alike to town and country populations.

Statistics.

London, Winchester, Abingdon, and some other boroughs of importance, are not entered in Domesday, and were probably not surveyed by the commissioners of William I., but the customs of 41 cities and burghs are noticed with some detail.

The eleven cities of London, Bristol, Canterbury, Chester, Exeter, Gloucester, Lichfield, Lincoln, Norwich, Worcester, York: and the five towns of Kingston-on-Hull, Newcastle-on-Tyne, Nottingham, Poole, Southampton, in England; and two, Caermarthen and Haverfordwest, in Wales, are "counties of themselves:" as was also the city of Coventry until lately. The cities on the old Roman sites maintained their independence of the country around them, as well as of the early Saxon kingdoms, to a larger extent than other towns; as is indicated by their independent county jurisdiction.

Some of the ancient boroughs fell into decay; new boroughs sprang up in other parts of the country; many towns were created boroughs for purposes not now very intelligible; and with the rapid progress of population which commenced after 1750, and has gone on for nearly a century—through three successive generations—the houses have spread beyond the limits of the old boroughs and cities. In 1835 a great change was made in their constitution; and the limits of many were enlarged by the adoption of the new boundaries settled for purposes of parliamentary elections, after an inquiry by commissioners into the circumstances of each place. The affairs of municipal boroughs are administered by *councils* elected in the several wards; by a mayor and aldermen, elected out of the council; auditors and assessors, elected by the burgesses; a treasurer and a town-clerk, appointed by the council. Such functionaries exist in every reformed borough; others may be appointed. Justices of the peace may be appointed by the Queen; so may salaried police magistrates and a recorder, after petition by the council to the crown. There are coroners of the borough. The control of the police, the administration of justice, the lighting and paving of the streets, and other local functions, are in the hands of the corporations; the burgesses and householders, in many municipal boroughs, elect burgesses by majorities to serve in parliament.

During the period of nearly twenty years which have elapsed since the investigation was made into the condition of the municipal boroughs, some of the unreformed corporations have ceased to exercise any active functions, having become, in fact, either extinct or dormant, while others, although still claiming to be corporations, are municipal only in name.

By section 141 of the Municipal Corporation Act, charters of incorporation may be granted to towns, on the petition of the inhabitant householders, if Her Majesty, by the advice of the privy-council, shall think fit to grant them. At the period of the census only 19 towns had petitioned to be incorporated, and all of them, except one—Huddersfield—have received charters.

The municipal organization, as regards the number of towns, stands thus:—

England and Wales—	
Reformed boroughs named in the schedules annexed to the Municipal Corporation Act	178
Boroughs which have had charters of incorporation granted to them since the passing of that act	18
London, and the other unreformed corporate towns	89
England and Wales	285
Scotland—	
Number of cities and burghs governed by the Municipal Acts for Scotland	83
Corporate towns in Great Britain	368

The 196 reformed boroughs in England and Wales and the city of London contain 4,473,138 inhabitants. One-half of the population (2,220,542) is found in 17 boroughs; each of which contains more than 60,000 inhabitants.

It is found, also, that 102 boroughs, or more than half of the total number, contain less than 9000 inhabitants in each; and in the aggregate 472,551 inhabitants.

A population ranging from 2000 to 7000 is that most commonly met with; 87 boroughs fall under this category. 27 municipal boroughs have from 20,000 to 40,000 inhabitants; 8 have from 40,000 to 60,000 inhabitants; 7 from 60,000 to 80,000 inhabitants; 2 from 80,000 to 100,000 inhabitants; 5 from 100,000 to 200,000 inhabitants; 3 have 200,000 inhabitants and upwards.

Although some of the most populous and important towns in England have obtained charters of incorporation since 1835, several considerable places are still without a municipal organization. Amongst these may be named, in England and Wales, the metropolitan parliamentary boroughs of

	Pop. in 1851.
The Tower Hamlets	539,111
Finsbury	323,772
Marylebone	370,957
Greenwich	105,784
Lambeth	251,345
Westminster	241,611

Census Report, 1851.

III.—*Harbours, Roads, Canals, Bridges.*

Harbours.

Portsmouth, Milford Haven, and Plymouth, are the finest harbours in England, and are surpassed by few if any in the world. Of these, Portsmouth is entitled to the pre-eminence. This noble harbour is about as wide at its mouth as the Thames is at Westminster Bridge, expanding within into a capacious basin, almost sufficient to contain the whole navy of Great Britain. Its entrance is unobstructed by any bar or shallow; and it has throughout water adequate to float the largest man-of-war at the lowest tides. The anchorage ground is excellent, and it is entirely free from sunken rocks, sand-banks, or any similar obstructions. The western side of the harbour is formed by the island of Portsea; and on its south-western extremity, at the entrance to the harbour, is situated the town of Portsmouth, and its large and important suburb of Portsea. Here are docks and other establishments for the building, repair, and outfit of ships of war, constructed upon a very large scale, and furnished with every conveniency.

Portsmouth harbour has the additional and important advantage of opening into the celebrated road of Spithead, lying between the Hampshire coast and the Isle of Wight, and forming a safe and convenient retreat for the largest fleets.

Milford Haven deeply indents the southern part of Pembrokeshire. It is of great extent, and has within it many bays, creeks, and roads. The water is deep and the anchorage ground excellent; and being completely land-locked, ships lie as safely in it as if they were in dock.

Plymouth, which, after Portsmouth, is the principal naval depôt of England, has an admirable double harbour. The roadstead in Plymouth Sound has been much improved by the construction, at a vast expense, of a stupendous breakwater more than 1700 yards in length. This bulwark protects the ships lying inside from the effects of the heavy swell thrown into the Sound by southerly and south-easterly winds.

London stands at the head of the river ports of Great Britain. Considering the limited course of the Thames, there is probably no river that is navigable for large ships to so great a distance from the sea, or whose mouth is less obstructed by banks. London is mainly indebted for the unrivalled magnitude of her commerce to her favourable situation on this noble river; which not only gives her all the advantages of an excellent port, accessible at all times to the largest ships, but renders her the emporium of the extensive, rich, and populous country comprised in the basin of the Thames.

The Mersey, now the second commercial river in the empire, is more incommoded with banks than the Thames, and is in all respects inferior, as a channel of navigation, to the latter. Still, however, it gives to Liverpool very great advantages; and the new channel which has recently been discovered in the banks promises to be of much importance in facilitating the access to and from the port.

Statistics.

Bristol and Hull are both river ports. Owing to the extraordinary rise of the tide in the Bristol channel, the former is accessible even to the largest ships. The Humber is a good deal impeded by banks; but it also is navigable as far as Hull by very large vessels. The Tyne admits vessels of very considerable burden as far as Newcastle, which, next to London, is the most important shipping port in the empire.

Roads.

It was not until after 1660 that the public took an active part in regard to the highways. Turnpikes were at that time placed on the great North Road, in the counties of Hertford, Huntingdon, and Cambridge; but it was not till after the peace of 1748 that adequate exertions were made to redeem our public roads from their wretched condition. After 1760 the increasing price of agricultural produce, and the general spirit of improvement, had the most beneficial operation in this respect; and in the fourteen years from that time to 1774, no less than 452 acts were passed for the amelioration of our roads. It was then also that our inland navigation assumed an aspect of activity. The Bridgewater and Trent Canals were commenced; yet the number of canal acts which passed between 1760 and 1774 was only 19. The American war interfered considerably with public improvement; and it is only from the date of its cessation that we enter upon an active and prosperous era.

The total length of paved streets and roads in towns in England and Wales may be taken, according to a parliamentary return in 1843, at about 29,000 miles; the total length of all other roads at nearly 96,000 miles. In France the highways are under the care of government, and are kept in repair out of the general taxes, without any tolls or turnpike dues; in England they are managed by the respective counties, represented by commissioners, and no part of the expense comes out of the public treasury. It is defrayed partly by local imposts, partly by dues levied; and the local impost is discharged either by labour, or by composition money.

In consequence of the superior means of communication afforded by the numerous railways, a great reduction has taken place both in the revenue and expenditure of the turnpike trusts. The receipts from tolls and other sources in England and North Wales, which, in 1835, amounted to L.1,755,222 were reduced in 1852 to L.1,142,592, and the total expenditure for repairs, improvements, interest of debt, &c., which in 1835 was L.1,733,404, was reduced in 1852 to L.1,126,384.

The returns for turnpike roads in South Wales are kept separate according to act 7 and 8 Vict., cap. 91.

According to the general law of England every public highway is a parochial charge, and is maintained by the rate-payers of the parish in which it is situated. Consequently each road or class of roads was constructed under the authority of private legislation.

The local turnpike acts were always temporary, generally limited to 20 or 30 years, probably with the view of the loans being paid off before the expiry of the term, but as the acts were usually renewed, the debts were unpaid and undiminished for many years.

The result of this state of things has been, that the turnpike debt of England amounted, in 1849, to L.6,382,647, and the unpaid interest upon the debt amounted, for the same time, to L.1,587,010. The bonded debt on the turnpike trusts in England and North Wales in 1852 amounted to L.5,813,728, and the unpaid interest to L.1,126,507. The debt on the roads in South Wales, at the same period, amounted to L.217,020, which is payable by annuity, and will cease partly in 1875, and altogether in 1879.

Railroads.

The railroads have, since 1830, along with steam-vessels, placed the English population in direct and easy communication, not only with each other, but with the rest of the world. The total length of railways in England and Wales open for traffic at 31st December 1853, was 5811 miles. The number of passengers conveyed in that year was 84,222,961, of whom considerably more than one-half were first and second class passengers. The receipts from the goods traffic somewhat exceed those from the passenger traffic. The length of lines in course of construction at 30th June 1853 was 491, while the length authorized was 2969 miles, nearly 2500 miles being neither open nor in course of construction.

The total amount of capital and loans authorized to be raised by railway companies in the United Kingdom previous to 31st December 1852 (after deducting amounts proposed for lines subsequently abandoned), was L.356,610,456, of which L.264,165,680 had been raised: the amount raised in 1852 was L.16,398,993. The number of passengers that travelled by railway in the half year ended 30th June 1854 was 45,080,316; the amount of receipts from passengers was L.4,092,661; from horses, carriages, luggage, and mails, L.505,116; from general merchandise, cattle, minerals, &c., L.4,826,825; total for six months, L.9,424,602.

Electric Telegraph.

Connected with the railways is the electric telegraph, which is now stretched along thousands of miles across the length and breadth of the land, or sunk in the depths of the ocean, conveying intelligence between distant points with the rapidity of lightning.

In 1846, an association under the title of the Electric Telegraph Company, obtained an act of incorporation, and having bought up the various patents for electric telegraphs, they secured the exclusive right of sending intelligence through the kingdom by this means. Since then, they have been extending their operations in all directions; but great as are the advantages conferred on the country by this invention, there is reason to expect that they will be vastly increased and extended, as the instrument is capable of still greater improvements; and when the charges for the conveyance of intelligence are reduced to their proper level, the electric telegraph will be much more generally used.

Canals.

The canals of England are extremely numerous; in fact, no country except Holland can enter into competition with us in this respect. The English canals are of moderate size, being from 25 to 30, 35, and 40 feet in width, and, in general, from 5 to 6 feet in depth; the barges navigating them are very long, frequently 70 or 80 feet, on a width of 10, 12, or 14 feet; but in many cases their dimensions, at least their width, are necessarily smaller, the less frequented canals being narrower than those we have mentioned. Could the application of steam to navigation have been foreseen, the canals of England would probably have been made wider. For full details with respect to the canals of England, and the recent improvements in their construction, and in travelling by them, the reader is referred to the article NAVIGATION INLAND.

Bridges.

The principal bridges in the kingdom are the railway bridges across the Tweed and the Tyne, and the seven erected across the Thames at London, four of which have been opened since 1817. Of these, two, the Southwark and Vauxhall, are of cast-iron, the one being of three very large arches, and the other of nine arches, each of 78 feet span. The first example of an iron bridge on a large scale, either in England or any other country, was that erected in 1796 at Wearmouth in Durham, the span of which was 240 feet. The chain bridge over the Menai Straits, and the tubular bridge over the same place, are wonderful examples of engineering skill. See article BRIDGES, &c.

IV.—*Agriculture.*

Of the state of English agriculture in former ages we can form some idea from a reference to the acts of the legislature. In these we find, at a very early date, the traces of

Statistics.

that policy which expects abundance and cheapness to result from discouraging the exportation of corn. No permission to export seems to have been granted till 1394, and then only on the payment of certain duties; in 1436 some additional latitude was given, and exportation was allowed when the quarter of wheat did not exceed a price corresponding to nearly 13s. of our present money. The reign of Elizabeth was the epoch of a great rise in the prices of corn, originating, not, as was vulgarly asserted, in the "decay of tillage," but in the sudden depreciation of money, produced (as has been explained in the article CORN LAWS) partly by degradation of the coin, and partly by the influx of silver from the mines of America. The complaints of the "decay of tillage," if they express anything more than the ordinary discontent of the ignorant part of the consumers, are to be accounted for by the gradual consolidation of small farms, and by inclosing land for pasture, with a view to the exportation of wool. In these days, however, government participated in the prejudices of the people; and the general purport of the acts passed under Elizabeth and her successors was to shackle exportation and prevent a rise of price. It was not till the reign of Charles II. (1670) that the exportation of corn was exempted from taxation; and it is from 1689 that we are to date that fundamental change in our corn laws which encouraged exportation by a bounty.

Clover, turnips, and potatoes were introduced into England in the seventeenth century. In the *Improver Improved*, published by Blythe in 1649, we find the first traces of what may be termed the modern system of husbandry; that is, of a rotation of crops, and of the occasional substitution of green for culmiferous crops. But the practice, though thus early introduced, and though it lies at the foundation of all good husbandry, made but little progress for a very long period. The writings and the example of the famous Jethro Tull, in the early part of last century, notwithstanding he carried his theory to an excess, did much to introduce the practice of drilling, and had a very favourable influence on agriculture. Nothing, however, did half so much to accelerate the march of improvement, as the wonderful increase of manufactures and commerce, and consequently of the town population, subsequently to the peace of Paris in 1763. The greater number, and still more the improved circumstances, of the people, occasioned, in particular, a very great increase in the demand for butchers' meat. And it is to this circumstance that we are mainly indebted for the extraordinary improvements which have been made during the last sixty or seventy years in stock husbandry. But the indirect influence of the augmented demand for butchers' meat has been equally conspicuous, and has proved of the utmost advantage to arable husbandry, inasmuch as it caused a corresponding increase in the demand for green food, that is, for turnips, clover, &c. This did incomparably more than anything else to introduce that intermixture of green and culmiferous crops which is so essential to good husbandry; and it was the real cause of the greatest of all agricultural improvements, namely, the substitution of turnips for fallows on all light lands. This has increased the productive power of the soil in a degree not easy to be conceived; and, coupled with the frequent substitution of beans for naked fallows on stiff clay lands, has in all probability more than doubled the available raw produce of the kingdom.

For a lengthened series of years England exported large quantities of corn. But notwithstanding the vast additions made to the supplies of corn by the improvements alluded to, the still greater increase of wealth and population, after occasioning, first a diminution, and next a cessation of exportation, has for many years past rendered a large importation necessary to meet the consumption of the country. It has been supposed by some that this change was owing to the alterations effected in the laws with respect to the importation of corn in 1772; but we have elsewhere shown that there is no ground for any such opinion. (See CORN LAWS AND CORN TRADE.)

Statistics.

The principal crops cultivated in England and Wales are wheat, oats and beans, barley and rye, turnips and potatoes, with clover, hops, flax, &c. It is to be regretted that no estimate, derived from authentic returns, has been formed on which much reliance can be placed, either of the extent of land under different crops, or of the average product per acre. Mr Caird, in his work on *English Agriculture* p. 522, gives the following estimate as the result of his survey of England in 1850–51 of the extent of land under the different species of crops, and in fallow, in England:—

	Acres.
Wheat	3,416,750
Barley and rye	1,416,750
Oats and rye	2,000,000
Beans and pease	1,139,000
Clover	2,277,750
Roots (turnips, mangold, potatoes, &c.)	2,116,750
Hops, gardens of all sorts, &c.	150,000
Fallow and rape	1,300,000
	13,817,000

An estimate of the extent of land in England and Wales under the principal descriptions of crops in 1852–53, with the average rate of produce per acre, the value of such produce, &c., will be found in our article CORN LAWS AND CORN TRADE. The recent agricultural reports of Scotland have shown that, as regards that country, the previous estimates of the extent of land under the different kinds of crops were very far from being correct. The result of these reports proves the great difficulty of arriving even at an approximation to the truth in such estimates, and that it is only by authentic returns that accuracy on that and similar subjects can be obtained; and it is by no means creditable to the country, that till this day no effectual measures have been taken to procure authentic information as to the amount of food which England can supply for the subsistence of her population; but after the example which has been set by the rural tenantry of Scotland, it is to be hoped that another year will not be permitted to pass till measures have been taken to procure equally satisfactory returns of the agricultural capabilities of England. In the meantime, we make the accompanying statements upon the most reliable estimates we have been able to procure.

Cattle.

Various estimates have been formed of the number of cattle in England and Wales; but judging from the best authorities, they may be said to amount to about 4,500,000. By systematic breeding, turnip feeding, and other means, the quality of the cattle has been much improved even within the present century. The principal breeds are the North Devons, Herefords, Suffolk duns, and the Teeswater short-horns.

Horses.

M'Culloch estimates the number of horses in Great Britain at from 1,300,000 to 1,400,000. The English horses are justly celebrated for their size and condition; and excite the admiration of foreigners who are accustomed to the miserable horses abroad. The famous London drays are reared in the fens and rich pastures of the midland counties. The Suffolk punches are compact, hardy, and very active, and have been long reared in the county from which they take their name. Another well-known English breed is the Cleveland bays, which are properly carriage horses, but in their native district they are largely employed in fieldwork.

Sheep.

The number of sheep in England and Wales may be estimated at about 27,000,000. The distinct breeds and varieties are very numerous. The most important and the most widely diffused are the Leicesters, which constitute the staple breed of the Midland counties. The Lincolns were at one time large ungainly animals, but by crossing them with Leicesters the character of the breed has been

Statistics. entirely changed, and it is now, in fact, a variety of the Leicester with larger frame and heavier fleece than the pure breed. This variety is reared in immense numbers on the wolds and heaths of Lincolnshire. The black-faced or heath breed is found on the mountainous parts of Yorkshire, Lancashire, Cumberland, and Westmoreland, being better adapted than any other for elevated pastures. The chief of the other breeds are the Cotswolds, New Oxfords, Teeswaters, Kents, South Downs, and Dorsets, whose names indicate the districts in which they chiefly prevail.

Merinos were introduced about the beginning of the present century, and were imported in large numbers after our alliance with Spain in 1809. Opinions differ in regard to their utility, the carcass not having answered so well as the fleece. Considerable advantage, however, has been derived from crossing them with our own breeds. The annual produce of wool is calculated at 550,000 packs of 240 lbs. each.

The great pasturage counties are Leicester, Northampton, Lincoln, and Somerset. Of the counties producing butter and cheese, the principal are Cheshire, Gloucestershire, and Wiltshire. But notwithstanding the immense supplies of these articles produced at home, the demand is such, that at an average we import about 130,000 cwts. a-year of foreign butter, and about an equal quantity of cheese, principally from Holland. The average annual importation of Irish butter into England cannot be precisely ascertained; but in 1825 it amounted to 425,000 cwts., and since that time has much increased.

Produce of grass-lands.

The produce of grass lands may be determined in two ways; either by ascertaining the quantity and value of the different articles annually produced, or by taking a general rough average value per acre. The former would be the most satisfactory mode; but the details are too numerous and too loose to admit of their being put forward with much confidence. We believe, however, that the annual value of the various products derived from pasture land may be estimated, on an average, at about L.3, 10s. an acre, being equivalent, upon 17,000,000 acres, to L.59,500,000.

Rent.

The rent of land in England and Wales is usually estimated at from one-fifth to one-fourth of the value of the produce, which, taking the latter at L.130,000,000, would give from L.26,000,000 to L.32,500,000, or L.29,250,000 at an average, as the rent of the kingdom. We incline to think that this is pretty near the real amount. In 1810 the rent of England and Wales, as ascertained by the property-tax commissioners, was L.29,500,673; and the general opinion seems to be, that the rent at present is about equal to the rent in 1810; the rise that took place in the four succeeding years having been balanced by the subsequent fall. Since 1851 the rent of land has been gradually rising.

Farmers' capital, profits, &c.

The capital employed in the cultivation and stocking of the land in England cannot be estimated, at the present prices, at less than from L.6 to L.7 an acre; which, excluding waste land, would give a total capital of from L.172,494,000 to L.201,243,000. It appears from the property-tax returns for 1810, that the profits made by the occupiers were almost identical with the rent. But it will be observed, that besides the interest on, or return for, the capital employed in farming, the profits in question included all that the occupiers received on account of their trouble in superintendence, and for the greater part of their own labour and that of their families.

Size of farms.

We have already, in the article Agriculture, treated of the points of superiority in our husbandry over that of the Continent; ascribing it to various causes, and to none more than the medium size of our farms, which differ equally from the large unmanageable tracts held by Polish noblemen, and the diminutive occupancies so common amongst the French peasantry, particularly since the Revolution.

The size of farms in England is greatest in the best-cultivated districts, that is, in the counties to the east of the metropolis, viz., Kent, Essex, Suffolk, and Norfolk, and in the various chalk districts. Farms are also extensive in Northumberland. In these counties the engagements of farmers are for larger sums than in East Lothian, Berwickshire, or any part of Scotland, rents being frequently from L.800 to L.1200 and L.1500 a-year. In more retired districts, particularly in Cumberland, Westmoreland, and Wales, the occupancies, whether farmed or held in property, are in general very small; and an average of all the farms of England and Wales would not much exceed L.150 a-year.

By the census of 1851, it appears that there are 285,936 farms in Great Britain, of the average size of 102 acres; in England and Wales the farms amount to 225,318, or 111 acres on an average; in Scotland 56,650 farms have an average size of 74 acres. The average English farm, it will be seen, differs little in size from the Hyde of the Anglo-Saxons, which according to some estimates contained 100, according to others, 120 acres. Half of the territory of Great Britain, two-thirds of the English territory, and one-fifth part of Scotland, are thus asserted to be occupied as farms. The rest remains unaccounted for; and the greater part of it is probably hill, moor, marsh, or other less fertile ground; as well as water and land now entirely sterile. The hill pastures are not included in the farms to which they are attached.

Two-thirds of the farms in Great Britain are of a size under 100 acres: or, taking the *exact proportions, in a thousand farms* 672 are under 100 acres; 187 are 100 and under 200 acres; 137 are 200 and under 1000 acres; and 4 are 1000 acres and upwards. The proportions to 1000 farms in England and Wales are 638 under 100 acres; 205 of 100 and under 200 acres; 154 of 200 and under 1000 acres; and 3 of 1000 acres and upwards. In Scotland there is at once a great excess of *small* and of *large* holdings. There are 360 farms in Scotland, and 771 farms in England of 1000 acres and upwards. There are 142,358 farms in England, and 44,469 farms in Scotland, each of which is under 100 acres. In England and Wales the *large holdings* abound in the *south-eastern counties* and in the *eastern counties;* the *small farms* in the *north-midland counties,* in *Yorkshire,* in *Wales,* and in the *north-western counties,* comprising *Lancashire* and *Cheshire.* Nearly all the farms (947 in 1000) in the Islands of the British Seas are small, if farms under 100 acres can be so designated.

Number of Farm Holdings of different Sizes in Great Britain.

Size of Farm Holdings.	Number of Farm Holdings returned in			
Acres.	Great Britain.	England and Wales.	Scotland.	Islands in the British Seas.
Under 100 acres	190,573	142,358	44,469	3,746
100	52,912	45,752	7,009	151
200	20,603	18,401	2,166	36
300	9,031	8,061	961	9
400	4,063	3,585	471	7
500	2,248	1,971	272	5
600	2,816	2,372	442	2
1000 and upwards.	1,132	771	360	1
Total....................	283,378	223,271	56,150	3,957

Note.—The size of 2558 farms in Great Britain was not stated.

The farmers who returned themselves as actually occupying land in England and Wales amounted to 225,318, of whom 133,620 had 665,651 labourers in their employ on the census day; 40,650 farmers, employing 5 or more labourers, had two-thirds or 467,709 of the agricultural labourers; 16,501 farmers, each having 10 or more, employed 311,707 of these labourers.

Statistics.

Farmers employing In and Out-door Labourers in England and Wales, from the Census Tables of 1851.

Number of Labourers employed by each Farmer.	Number of Farmers employing the Labourers.
0	*91,698
1	33,564
2	27,949
3	17,348
4	14,109
5	7,622
6	6,449
7	3,849
8	3,806
9	2,423
10	8,632
15	3,221
20	2,073
25	850
30	721
35	256
40	275
45	106
50	132
55	65
60 and upwards	170
Total Farmers	225,318
Total Labourers,	665,651

* 91,698 *farmers* made no return of the number of *labourers* on their *farms;* in the majority of such cases it may be assumed that no labourers were employed by them.

Leases.

Leases in England are, with the exception of particular districts, granted for seven years only; when the term is longer the case is peculiar, and applies to land which evidently requires very extensive improvement. But by far the largest portion of England is held by tenants at will, or by tenants holding only from year to year. There is in such cases something like an assurance, on the part of the landlord, that the tenant shall not be removed for a certain number of years, or that otherwise the improvements shall be considered and allowed for. When a tenant holds from year to year there is a written agreement, with specified covenants, the tenant being subjected to fines in the event of a deviation from them. Both methods are highly injudicious; and it is in the prevalence of these that we are to look for the backward state of agriculture in many of our finest counties. No class of men have more liberality than the English landholders; but it would be in vain to expect a tenant to lay out much capital on the improvement of a farm of which his tenure comes to an end in seven years, or may be disturbed by the commission of a trespass or the occurrence of a death. A tenant so situated loses the habit of reflecting on improvements, and even of carrying into effect those which he is aware would in time be advantageous. If he succeed in saving money, he is much more likely to place it out at interest than to employ it in his own business.

Comparison with Scotland and the Continent.

In Scotland the rent bears a higher proportion to the gross produce than in England, being in general not less than from one-fourth to one-third. This is owing not certainly to greater capital, and still less to superior soil, but to an exemption from tithe, the use of long leases, and partly, and principally, we believe, to greater economy, particularly in horses. It is in tillage, not in pasturage, that the Scotch farmers lay claim to superiority. On comparing English agriculture with that of the Continent, we find that our chief superiority consists in machinery and in live stock. Thrashing machines are little used on the Continent, and all iron manufacture is of inferior quality. In regard to live stock, the countries which approach nearest to us are Jutland, Holstein, Holland, Flanders, and Normandy; all evidently indebted for their extensive pasturages to the vicinity of the sea: in the interior of the Continent, pasturage is, in general, very indifferent. Even in these maritime provinces, the cattle, though frequently large, are not fattened in the same gradual manner as in our grazing counties; and the meat, consequently, is not of equal flavour. In horses the inferiority is more apparent to the eye, and holds both as to size and shape. Flemish horses are large, but heavy; whilst the Norman breed, though capable of much labour, is small in size when compared with the English. Nowhere are horses seen of such bulk and strength as the drays in London. If they are, as is supposed, of foreign origin, they have greatly surpassed the primitive stock, since neither the Netherlands nor Holstein can now match them.

We cannot close this part of our subject without a few remarks on the connection between the state of our agriculture and the extent of our financial burdens. Those who compare the heavy pressure of our taxes with the lighter burdens of our Continental neighbours, have in general the satisfaction of finding some counterpoise in the superior dexterity of our people, and the productiveness of our capital. This holds true in regard to our navigators, our merchants, and our manufacturers; and it holds in agriculture in regard to grazing, because in grazing little personal labour is requisite, whilst capital and active habits of business are of the most beneficial operation. But, in the department of tillage, much remains to be done ere England can claim any great superiority. Farms are yet too small in more than two-thirds of England, and leases are generally too short. The course of husbandry is frequently injudicious, the ploughs are on a bad construction, and there exists a gross misapplication of animal strength. However light the soil, and however strong the horses, it is still customary to put three, four, and frequently five, in a plough, throughout almost all the south, the west, and south-west counties. These are the main causes of the comparative unproductiveness of our finest counties.

The quantity of land still remaining uncultivated in the shape of wastes and commons is a frequent topic of animadversion; persons unacquainted with agricultural calculation calling loudly for this island being brought into culture, whilst the landed interest object to passing a general inclosure act, or, in other words, to giving unlimited scope to speculative cultivation. We by no means participate in the apprehensions of the latter; but we would abstain from giving any artificial stimulus to this, more than to any other branch of industry. Let the progress of inclosure be regulated by the gradual increase of our population, and the discovery of better methods of turning such land to account. No benefit can be derived from applying to this purpose any more capital than would go to it voluntarily; and every experienced farmer is aware that the best prospect of profit lies, not in reclaiming new soils, but in bestowing further labour and expense upon the land already under culture.

V.—*Mines—Quarries—Iron, Copper, Tin, and Salt Works.*

In regard to minerals, England does not yield to any country in Europe in natural abundance, and takes the lead of all in the extent to which these rude treasures have been converted to purposes of utility. Our great superiority lies in our coal-mines, which are not only more productive, but much more advantageously situated, than those of the Continent. To the mines along the coast a ready conveyance is afforded by our insular position, and to those in the interior by our inland navigation. The consumption of coal in England for domestic use has been estimated at 20,000,000 tons annually. Large as this quantity is, and larger as it must be when we add to it the vast consumption of manufactories, such as iron-works, copper-works, salt-works, glass-houses, and the like, there is no reason to apprehend the exhaustion of this precious mineral; the depth of the coal beds being very great, and the extent of ground containing them amounting to many hundred thousand acres.

Statistics. The principal coal-beds lie in Northumberland, Durham, Derbyshire, Staffordshire, and Glamorganshire. The ports for shipping coal in large quantities are Newcastle, Sunderland, and Hartlepool. The motive of the tax on coal exported to foreign countries was thus neither an apprehension of eventual scarcity, nor even a calculation of revenue, so much as a dread of giving our Continental neighbours the means of rivalling our manufactures. Coal is not wanting in France and Germany, but the mines are at a distance from water carriage, and as yet very imperfectly wrought; whilst for the purpose of domestic fuel the inhabitants give a preference to wood. After various changes, the export duty on coal was totally abolished in 1850.

According to the census of 1851 the total number of persons engaged in the coal trade is 239,459.

In 1853 the exports of coal to foreign countries, according to the real or declared value, amounted to L.1,602,762. See articles COLLIERY and COAL TRADE.

Quarries. In quarries, whether of stone or slate, England is not rich, particularly the eastern half of the kingdom; and hence the almost universal use of brick in ordinary buildings. It is not till the traveller reaches Durham that he finds stone commonly used. In the northern counties quarries occur frequently; in the southern, those of Portland and Bath are the most considerable. Still the annual profits of the whole are small.

Iron mines and works. No branch of our industry has increased more rapidly in the present age than our iron-works. A century ago it was computed that we required an annual importation of 20,000 tons of foreign iron; an importation which for many years seems to have been on the increase, so as, after the middle of last century, to carry the quantity required to 30,000, 40,000, and even to 50,000 tons. This supply was brought to us from Sweden and Russia, and, though burdened with duty, it was in quantity more than double our native produce. But fortunately, after the year 1780, discoveries were made which increased greatly our supply at home. Bar iron had been manufactured in England, as on the Continent, with charcoal fuel only, coal being deemed inapplicable to that purpose. Under that impression, the rapid consumption of the wood in the neighbourhood of our different iron-works had necessitated a removal, at a great expense, of materials from one spot to another, and was on the point of causing an alarming decay in the business, when our iron-masters, after long perseverance, succeeded in applying coal to their manufacture. They had to contend with various prejudices, particularly the supposed inferiority of iron so made; but, in the course of years, the manufacture acquired such an extent that there were, in 1805, 220 blast-furnaces, making 250,000 tons of pig iron.

The transition from war to peace did a good deal of injury to some branches of the iron trade; but the effect of the change was not of long duration, and the production of iron has since been astonishingly increased. In 1820 the produce was calculated at 400,000 tons. The excitement and speculation of 1824 and 1825 had a wonderful influence on this department. According to careful inquiries made at the time, the furnaces at work in England and Wales in 1827, with their produce, were as under:

Staffordshire	95 furnaces	216,000 tons.
Shropshire	31	78,000
South Wales	90	272,000
North Wales	12	24,000
Yorkshire	24	43,000
Derbyshire	14	20,500
Totals	266	653,500

Owing to the failure of various railroad and other projects set on foot in 1825 and 1826, the supply of iron seems to have greatly exceeded the demand; and there was a very heavy fall of prices in 1828, 1829, and 1830, and again in 1850 and 1851. But within the last two years prices have again risen; and the iron trade is at this moment in a state of great activity. The produce of the various furnaces of England and Wales may be estimated at nearly two millions of tons.

Account of the number of Furnaces, and of the Quantities of Iron produced in Great Britain in 1825 *and* 1848.

	Total Furnaces in 1825.	Produce of Iron in 1825.	Total Furnaces in 1848.	Produce of Iron in 1848.
		Tons.		Tons.
South Wales	107	230,412	196	706,680
North Wales	14	17,756	11	16,120
Northumberland	...	...	36	100,000
Yorkshire	34	39,104	28	66,560
Derbyshire	19	22,672	30	95,000
Staffordshire	107	182,156	158	385,840
Shropshire	48	89,596	34	88,000
Scotland	25	33,540	130	550,000
Totals	354	615,236	623	2,008,200

The quantity of iron of all kinds manufactured and unmanufactured, exported in 1852, amounted to 1,035,884 tons, besides 25,289 tons of cutlery of the declared value of L.2,691,697. Now that the railways are nearly completed, it might have been expected that this would have caused a stagnation in its manufacture; but iron is now so extensively used in the construction of steam-vessels, that the demand has been maintained. For more ample details, the reader is referred to the article IRON.

Copper. Copper-mines have long been known in England, but they were wrought with very little skill or effect until towards the year 1700. Even at that time the annual produce, after smelting the metal from the ore, was only a few hundred tons of copper; and it hardly exceeded 1000 tons annually down to the middle of last century. From that time forwards the increase became considerable, as well in Cornwall as in Devon, North Wales, and Derbyshire; in all of which copper-mines were discovered and wrought. In North Wales there were two mines, Parys and Mona, which, for some time after the year 1780, yielded annually a large quantity of ore, but they are no longer so productive; the mines of Devon and Derbyshire continue to be wrought, but the great product is from Cornwall; the mines of Cornwall and Devon in 1853 yielded 181,969 tons of copper ore, the metal obtained from which, at the rate of $6\frac{1}{2}$ per 100, produced 11,823 tons of standard copper, which, at the average rate of L.140 per ton, amounted to L.1,655,220. It is the Welsh collieries which afford to Cornwall, as to Devonshire, the means of smelting; and as the ore is less heavy than the coal required for this operation (one ton of ore requiring from two to two and a-half tons of coal), the practice is to convey the ore in vast quantities to Wales, particularly to Swansea. In this, as in other minerals, France is greatly behind England. She has various copper-mines, but her coal-mines, at least those hitherto wrought, are at too great a distance to make such undertakings profitable; and she consequently requires an annual importation from England.

In 1854 there were exported of brass and copper manufactures 1,851,689 cwts., of the value of L.1,761,878.

Tin. Cornwall is also the great seat of the tin-mines of England. A century ago the average produce of our tin-mines hardly exceeded 1500 tons; it may now be estimated at about 5000 tons a-year. From abroad we receive tin principally from our Indian possessions, Holland, and the United States. Of this we imported, in 1853, 49,740 cwts. The value of tin unwrought, and in plates exported in 1854 was L.1,307,246.

Statistics.

Lead. The lead-mines of England are principally in Cumberland, Northumberland, Derbyshire, Flintshire, and Salop. In 1852, England and Wales produced 80,790 tons of lead ore, and 57,621 tons of lead. Black lead is found in Cumberland, in the romantic district of Borrowdale. The mine was formerly opened only periodically, in order that the market may not be overstocked; but for a considerable number of years past it has been constantly open.

There is no country so well supplied as England both with brine springs and beds of fossil or rock salt. The brine springs are found in Cheshire, in the southern part of the county, in places contiguous to the river Weaver, and at Droitwich in Worcestershire. The beds of rock salt, which are of great thickness, were discovered in the vicinity of Northwich and Lawton. The greater part of the salt produced is obtained from the brine springs. Formerly considerable quantities were produced by the evaporation of sea water, but since the abolition of the duties most of the works appropriated to this manufacture have been abandoned. From the brine springs it is obtained (see the article CHESHIRE) at the rate of one gallon of solid salt from four gallons of liquid, whilst common sea water does not yield above one in twenty-eight. The consumption of salt in this country is immense. Necker estimated its consumption in those provinces of France which had purchased an exemption from the gabelle (*pays francs redimées*) at about 19½ lbs. (Eng.) for each individual. (*Administration des Finances*, tome ii. p. 12.) From all that we have been able to learn on the subject, we believe that the consumption of the people of this country may be estimated a little higher, or at 22 lbs.; the difference in our food and habits, as compared with those of the French, fully accounting for this increased allowance. On this supposition, and taking the population of Great Britain at 21,000,000, the entire consumption will amount to 462,000,000 lbs., or 206,250 tons.

Exclusive of this immense home consumption, we annually export about 18,000,000 bushels, which, at 56 lbs. a bushel, are equivalent to 357,143 tons. The Americans are the largest consumers of British salt.

The cheapness of this important necessary of life is not less remarkable than its diffusion. Its present cost may be estimated, at a medium, at from 14s. to 16s. a-ton.

Salt has been at all times a favourite subject of taxation. In this country it was first taxed in the reign of William III. In 1798 the duties amounted to 5s. a bushel, but they were subsequently increased to 15s. a bushel, or about forty times the cost of the salt. So exorbitant a duty was productive of the worst effects, and, in particular, occasioned a great deal of smuggling. The duty having in consequence become exceedingly unpopular, was finally repealed in 1823.

VI.—*Fisheries.*

At present our space allows no more than a brief notice of the principal branches of our fisheries.

Mackerel. The mackerel fishery is strictly English, and is carried on with great vigour on the coasts of Kent and Sussex, in May, June, and July. Large as the supply is, it would still admit of augmentation; and herrings also might be caught in vast quantities on the coast of Kent in October and November. The desideratum with the fishermen is not so much a high price as a certain market; and the most effectual way to procure that is, to quicken, by every possible means, the conveyance to London, which has been accomplished by the employment of steam-boats and railways.

Pilchards. The pilchard fishery takes place chiefly on the coast of Devonshire and Cornwall, and, though subject to great fluctuations, as well from the seasons as from our political situation relatively to the Continent, forms on the whole an important branch, employing a number of seamen both in catching the fish and in carrying it to foreign markets. Its season is generally from June to September.

Statistics.

Herrings. The herring, the most important of all our fisheries, is happily now in a state of rapid extension. It formed, during the seventeenth century, the great employment of the Dutch seamen, and was contemplated by their neighbours with very jealous eyes. Accordingly, in the reign of Charles II., particularly after the rupture with Holland in 1672, several acts were passed for the encouragement of our fishermen, and in a spirit of hostility to the Dutch. The subsequent accession of William to our throne, and the long friendship between the two countries, relaxed the exertions of government; and it was not till after the peace of 1748 that a large bounty was given on the tonnage of the busses, or masted vessels, so employed. Still our fishermen proved unable to compete with the experience and patient perseverance of the Dutch, and it was found necessary to raise the bounty from 30s. to 50s. per ton. This had the desired effect, and the number of busses increased; but the additional 20s. being withdrawn in 1771, the fishery again declined. The American war, and, subsequently, the wars of the French revolution, proved extremely adverse to its extension. At last, in 1808, an act was passed carrying the bounty to L.3 a ton on the busses, with a further grant of 2s. per barrel on all herrings caught, whether in busses or boats. This act was further confirmed in 1815, and the bounty per barrel raised to 4s. with the qualification that the herrings should be gutted before curing.

In consequence of the encouragement thus afforded, the fishery was materially extended; but this was effected at a great expense, and had, besides, several bad consequences. The bounties given by government tempted persons without capital or skill to enter into the business, to the great injury of the regular fishermen; so that notwithstanding the extension of the business, it was found, as is invariably the case with all departments carried on by means of a bounty, to be in a very unhealthy state. In consequence partly of the circumstances now stated, and partly in consideration of the real and substantial relief given to the fishery by the abolition of the duties on salt, it was resolved gradually to withdraw the bounty, which totally ceased in 1830. And we are happy to have to state, that though the fishery fell off whilst the bounty was in the course of being withdrawn, it has since been materially increased, and is now in a better situation than at any former period. From the year 1811 to 1830, the year when the bounty ceased, the greatest number of barrels cured in Great Britain was 442,195; and in the year ending December 1853, they amounted to 778,039, the largest number cured in any previous year. The quantities cured in each year vary considerably according to the abundance of the shoals that appear upon our coasts in different seasons; but since 1838 the annual quantity cured has never fallen below 500,000 barrels, while for the 25 previous years they would scarcely average 300,000. In 1851 there were exported 239,330 barrels of the declared value of L.228,885.

Cod Fishery. This fishery is next in importance to that of the herring. It is carried on in a great variety of places contiguous to the British shores. The finest fish is caught round the edges of the Dogger Bank, but within these few years London has been principally supplied with cod taken between Yarmouth and the Nore. The fisheries in the neighbourhood of the Shetland and Orkney islands are productive and valuable, but the great bank of Newfoundland is the principal station of the distant cod fishery. About 2000 men are employed in the sole fishery.

Salmon. Salmon are rarely caught except in estuaries or rivers, which in most instances are private property. It is found in most English rivers, but in such small quantities as to make the fishing an object of little consequence.

England is chiefly supplied from the fisheries in the Scotch

Statistics.

and Irish rivers, but from some cause or other there is a growing scarcity in this fish, probably from the weirs or salmon traps placed in the rivers and estuaries in the way of the fish when ascending the rivers to spawn.

Whale fishery.

Greenland was first discovered by the English; but in this, as in other branches of navigation, we long allowed the Dutch to take a lead. It was not till after 1750 that, government having granted a bounty of 40s. a ton on every vessel employed in the whale fishery, a considerable increase took place in this branch.

In 1750, the vessels employed were only nineteen; in 1756 they had increased to sixty-seven. The war soon caused a decrease of one-half; but at the return of peace in 1763 this fishery revived, and in 1770 the vessels employed amounted to fifty, in 1773 to fifty-five, in 1775 to ninety-six. The American war again caused a decrease, and in 1782 the vessels so employed were only thirty-eight. In 1784 they increased to eighty-nine, and in 1785 to 140. After this they exceeded 200 annually till 1793; but the long continuance of the late wars reduced them below half the number employed previously. In 1852, the whale fishery employed ships, of the aggregate burden of 16,113 tons

The Newfoundland fishery has been considerable for fully a century past. As a nursery for seamen, it is accounted of such consequence as to have formed the object of a specific article in most of our treaties of peace. The fish caught, particularly in time of peace, is sent less to Britain than to the Catholic countries in the south of Europe; a market subject to all the interruptions attendant on a change of political relations. The number of vessels employed in this fishery at different times was as follows:

In 1731	70
1764	140
1774	254

The American war caused a diminution; but in

1784 the number was	236
1785	292

At this rate the fishery continued until the war of 1793, after which, particularly after our rupture with Spain in 1797, it fell off greatly; the fishing vessels in 1798 being only 140.

The continuance of war, and the aggrandisement of the French in Italy, occasioned additional depression; so that in 1810 the number of our vessels employed at Newfoundland did not exceed ninety-two. The peace seemed to promise a revival of this important nursery of seamen; and in the year 1816 the number of vessels which arrived in Newfoundland was 795, manned by 6000 seamen (*Report of Committee* in June 1817, p. 7); but the trade, both then and in 1817 and 1818, proved unprofitable, in consequence of indifferent seasons, of the high duty imposed on fish imported in British vessels into Naples, and of the competition of the French fishermen, supported by a high bounty from their government. The total value of fish exported from the British colonies in North America in 1851 was L.827,738.

It is matter of surprise to foreigners that a maritime nation should not have more effectually cultivated this great means of facilitating the support of our population. The ample supply which might have been afforded by the Nymph Bank, on the south-east coast of Ireland, has been avowedly neglected; and it was only in 1818 that we made the discovery of a bank of almost equal productiveness in the vicinity of Orkney.

Fish is little known to the mass of the people in our inland counties, though the facilities of transport afforded by the railways is gradually distributing it in larger quantities. London has always been amply supplied. Mr Mayhew, in his pamphlet on *London Labour and the London Poor*, estimates the weight of fish annually consumed in London at above 450 millions of pounds, besides an enormous quantity of shell-fish. Calculating the fish of all kinds at 3d. per lb. on an average, the amount would exceed five millions sterling. See the article FISHERIES.

VII.—*Manufactures.*

Woollen manufacture.

In this great department of our productive industry we begin with woollens, which, although no longer the largest of our manufactures in point of exportation, nor even in the value annually made, is entitled to the first place from the priority of its establishment, as well as from the substantial basis on which it rests. England, from the extent of her pastures, abounded in wool from a very remote age, and the inhabitants were doubtless capable of manufacturing it into rude clothing; each weaver working in his separate cottage, and with very little aid from machinery. In the twelfth and thirteenth centuries we appear to have had only the most humble fabrics, and to have imported all cloth of finer texture; sending abroad our wool in quantities to Flanders, a country the inhabitants of which were at that period much further advanced than the rest of Europe, with the exception of Italy. It was in the middle of the fourteenth century that a better system was introduced. Flemish manufacturers were invited over to England, and improved greatly the quality of our home-made woollens. The seats of this branch of industry appear at that time to have been Kent and Essex; afterwards Gloucestershire, and subsequently the West Riding of Yorkshire. It occupied at first the southern and more improved districts, and spread afterwards to the northward, on account of the cheapness of labour, the abundance of coal, and the convenience of waterfalls for the machinery. The general character of the woollen manufacture of England has been that of slow progress, but of little fluctuation; the latter evidently a consequence of its depending more on home consumption than on exportation. In the long period from 1700 to 1780, the exports experienced a regular but not rapid rise, amounting in the latter years to about L.3,500,000, whilst our home consumption increased in proportion to our augmenting numbers. More recently the manufacture has been materially improved by the adoption of various important mechanical inventions in the spinning, weaving, and dressing departments. On the whole, however, improvement has been much less rapid in it than in the cotton manufacture; so that whilst our exports of cotton stuffs and yarn have increased beyond all precedent, those of woollens have been comparatively stationary.

As we shall enter fully, in the article WOOLLEN MANUFACTURE, into the details connected with its history, progress, and present state, it would be useless, even if our limits permitted, to anticipate these here. We shall only observe, therefore, that the entire value of the manufacture is estimated at about L.25,000,000.

According to the census of 1851, there were employed in the various branches of the woollen manufactures 176,131 males and 118,642 females.

By far the largest proportion of the raw material of the manufacture is the produce of our own flocks; but for many years past we have imported large quantities. Previously to 1800 our average imports did not exceed 3,000,000 lbs., mostly brought from Spain, the wool of which long maintained a high character. In 1800 our imports increased to 9,000,000. Since then they have gone on increasing, till, in 1852, they reached 93,761,458 lbs., of which 43,197,301 lbs. came from our own dependencies in Australia.

In 1831, the exports of woollen manufactures amounted to L.5,232,013. Since then they have annually increased, till, in 1852, they reached L.8,730,934.

For an account of the prices and qualities of wool, &c., the reader is referred to article WOOL in this work, or in M'Culloch's *Commercial Dictionary*.

Statistics.

Cotton manufacture

Our cotton manufacture is entitled to the greatest attention on different accounts. Of all our manufactures, it affords the largest export, and exhibits the most rapid improvements in machinery. Its introduction, though not remote, is less recent than is commonly supposed. It appears to have taken place early in the 17th century, when it was established at Manchester; but it was long conducted upon a very limited scale. The raw material, imported at first only from the Levant, in particular from Smyrna, began after 1660 to be supplied by our West India colonies. The quantity imported amounted, about the year 1700, to 3500 bales; but, increasing with the extended cultivation of our colonies, it averaged, about the year 1720, something more than 7000 bales. From the colonial conquests of the war of 1756, our import of cotton received a further augmentation; but the manufacture increased very slowly, a great part of our cotton being re-exported to Holland, for the supply of Dutch and German weavers. It was not till after the peace of 1763, and the invention, first of the carding machine, and next of the spinning jenny, that this manufacture became considerably extended. In 1775, the average import of cotton approached to 18,000 bales. A variety of inventions, unequalled in the history of manufacturing industry, were now made (see our article on the COTTON MANUFACTURE), which gave an astonishing stimulus to the business. Fine calicoes and muslins were introduced; the workmen were withdrawn from their detached dwellings, and collected into large factories; and the price of the finished article experienced a reduction, notwithstanding a rise in the raw material, and in the wages of labour. The period which followed the peace of 1783 is perhaps unexampled for the reduction of price, and the consequent extension of sale that took place in regard to cotton goods. The commencement of hostilities in 1793 gave a pretty severe shock to the business; but the improvements in machinery continuing, the manufacture soon recovered, and has gone on increasing, under many vicissitudes, with a rapidity unparalleled by any other business, either in this or any other country. Neither does there seem to be any ground for fearing that this progress will be speedily checked. On the contrary, our superiority in all that contributes to the advancement of the manufacture is so very decided, that, provided the public tranquillity be preserved unimpaired, we have nothing to fear from the competition of others.

The reader is referred to the article COTTON MANUFACTURE in this work, for an account of the rise and progress of this great branch of national industry, and for tabular statements, exhibiting the present magnitude and importance of the trade, the sources whence the raw cotton is derived, and the foreign markets for the finished articles.

Hardware.

We have already noticed the surprising increase in the produce of our iron mines since 1780. This increase of the raw material, joined in some cases to the command of coal in the vicinity, and in all to a facility of conveyance of coal and iron by canals and railroads, has, in the last fifty years, given a great extension to our hardware manufacture. In it we take the lead of foreigners as decidedly as in our cottons; and if the ratio of increase has not been altogether so rapid, it is owing, not to inferior ingenuity in the workmen, but to radical differences in the two manufactures. In no department has the subdivision of employment been carried to so great a length; in none are its effects in cheapening production so conspicuous. Birmingham and Sheffield are the two great workshops for our hardware; the latter is confined to iron and steel, whilst in the former, not only iron and steel, but copper and brass, constitute the materials of labour. Sheffield fabricates articles which are less for ornament than utility, and which possess in general a certain bulk, such as grates, spades, sickles, files, knives, fenders, fire-irons; whilst in Birmingham there is, in addition to articles of solidity, a surprising variety of toys, fancy goods, and petty manufactures; each trifling when considered separately, but the whole forming an aggregate of great value. The most insignificant of these, such as a brass cock or a button shank, passes through a number of hands, and each artisan performs only a single operation. He thus acquires an extraordinary dexterity in his limited department, and in the course of a day despatches several hundred, perhaps even a thousand articles, through his particular stage; the result of all which is, that the price, when sold in quantities, is incredibly low. Another and very interesting feature in the situation of Birmingham, is the populousness of its neighbourhood. Yet in none of our large towns is living less expensive; an advantage owing partly to the abundance of coal, partly to the ready supply of milk and vegetables from the wide space occupied by the population.

The nail trade is carried on, not in the town of Birmingham, but in a part of the surrounding district. It is computed, by the census of 1851, to employ, in England and Wales, 16,965 males, and 9976 females, of whom 7625 are under 20 years of age; for even this heavy article admits of a subdivision of employment, which lightens the labour, and enables the workman to avail himself of the aid of his family. Of the two towns, Sheffield is by much the more ancient; the command of coal and iron in the same neighbourhood having rendered it, so far back as the thirteenth or fourteenth century, a place for the fabrication of the homely articles used in these days by our ancestors. It is about a century since its razors, knives, and files began to take a more delicate shape. Birmingham, however, embraced a wider range, and advanced with much greater rapidity; but Sheffield also has its adjacent district inhabited by manufacturers, though to a much less extent than the vicinity of Birmingham. This district, called Hallamshire, extends six or seven miles to the W. of Sheffield.

Hardware is made in several other places, such as Bilston, Wolverhampton, Dudley, and Walsall. Each of these towns is situated in Staffordshire, and, in point of manufacture, is small only in comparison with Birmingham or Sheffield. Articles apparently very trifling are manufactured to a surprising extent in different places, such as pins at Gloucester, needles at Red-ditch in Worcestershire, watch movements and main springs at Prescott in Lancashire. The total value of our articles of iron, steel, brass, and copper, including the manufacture from its earliest to its most finished stage, is necessarily fluctuating, but may be computed at L.30,000,000 annually; two-thirds of which appear to be consumed amongst ourselves, whilst the other third is exported to two great markets, the Continent of Europe and the United States of America.

The number of persons employed in the hardware manufacture in England in 1851 was about 465,000. In the United States, iron and coal are found, where land and provisions are certainly much cheaper than in Britain; but the scattered state of American population must, during several ages, oppose serious obstacles to the division of employment necessary in all the nicer branches of the hardware manufacture; particularly as the ease with which the Mississippi and Ohio are navigated by steam opens even the western states to the importation of British goods. Upon the whole, therefore, we look on our hardware manufactures as resting on a solid basis, because in them we combine several advantages;—the raw material, the command of cheap fuel, and the use of machinery, which, the more it is adopted, will bring a greater proportion of the work within the compass of women and boys, and thus lessen the proportion borne by wages in the cost of the finished article.

Linen manufacture.

Linen has never formed one of the staple manufactures of England, flax having been less cultivated amongst us than on the opposite shore of the Netherlands; a country

Statistics.

which, in the fourteenth and fifteenth centuries, supplied the rest of Europe with the finest linens and woollens. When England subsequently advanced in manufacturing arts, the abundant supply of wool pointed out the most suitable branch; and we were contented to continue our imports of linen from the Netherlands, from France, and from Germany, or to favour the manufacture of the sister island in a department which did not excite our jealousy. In Ireland, the linen manufacture dates about two centuries ago, and is said to have owed much of its extension to the measures of the unfortunate Wentworth, in the reign of Charles I. The annual consumption of linen in England a century ago was probably not far below that of her double population at present, owing to the very general substitution in our time of cotton articles. At that time the linen manufacture of England was established chiefly in Lancashire, in Cumberland, and in a county very remote from these, namely, Dorsetshire. In 1745, government, apprised of the extension of the manufacture of coarse linen in Silesia and other parts of Germany, and actuated by the fallacious notion of making a monopoly of all kinds of productive industry, granted a bounty of 1½d. per yard on the exportation of all British linen of a value from 6d. to 18d. per yard; in other words, a premium of 20 or 25 per cent. on the prime cost of all inferior qualities exported. So large a grant soon augmented the manufacture of osnaburgs and other coarse cloths, particularly in Scotland, although the ratio of increase was infinitely smaller than in the case of cotton, where there was no premium, but a rapid improvement of machinery. The demand for bounty in the ten years ending in 1785, was about L.33,000 annually. More recently these impolitic issues were greatly increased; but at length the impolicy of forcing a manufacture in this way having become obvious to every one, the bounties, after being gradually reduced, ceased finally in 1830.

The manufacture is principally carried on in the West Riding of Yorkshire, its chief seat being in Leeds and its neighbourhood, and in Lancashire, Dorset, Durham, and Salop.

Ireland and Scotland, particularly Dundee, are both superior to England in the manufacture of linen. But some of the flax mills established at Hull are on a more extensive scale than any other in the empire. The reader will find under the head of LINEN, in this work, an account of the value of the manufacture in each division of the empire, of the amount of capital, and the number of hands employed in it, &c.

	1851.	1852.
The exports of linen manufactures from Great Britain and Ireland in 1851 and 1852 were of the declared value of	*L.* 3,822,935	*L.* 3,872,491
Thread and small wares	284,461	359,295
Linen yarn	951,426	1,140,565
	5,058,822	5,372,351

Silk manufacture.

In the silk manufacture, as in linen, we have had to contend with a formidable opposition in other countries, particularly in France and Italy; and we have also had to import the whole of the raw material. It would therefore hardly have been attempted by our countrymen, but for the great profits expected from an article of general use amongst the higher classes. Its introduction amongst us goes back to the fifteenth century. About the beginning of the seventeenth it seems to have been carried to a considerable extent, owing certainly not to the luxury of the age, nor to any great proportion of affluent persons in the community, but to silk being almost the only article of apparel in which the vanity of dress could display itself. Towards the end of the reign of Charles II., about the year 1680, raw silk began to be imported in quantities from India; and the English manufacture received a substantial addition by the numbers and ingenuity of the Frenchmen who settled in this country after the revocation of the edict of Nantes in 1683. Various circumstances thus contributed to preserve and extend the manufacture, which continued rather upon the increase till the general substitution of cottons for silks about 1790. This gave a serious shock to the manufacture, from which it recovered only by slow degrees. Its situation had not indeed been at any time prosperous; and the continued complaints of the manufacturers occasioned within these few years a fundamental change in the policy under which it had previously been conducted.

From the first introduction of the manufacture into England down to 1825, foreign silks were either positively or virtually excluded. But the monopoly which was thus secured to the manufacturers produced, what all monopolies invariably do, an indifference to improvement. Instead of trusting to the ingenuity or to the superior skill which they might have called to their aid for preserving their ascendency in the market, the manufacturers depended upon custom-house regulations, and additional penalties on smuggling. In consequence, invention was quite at a stand. Such indeed was the influence of the system in this respect, that in 1826 the member for Coventry (Mr Edward Ellice) affirmed in his place in the House of Commons that the improved silk looms in use in various parts of the Continent enabled the workman to execute *five* times as much work as he could do here; whilst in every business not protected by a monopoly the result was precisely opposite. At length, after a great deal of discussion, it was resolved to adopt a more liberal system. In 1825 a bill was in consequence passed, allowing the importation of foreign silks on payment of an *ad valorem* duty of 30 per cent., accompanied, however, by the effectual reduction of the singularly oppressive duties which had previously been imposed on the imports of raw and thrown silk. This measure, though vehemently opposed at the time, has proved most successful. We are quite sure that we are within the mark when we affirm that the silk trade has made more progress since 1826, when the new system was introduced, than it did during the whole of the preceding century. The following quantities of the raw and thrown silk were imported into the United Kingdom in

Years.	lbs.	Years.	lbs.
1822	2,680,568	1850	5,411,934
1832	4,224,897	1851	5,020,972
1849	5,606,242	1853	7,309,217

This table shows conclusively that the manufacture has increased nearly 200 per cent. since the adoption of those sound and liberal measures which have been the theme of so much ignorant invective. It is of importance, too, to observe, that not only our imports of raw silk, but also our exports of manufactured silk goods, are rapidly increasing. The following table shows this:—

1822	L.381,703	1851	L.1,326,778
1832	529,990	1852	1,551,866
1850	1,225,641	1853	2,044,912

It is plain, therefore, that the manufacture is not increasing merely by reason of an increased demand in the home market, but because we are rapidly gaining on our rivals in the markets of foreign countries. This affords unquestionable evidence of the improvement as well as the extension of the manufacture. In 1852 our exports of wrought silks to France amounted to L.257,555, and to the United States to L.464,590.

Leather manufacture.

Leather, however little it may figure as an article of export, is necessarily one of extensive home consumption in every civilized country, particularly in such a climate as ours, and where there are so many rich and sumptuous equipages. It is matter of regret that we should have so very few *data*, official or otherwise, on which to form an estimate of the export or import of hides in former ages. Such an estimate would possess interest, as indicating the extent of our pasturage and the number of our cattle in comparison with our population. Whatever may have been

Statistics. the case at a remote date, the custom-house returns, for many years past, show, by the annual imports, that the demand for leather has greatly exceeded the home supply of hides. For a long time this importation took place from the Continent of Europe, and from the least civilized quarters; from countries, such as Lithuania and Poland, where the quantity of hides furnished by the cattle materially exceeds that of the leather required by the inhabitants. But since the opening of the trade to South America, it has been found more advantageous to import hides from that continent, where the herds of wild cattle are so numerous as to meet the eye of the traveller in almost every point of the horizon.

On an average there are imported annually about two millions of hides, tanned and untanned. The quantity of leather annually made in England and Wales may be estimated at about 50,000,000 lbs. The largest tanneries are at Bermondsey in Southwark; but there are also very extensive establishments of the kind in the country, as in Cheshire, Lancashire, Westmoreland, Cumberland, and also in Lincolnshire. The late war, by its long continuance, and the magnitude of our army and navy, produced great orders from government for our leather manufacture. Shoes were and still are made wholesale in several towns of Staffordshire, Cheshire, and Northamptonshire; but those made in London, by the principal dealers, are, though expensive, by far the best.

Of the annual value of the leather manufactured into shoes, boots, harness, saddlery, &c., there are no means of forming a correct estimate; but we have merely to consider the population of England, and the unavoidable extent of their wants, to be satisfied that from ten to twelve millions sterling are rather below than above the mark. But whilst our home consumption is so considerable, our export is comparatively small, in ordinary years not exceeding L.800,000; but in 1853 the exports of manufactured leather rose to L.1,578,595. This large increase was probably occasioned by the reckless consignments to Australia. The leather shipped to Ireland is merely tanned; to other countries our exports are in a manufactured shape. The duty on leather was wholly abolished in 1830.

Glove trade. Connected with our general manufacture of leather is the glove trade, a branch of no inconsiderable extent, being carried on in several of the midland and western counties, viz. at Woodstock, Worcester, Ludlow, Hereford, Yeovil in Somersetshire, &c. This branch of industry enjoyed for a lengthened period the protection of monopoly, which, however, was abolished in 1825. Many contradictory statements have been made as to the effects of this measure. We believe, however, that the depression so much complained of has not been produced by it, but by the substitution of cotton gloves for those of leather; and we have no doubt that, had it not been for the greater cheapness and improved quality of leather gloves, caused by the abolition of the monopoly, this substitution would have been carried much farther than it has been. The increased imports of the lamb and kid skins used in the manufacture show conclusively that it is not declining.

Paper. The manufacture of paper, and the trades connected with it, such as printing, bookselling, bookbinding, &c., give occupation to between 60,000 and 70,000 persons. From the excise returns, it appears that the quantity of paper of all kinds manufactured in England in 1852 was 114,521,304 lbs.; and the duty, which is at the rate of 1½d. per lb., plus 5 per cent., amounted to L.751,546. It is difficult to say what portion of this was used in printing books, and how much was consumed by the newspapers; but the quantity used by some of the latter is so great, that a single newspaper, *The Times*, is said to consume about 50 tons a week. See Bookselling and Newspapers.

Brewery. We come next to a branch of industry of a very different description, namely, the brewery. The amount of capital and labour invested in brewing establishments in England is very large, and particularly striking to those who have lived on the Continent, and have contrasted our situation with that of the wine countries of the south of Europe. It is only in Flanders and Germany that breweries are numerous; and in the latter, from the limited capital, and the scattered state of their population, there are hardly any of those large establishments which exist in our metropolis.

An Account of the total number of Quarters of Malt made between the 5th day of January 1852 and the 5th day of January 1853, in the United Kingdom; distinguishing the Quantity made in each Country, and the Quantity used by Brewers, by Victuallers, and by Retail Brewers;—and similar Account for the year ending the 5th day of January 1854.

YEAR ENDED 5TH JANUARY 1853.				
	Quarters of Malt made.	Quarters of Malt used		
		By Brewers and Victuallers.	By Retail Brewers.	Total.
England	4,435,453	3,445,245	481,007	3,926,252
Scotland	491,474	150,386	...	150,386
Ireland	207,134	160,693	...	160,693
The United Kingdom	5,134,061	3,756,324	481,007	4,237,331
YEAR ENDED 5TH JANUARY 1854.				
	Quarters of Malt made.	Quarters of Malt used		
		By Brewers and Victuallers.	By Retail Brewers.	Total.
England	4,530,730	3,576,166	487,128	4,063,294
Scotland	520,479	164,677	...	164,677
Ireland	203,759	160,929	...	160,929
The United Kingdom	5,254,968	3,901,772	487,128	4,388,900

Quantities of Spirits charged with Excise Duties in the United Kingdom in—

	Gallons.
1850	23,901,432
1851	24,030,933
1852	25,270,262

The quantity of beer brewed in England in 1830 was 4,678,428 barrels. The duty on beer having ceased on the 10th of October 1830, there are no subsequent accounts of the quantities brewed. There can be no doubt, however, from the increased quantity of malt, that the production of beer has likewise greatly increased.

Spirituous liquours. Spirituous liquors form one of the branches of manufacture in which England is dependent on her neighbours, as she imports an annual supply of corn spirit from Scotland and Ireland, rum from the West Indies, and brandy from France. It has been generally supposed that the consumption of gin has increased materially in England since 1825, when the duties were reduced. We are, however, inclined to doubt whether such be really the case, and are disposed to believe that the effect is more apparent than real; in fact, that it has resulted rather from a diminution of smuggling, than from a positive increase of consumption. That such has been the case in Scotland and Ireland is beyond all question; and there seems no reason to conclude that it is otherwise in England. For tables of the quantity of malt used in 1853, and of the quantity of spirits charged with excise duties in 1850, 1851, 1852, see articles Brewing and Distilling.

Lesser manufactures glass, hats, pottery. To the remaining manufactures our limits allow of little space, though several of them would be accounted of great importance in any other country than England. The ex-

Statistics. tent to which such articles as soap and paper are made among us is amply shown by the excise returns; but the list of our exports is of more consequence to the political economist, not from the vulgar notion that it is by export only that national profit is realised, but as indicative of those commodities for which we possess, in our soil, our climate, or our colonial possessions, advantages that give us a superiority over our neighbours. Thus, in the case of glass, the abundance and cheapness of our coal enable us to make an annual export of above L.500,000. In the manufacture of hats, likewise, our command of wool for the coarser kind, and of furs from our North American colonies for beaver hats, enables us to ship to an extent of nearly 45,000 dozen, or L.44,000 a-year. In earthenware we have the advantage of clay, of fuel, and of ready communication by canals. These, joined to the taste and ingenuity of individuals engaged in the manufacture, carried it, in the course of the eighteenth century, to an extent which has rendered it a national object; a tract of seven or eight miles in Staffordshire, called the Pottery District, being almost entirely appropriated to it. The population of this tract is about 60,000. The great outlet is Liverpool, and the shipments take place partly to the United States, partly to the continent of Europe. Exports (comprising procelain) in 1853 reached L.1,337,911 in real value.

The stocking manufacture is carried on chiefly in the counties of Nottingham, Derby, and Leicester. It formerly employed great numbers of women in knitting; but in this, as in most other branches, machinery has greatly superseded manual labour. Lace is made in vast quantities in the midland counties; and here also machinery is extensively applied. And so extraordinary has been the progress of invention in this department, that British lace at present commands a ready sale in all foreign markets, and is largely smuggled even into France.

VIII.—*Commerce and Shipping.*

Commerce. With Ireland the intercourse of England is very great, that country sending us grain, salted and fresh provisions, live cattle, butter, &c. to the amount of six or seven millions annually, and taking largely in return our manufactures, particularly cotton, woollen, and hardware.

North of Europe.—From Russia our chief imports are tallow, hemp, flax, corn, linen, timber, pitch, &c.; from the Swedish dominions, iron and timber; from Poland, wheat, timber, and potash; from Prussia, wheat, timber, and flax. All these countries take our cottons, hardware, and colonial produce.

Central part of Europe.—From Holland our imports are not foreign merchandise, as in the seventeenth century, when the Dutch were the carriers of Europe, but agricultural produce, as oats, wheat, seeds, hemp, cheese, butter; also gin; the whole to a large amount; in return for which the Dutch take our hardware, cottons, and woollens. From France our imports have long been burdened with heavy duties, but still they are large and increasing, consisting chiefly of wine and brandy, silk, lace, gloves, &c. With Germany our chief intercourse is through the medium of Holland and Hamburg. With these countries our exports are large, particularly in cottons, hardware, and colonial produce. Our imports are also very various and large, consisting of wool, corn, flax, timber, linen, and wine, from the vicinity of the Rhine.

South of Europe.—Here we enter on countries of much less industry. From Portugal we take wine in very large, and fruit in smaller quantities, in return for our cottons, our woollens, and our hardware. From Spain we receive wool, wine, brandy, oil, fruits, barilla, &c. Italy, without any commercial treaty, takes a large quantity of our manufactures, and gives in return silk, oil, and fruit. With the Levant, our traffic is similar; consisting of an export of manufactures, particularly printed cottons and hardware, and of an import of silk, fruit, and drugs.

Statistics. The *United States* are, notwithstanding their tariff, our best customers, receiving from us manufactures of almost every kind to a great amount, and sending us in return vast quantities of cotton, tobacco, rice, and flour; but the merchandise received from them being far inferior to the value of our exports, the difference is paid by remittances in money from the Continent of Europe, arising from American merchandise sold there. With South America a wide field of commercial intercourse has been opened; at present, however, the chief articles received from that vast region are bullion, hides, skins, indigo, and cochineal. The trade is, and will long be, subject to the various disadvantages of a newly-settled country, bare of capital, deficient in industry, and possessing but a small number of consumers of European commodities in proportion to its extent and fertility.

From *Asia* we import tea, indigo, cotton, coffee, sugar, piece goods, ivory, drugs, &c. Our principal article of export is cotton goods, for which, how singular soever it may appear, India has, since the opening of the trade in 1814, become one of our very best markets. Besides cotton stuffs and yarn, we send to Asia woollen goods, copper, and a great variety of other articles.

From *Africa* we import drugs, ivory, teak wood, hides, &c. Our exports are but inconsiderable, consisting principally of cotton and linen manufactures. The hopes so frequently entertained, of opening an advantageous trade with the interior of Africa, have hitherto been altogether disappointed, and we do not suppose that they are destined to be more successful in future.

The recent discovery of the gold fields in Australia, and the consequent influx of immigrants into that country, have made it an important market for our produce and manufactures. The declared value of our home produce and manufactures exported to the Australian colonies, including Van Diemen's Land and New Zealand, in 1850, was L.1,574,145, while in 1851, 1852, and 1853 it respectively amounted to L.2,807,356; L.4,222,205; and L.14,506,532. The number of ships that cleared from the United Kingdom for the various Australian colonies was 272 in 1851, 568 in 1852, and 1201 in 1853. A return of the exports and imports to the Australian colonies for 1851, 1852, and 1853, shows some curious results. The exports for 1853 exhibit in some instances an extinction, and in almost every article a decline, except wool, and of course gold, which is not noticed in the return; thus tanner's bark, of which 35,894 cwts. were exported in 1852, was reduced to 4776 cwts. in 1853; and tanned hides, of which 642,198 lbs. were exported in 1852, only amounted to 9842 lbs. in 1853; while untanned hides rose from 30,243 cwts. in 1852, to 41,987 in 1853. Flax and hemp, guano, wine, timber, tortoise shell, whalefins, &c., all declined or disappeared from the return. So did copper and lead ore; but copper partly wrought, that is, in bars, rods, or ingots, increased from 373 tons in 1852, to 686 tons in 1853. Quicksilver fell from 14,631 lbs. in 1852, to 6933 lbs. in 1853; and wool rose from 43,197,301 lbs. in 1852, to 47,075,963 lbs. in 1853.

The amount of exports in 1851 being doubled in 1852, and quintupled in 1853, and probably increased still more in 1854, could not fail to cause a glut in the market, which has produced great embarrassment in the colony, and entailed heavy losses on the speculators.

The value of the produce and manufactures of the United

Statistics.

Kingdom exported from Great Britain and Ireland to foreign parts, according to the real or declared value, amounted in 1832 to.......... .... L.38,251,502

In 1851 they had risen to.......................... 74,448,732

Of which were sent to the United States........................L.14,362,976

To the various British dependencies................ 19,513,960

To Brazil and South American States................ 8,229,628

42,106,564

From which it appears that the United States of America consume nearly one-fifth of our exported produce and manufactures, and that the countries colonized by Great Britain, and those dependent on her, are her customers for nearly a half of all the produce and manufactures which she sells to the world. There is every reason to expect that, under the wise and liberal constitutions granted to the British colonies, increasingly populous and prosperous nations will extend over the present unexplored wildernesses; and as the United States of America are rapidly enlarging their boundaries to the west and the south, and as their increasing population has been uniformly attended with a proportionate increase of trade, it is obvious that the prosperity of Britain is especially bound up with the prosperity of her colonies and with that of the United States. Britain is not less interested in the increasing wealth and prosperity of the other countries of the world; for the richer and more prosperous they are, the better customers will they be for our goods, and the more will they be able to contribute to our comfort and enjoyment by the produce which they will be able to export to our shores.

An Account of the Declared Value of British and Irish Produce and Manufactures Exported from the United Kingdom to various Countries in each Year from 1850 *to* 1852.

Countries.	1850.	1851.	1852.	Countries.	1850.	1851.	1852.
	L.	*L.*	*L.*		*L.*	*L.*	*L.*
Russia, Northern Ports...	1,297,660	1,157,543	994,330	Ascension and St Helena	30,063	30,555	31,760
... in the Black Sea	157,111	132,161	105,587	Mauritius..................	368,726	232,955	229,693
Sweden.....................	151,030	189,319	184,734	Aden........................	13,711	17,184	20,686
Norway.....................	211,917	257,814	254,276	British East Indies........	8,022,665	7,806,596	7,352,907
Denmark....................	454,304	445,500	452,436	French Possessions.........	1,746	443	...
Prussia....................	424,480	503,531	581,884	Java........................	507,499	759,361	618,368
Mecklenburg-Schwerin...	33,898	33,153	38,351	Philippine Islands.........	193,269	202,585	115,303
Hanover....................	231,987	227,288	365,843	Other Islands..............	...	652	1,134
Oldenburg & Kniphausen	11,436	10,009	31,715	China and Hong-Kong...	1,574,145	2,161,268	2,503,599
Hanseatic Towns..........	6,755,545	6,920,078	6,872,753	British Settlements in Australia...............	2,602,253	2,807,356	4,222,205
Heligoland.................	250	238	60				
Holland.....................	3,542,632	3,542,673	4,109,976	South Sea Islands.........	18,143	60,795	33,784
Belgium....................	1,136,237	984,501	1,076,499	British North America...	3,235,051	3,813,707	3,065,364
Channel Islands...........	506,415	613,724	564,453	... West Indies......	2,030,229	2,201,032	1,908,552
France.....................	2,401,956	2,028,463	2,731,286	Honduras..................	183,352	232,633	122,806
Portugal, Proper..........	1,029,204	1,048,356	1,104,213	Cuba........................	849,278	1,164,177	1,033,396
... Azores.........	47,607	59,635	63,479	Porto Rico.................	45,205	63,353	35,069
... Madeira........	41,578	41,941	41,825	Gaudaloupe................	267	135	830
Spain........................	864,997	1,015,493	1,253,957	Martinique.................	340	1,642	900
... Canary Islands......	61,754	49,827	39,641	Curaçoa....................	30,126	43,096	21,675
Gibraltar...................	388,141	481,286	510,889	St Croix....................	2,873	5,086	917
Sardinian Territories......	774,512	706,108	924,225	St Thomas.................	589,655	572,721	536,965
Duchy of Tuscany.........	769,409	869,131	693,749	Dutch Guiana..............	5,152	2,130	7,426
Papal Territories..........	222,559	266,633	188,231	Hayti........................	274,918	239,146	251,409
Naples and Sicily.........	1,026,456	1,266,211	911,658	U. States of America...	14,891,961	14,362,976	16,134,397
Austrian Territories......	607,755	812,942	674,423	California.................			433,340
Malta and Gozo...........	314,386	301,443	256,867	Mexico......................	451,820	577,901	366,020
Ionian Islands.............	135,912	223,096	138,642	Central America..........	251,073	319,814	260,699
Kingdom of Greece.......	202,228	220,592	152,527	New Grenada.............	330,810	319,889	502,128
Turkish Dominions.......	2,515,821	1,937,011	2,079,913	Venezuela.................	301,094	349,701	273,738
Wallachia and Moldavia	294,604	284,348	269,533	Ecuador....................	33,289	54,099	3,163
Syria and Palestine.......	303,254	359,871	511,096	Brazil.......................	2,544,837	3,518,684	3,464,394
Egypt.......................	648,801	968,729	955,701	Uruguay....................	60,480	218,078	615,453
Tripoli......................	...	...	2,947	Buenos Ayres.............	848,800	458,329	837,513
Tunis........................	5,128	7,549	336	Chili.........................	1,156,266	1,181,837	1,167,494
Algeria.....................	15.069	6,917	6,800	Bolivia......................	...	20,100	1,024,007
Morocco....................	31,799	40,783	110,126	Peru.........................	845,639	1,208,253	7,792
Western Coast of Africa..	641,975	658,934	536,358	Falkland Islands..........	1,145	2,841	...
British South Africa......	796,600	752,393	1,064,283	Russian America..........	10,063	...	...
Eastern Coast of Africa...	...	224	5,542	Greenland..................	565	282	125
African Ports on Red Sea	1,728	788	1,138				
Cape Verd Islands........	3,242	11,094	9,561	Total........L.	71,367,885	74,448,722	78,076,854

Statistics. Statistics.

Value of Imports into Great Britain and Ireland from Foreign Parts, calculated at the Official Rates of Valuation, for the years ending 5th January.

SPECIES OF IMPORTS.	GREAT BRITAIN.		IRELAND.		UNITED KINGDOM.	
	1853.	1854.	1853.	1854.	1853.	1854.
	L.	L.	L.	L.	L.	L.
Almonds of all sorts	69,216	65,305	689	476	69,905	65,781
Animals, living; viz.—						
Oxen, Bulls, Cows, and Calves	138,830	192,508	...	...	138,830	192,508
Sheep and Lambs	50,833	57,621	...	2	50,833	57,623
Annatto	40,101	51,421	...	...	40,101	51,421
Ashes, Pearl and Pot	199,082	201,181	...	...	199,082	201,181
Bacon	166,408	428,567	...	...	166,408	428,567
Barilla and Alkali	2,664	1,621	40,662	39,428	43,326	41,049
Bark for Tanning or Dyeing	82,461	79,770	8,715	9,494	91,176	89,264
—— Peruvian	254,896	192,784	...	39	254,896	192,823
Beef, Salted or Fresh	114,710	167,626	3	398	114,713	168,024
Bones of Animals and Fish	231,907	179,304	290	185	232,197	179,489
Books, Bound or Unbound	41,787	44,710	11	90	41,798	44,800
Boots, Shoes, and Galoches	90,568	135,610	10	82	90,578	135,692
Borax	171,091	287,761	...	...	171,091	287,761
Brimstone	378,047	462,712	11,137	9,425	389,184	472,137
Bristles	36,628	60,695	...	...	36,628	60,695
Butter	410,177	590,930	1	...	410,178	590,930
Caoutchouc	54,900	48,485	...	...	54,900	48,485
Cassia Lignea	37,270	16,632	...	...	37,270	16,632
Cheese	442,182	603,387	15	4	442,197	603,391
Cinnamon	108,371	144,356	...	...	108,371	144,356
Clocks	89,263	126,690	93	628	89,356	127,318
Cloves	78,634	120,939	1	...	78,635	120,939
Cochineal, Granilla, and Dust	1,977,319	910,936	2,274	...	1,979,593	910,936
Cocoa and Chocolate	151,086	191,406	4,419	4,433	155,505	195,839
Coffee	3,427,019	3,469,737	148	1,735	3,427,167	3,471,472
Copper Ore and Regulus	107,609	125,983	...	...	107,609	125,983
Copper, unwrought and part wrt.	534,281	533,021	...	...	534,281	533,021
Cork	57,139	67,409	10,618	14,195	67,757	81,604
Corn, Meal, and Flour	6,928,565	10,559,120	4,343,477	4,276,234	11,272,042	14,835,354
Cotton Manuf. of India and China	461,172	588,097	...	...	461,172	588,097
—— of Europe, &c.	355,135	478,454	26	25	355,161	478,479
Cream of Tartar	95,200	131,295	724	53	95,924	131,348
Currants	363,623	279,869	1,292	1,469	364,915	281,338
Dye and Hardwoods; Barwood	59,777	10,089	...	...	59,777	10,089
—— Brazil Wood	8,350	146,193	...	...	8,350	146,193
—— Fustic	48,045	49,293	...	...	48,045	49,293
—— Logwood	224,156	236,701	6,662	3,364	230,818	240,065
—— Mahogany	403,438	241,109	2,586	1,146	406,024	242,255
—— Rosewood	82,475	113,000	...	...	82,475	113,000
Embroidery	74,317	103,678	2	5	74,319	103,683
Figs	24,772	31,392	56	55	24,828	31,447
Flax and Tow	2,813,469	3,889,587	141,114	144,774	2,954,583	4,034,361
Ginger	25,372	27,673	...	...	25,372	27,673
Glass, except Bottles	166,837	246,531	7	23	166,844	246,554
Guano	1,296,200	1,231,655	2,695	...	1,298,895	1,231,655
Gum Animi and Copal	70,335	90,646	...	...	70,335	90,646
—— Arabic	104,034	132,637	...	290	104,034	132,927
—— Lac Dye	74,052	75,811	...	...	74,052	75,811
—— Shellac	68,695	119,712	...	...	68,695	119,712
—— Senegal	9,844	15,008	...	...	9,844	15,008
Hair, Manufacture of	237,559	245,245	...	...	237,559	245,245
Hair, Horse	62,274	86,113	...	...	62,274	86,113
Hams	16,810	34,906	70	200	16,880	35,106
Hemp	920,098	1,153,706	20,288	18,968	940,386	1,172,674
Hides, raw or tanned	1,701,856	2,461,209	9,256	13,343	1,711,112	2,474,552
Indigo	1,236,169	972,752	...	...	1,236,169	972,752
Iron in bars, unwrought	324,158	466,006	2,091	...	326,249	466,006
Isinglass	24,678	20,761	...	...	24,678	20,761
Lace	65,758	91,930	2	...	65,760	91,930
Lard	92,985	177,621	...	...	92,985	177,621
Lead, Pig and Sheet	198,767	260,825	58	1,686	198,825	262,511
Leather Gloves	66,393	86,910	...	...	66,393	86,910
Linens	50,559	66,320	294	333	50,853	66,653
Liquorice Juice and Paste	45,986	53,217	877	392	46,863	53,609
Mace	38,561	51,889	1	...	38,562	51,889
Madder and Garancine	1,919,757	2,342,674	160	851	1,919,917	2,343,525
Nutmegs	71,784	60,323	1	...	71,785	60,323
Oil, Castor	341,910	253,082	...	...	341,910	253,082
—— Cocoa Nut	304,317	490,536	...	...	304,317	490,536
—— Olive	298,259	333,930	2,535	12,424	300,794	346,354
Carry forward	31,320,980	38,066,612	4,613,360	4,556,249	35,934,340	42,622,861

Statistics.

Value of Imports into Great Britain and Ireland from Foreign Parts, calculated at the Official Rates of Valuation, for the years ending 5th January—Continued.

Statistics.

SPECIES OF IMPORTS.	GREAT BRITAIN.		IRELAND.		UNITED KINGDOM.	
	1853.	1854.	1853.	1854.	1853.	1854.
	L.	*L.*	*L.*	*L.*	*L.*	*L.*
Brought forward	31,320,980	38,066,612	4,613,360	4,556,249	35,934,340	42,622,861
Oil, Palm	523,812	636,581	...	87	523,812	636,668
—— Rape Seed	128,745	185,482	...	3,912	128,745	189,394
—— Blubber	373,801	383,071	349	80	374,150	383,151
Oil Seed Cakes	260,707	350,692	40	61	260,747	350,753
Oranges and Lemons	87,077	99,712	3,169	2,542	90,246	102,254
Pepper	110,523	91,605	16	37	110,539	91,642
Pimento	64,155	38,379	...	...	64,155	38,379
Pork, Salted or Fresh	90,475	144,557	73	...	90,548	144,557
Potatoes	386,104	565,077	7	150	386,111	565,227
Quicksilver	422,637	373,624	...	...	422,637	373,624
Rags, &c. for Paper	38,601	52,345	664	1,005	39,265	53,350
Raisins	238,749	304,979	4,761	5,628	243,510	310,607
Rhubarb	53,857	88,773	...	...	53,857	88,773
Rice	770,677	1,151,635	5	2,351	770,682	1,153,986
Rosin	113,310	185,987	1,596	522	114,906	186,509
Safflower	134,529	72,397	...	1	134,529	72,398
Sago	144,881	191,507	...	2,039	144,881	193,546
Saltpetre and Nitre	367,050	422,458	...	5	367,050	422,463
Seeds, Clover	81,351	128,928	951	1,706	82,302	130,634
—— Flax and Linseed	729,949	966,421	106,393	171,487	836,342	1,137,908
—— Rape	151,104	88,257	...	2,074	151,104	90,331
Senna	24,971	14,650	...	...	24,971	14,650
Shumac	62,665	69,624	1,447	1,534	64,112	71,158
Silk, Raw and Waste	2,729,343	3,208,717	...	5,444	2,729,343	3,214,161
—— Thrown	550,817	1,054,830	...	...	550,817	1,054,830
—— Manuf. of India and China	329,866	325,122	308	...	330,174	325,122
—————— of Europe, &c.	1,398,489	1,902,941	32	14	1,398,521	1,902,955
Skins and Furs	348,886	360,099	...	80	348,886	360,179
Spelter	925,268	1,170,923	...	...	925,268	1,170,923
Spirits, Brandy	534,005	666,251	5,142	5,741	539,147	671,992
——— Geneva	13,914	24,619	75	264	13,989	24,883
——— Rum	470,241	355,903	547	755	470,788	356,658
Sugar, Raw and Refined	9,739,227	10,322,372	722,991	720,469	10,462,218	11,042,841
——— Molasses	368,372	618,419	44	2	368,416	618,421
Tallow	1,070,668	1,236,216	45,564	14,133	1,116,232	1,250,349
Tar	129,404	144,216	3,246	4,392	132,650	148,608
Tea	6,560,183	7,113,482	75,870	32	6,636,053	7,113,514
Teeth, Elephants'	54,396	59,709	...	...	54,396	59,709
Terra Japonica and Cutch	115,069	90,327	...	1,837	115,069	92,164
Tin	237,215	248,702	...	...	237,215	248,702
Tobacco and Snuff	450,039	638,816	9	196	450,048	639,012
Turpentine	240,733	196,324	...	160	240,733	196,484
Valonia	66,646	98,122	19,292	13,787	85,938	111,909
Watches	146,970	199,729	...	169	146,970	199,898
Wax, Bees'	63,694	55,561	...	...	63,694	55,561
Whale-fins	64,205	72,507	...	...	64,205	72,507
Wines	702,502	1,178,589	46,864	67,314	749,366	1,245,903
Wood and Timber, viz.:—						
Deals, &c., Sawn	246,512	305,703	40,862	47,520	287,374	353,223
Timber, not Sawn	900,115	1,142,296	146,385	155,185	1,046,500	1,297,481
Teak Staves	65,334	94,920	1,974	1,702	67,308	96,622
Wool, Cotton	30,311,094	28,881,813	14,478	1,004	30,325,572	28,882,817
—— Sheep's	2,459,142	3,111,708	3,896	2,859	2,463,038	3,114,567
Woollen Manufactures	719,726	1,210,673	51	85	719,777	1,210,758
Yarn, Worsted or Silk	61,423	128,336	...	...	61,423	128,336
All other Articles	4,654,187	6,340,466	76,553	110,457	4,730,740	6,450,923
TOTAL Official Value of Imports from Foreign Parts	103,408,395	117,231,764	5,937,014	5,905,071	109,345,409	123,136,835

Statistics.

Value of the Produce and Manufactures of the United Kingdom, Exported from Great Britain and Ireland to Foreign Parts, according to the Real or Declared Value thereof, for the years ending 5th January.

SPECIES OF EXPORTS.	GREAT BRITAIN.		IRELAND.		UNITED KINGDOM.	
	1853.	1854.	1853.	1854.	1853.	1854.
Agricultural implements	L. 59,225	L. 77,309	L. 16	L. 70	L. 59,241	L. 77,379
Alkali of all sorts	399,236	478,532	...	...	399,236	478,532
Alum	27,543	25,039	...	...	27,543	25,039
Apothecary wares	380,308	538,537	...	79	380,308	538,616
Apparel and slops	1,246,160	2,765,094	517	1,602	1,246,677	2,766,696
Arms and ammunition	398,458	548,927	389	1,547	398,847	550,474
Bacon and hams	47,305	137,021	2,207	1,470	49,512	138,491
Bags, empty	149,771	187,118	523	218	150,294	187,336
Beef and pork, salted	33,578	60,237	4,351	1,638	37,929	61,875
Beer and ale	748,596	1,285,623	6,031	5,734	754,627	1,291,357
Bichromate of potash	25,624	23,867	...	...	25,624	23,867
Bleaching materials	107,609	94,230	284	681	107,893	94,911
Books, printed	289,388	451,711	45	351	289,433	452,062
Brass and copper manufactures	1,704,054	1,853,641	29	690	1,704,083	1,854,331
Bread and biscuit	20,110	41,961	...	...	20,110	41,961
Bricks	45,894	67,350	719	463	46,613	67,813
Butter and cheese	294,845	445,344	98,474	75,312	393,319	520,656
Cabinet and upholstery	131,719	349,560	775	435	132,494	349,995
Caoutchouc and gutta, manufact. of	46,014	72,687	...	...	46,014	72,687
Carriages of all sorts	70,133	159,625	732	165	70,865	159,790
Cement	49,833	64,212	29	5	49,862	64,217
Coals and culm	1,369,625	1,602,762	2,489	1,829	1,372,114	1,604,591
Confectionery	46,476	97,424	2	65	46,478	97,489
Cordage	144,588	221,626	1,336	4,776	145,924	226,402
Corn, meal, and flour	143,407	375,740	12,038	15,925	155,445	391,665
Cotton manufactures	23,221,085	25,807,986	2,347	9,263	23,223,432	25,817,249
——— yarn	6,654,655	6,895,653	...	...	6,654,655	6,895,653
Earthenware of all sorts	1,151,790	1,337,911	107	459	1,151,897	1,338,370
Fish of all sorts	349,456	456,008	940	10	350,396	456,018
Fishing tackle	46,566	50,015	...	...	46,566	50,015
Fuel, manufactured	39,741	48,664	146	...	39,887	48,664
Glass of all sorts	378,418	517,842	409	698	378,827	518,540
Haberdashery and millinery	2,074,117	4,156,139	63	355	2,074,180	4,156,494
Hardwares and cutlery	2,691,242	3,663,746	455	1,305	2,691,697	3,665,051
Hats, beaver and felt	48,055	87,388	...	161	48,055	87,549
——— of all other sorts	92,460	174,783	...	...	92,460	174,783
Hemp, dressed	31,872	17,351	...	...	31,872	17,351
Hops	29,726	39,591	...	...	29,726	39,591
Horses	98,495	85,887	372	80	98,867	85,967
Iron and steel, wrought and unwrt.	6,656,148	10,802,690	28,128	42,732	6,684,276	10,845,422
Lard	6,253	6,582	2,465	1,171	8,718	7,753
Lead and shot	353,165	372,940	15	...	353,180	372,940
——— red and white	65,079	66,703	...	...	65,079	66,703
Leather and saddlery	843,322	1,576,253	1,437	2,342	844,759	1,578,595
Linen manufactures	4,230,126	4,756,839	1,660	1,593	4,231,786	4,758,432
——— yarn	1,140,155	1,154,939	410	38	1,140,565	1,154,977
Machinery and mill-work	1,248,360	1,985,317	3,000	219	1,251,360	1,985,536
Mathematical instruments	44,222	59,441	1	...	44,223	59,441
Molasses	52,409	48,033	...	...	52,409	48,033
Musical instruments	122,918	175,370	40	25	122,958	175,395
Oil, hemp, linseed, and rape	434,899	516,311	60	17	434,959	516,328
——— Train and spermaceti	49,715	60,505	...	...	49,715	60,505
Painters' colours and materials	249,099	324,169	31	676	249,130	324,845
Perfumery	44,029	69,627	26	279	44,055	69,906
Pickles and sauces	146,330	332,448	50	14	146,380	332,462
Plate ware, jewellery, &c.	425,705	727,351	...	35	425,705	727,386
Platting for hats of straw, &c.	67,970	54,877	...	...	67,970	54,877
Potatoes	6,349	1,312	415	572	6,764	1,884
Provisions, not described	56,488	139,999	40	1	56,528	140,000
Salt	221,101	271,129	2,875	1,044	223,976	272,173
Saltpetre, refined in United Kingd.	51,395	48,965	...	...	51,395	48,965
Seeds of all sorts	19,893	23,745	777	...	20,670	23,745
Silk manufactures	1,551,846	2,044,289	20	72	1,551,866	2,044,361
Soap and candles	315,649	412,265	8,795	7,614	324,444	419,879
Spelter, wrought and unwrought	33,365	97,328	...	...	33,365	97,328
Spirits	63,618	204,141	2,930	4,300	66,548	208,441
Stationery of all sorts	411,590	618,498	123	384	411,713	618,882
Sugar, refined	300,134	301,627	...	...	300,134	301,627
Tin, unwrought	83,604	140,859	...	...	83,604	140,859
Tin and pewter wares	1,080,725	1,213,612	...	18	1,080,725	1,213,630
Tobacco, manufactured	12,651	19,669	...	...	12,651	19,669
Toys	26,783	46,825	...	...	26,783	46,825
Turnery and turners' wares	30,142	40,094	...	19	30,142	40,113
Twine	54,775	57,037	...	25	54,775	57,062
Umbrellas and parasols	79,777	119,905	...	...	79,777	119,905
Wool, sheep's, and other sorts	792,289	483,812	53,480	700	845,769	484,512
Woollen and worsted yarn	1,430,140	1,456,786	...	...	1,430,140	1,456,786
Woollen manufactures	8,729,609	10,170,788	1,325	1,394	8,730,934	10,172,182
All other articles	1,361,587	2,342,467	52,335	33,423	1,413,922	2,375,890
Total exports	77,780,591	98,709,688	296,263	224,093	78,076,854	98,933,781

Statistics.

An Account of the Value of the Imports into, and of the Exports from, the United Kingdom, during each of several years ending the 5th January, showing the official as well as the real or declared values of these.

Years ending Jan. 5,	Imports into the U. Kingdom calculated at the official rates.	Exports calculated at the Official Rates of Valuation.			Produce and Manufactures of the U. Kingdom exported, at the real or declared value.
		Produce and Manufactures of the United Kingdom.	Foreign and Colonial Merchandise.	Total Exports.	
	L.	L.	L.	L.	L.
1815...	32,620,771	32,200,580	19,157,818	51,358,298	43,447,373
1853...	109,345,409	196,176,601	23,329,089	219,505,690	78,076,854
1854...	123,136,835	214,360,489	27,767,733	242,128,222	98,933,781

Decline in the real value of the exports.

The great increase in the official, and the comparative decline in the real or declared value of the exports, since 1815, has given rise to a great deal of irrelevant discussion. It has been looked upon as a proof that our commerce is daily becoming less prosperous, whereas, in point of fact, a precisely opposite conclusion should be drawn from it. The rates according to which the official values of the exports are determined were fixed as far back as 1696; so that they have long ceased to be of importance as affording any criterion of the actual value, their only use being to show the fluctuations in the *quantities* exported. To remedy this defect, a plan was formed during the early part of Mr Pitt's administration, for keeping an account of the *real* value of the exports, as ascertained by the declarations of the exporters. Those who contend that our trade is getting into a bad condition, argue that the great increase in the official value of the exports since 1815 shows that the *quantity* of the articles exported has been proportionally augmented, whilst the fall in their real value shows that we are selling this larger quantity for a smaller price, a result which, they affirm, is most injurious. But the circumstance of a manufacturer or a merchant selling a large or a small quantity of produce at the same price, affords no criterion by which to judge as to the advantage or disadvantage of the sale; for if, in consequence of improvements in the arts or otherwise, a particular article may now be produced for half the expense that its production cost ten or twenty years ago, it is obvious that double the quantity of it may be afforded at the same price without injury to the producers. Now this is the case with some of the most important articles which are exported from England. Cottons and cotton-twist form a full third or more of our entire exports; and since 1814 there has been an extraordinary fall in the price of these articles, occasioned partly by cotton wool having fallen from about 1s. 6d. per lb. to about 5d. per lb., but more by improvements in the manufacture. Hence, whilst the official value of the exports of cotton goods and twist has increased from about L.18,000,000 in 1814, to about L.100,000,000 in 1853, their declared value has risen only from about L.20,000,000 at the former period to about L.33,000,000 at the latter. Surely, however, this is, if anything can be, a proof of increasing prosperity; it shows that we can now export and sell with a profit (for unless such were the case, does any one imagine the exportation would continue?) nearly four times the quantity of cotton goods and yarn which we exported in 1814 for about the same price. See Cotton Manufacture.

The commercial interests of England long suffered from the inextricable confusion of our maritime laws. From the revolution down to 1786 some hundreds of acts were passed, each enacting some addition, diminution, or change of the duties, drawbacks, bounties, and regulations previously existing in the customs. Mr Pitt has the merit of having first introduced something like order into this chaos. Under his auspices all the separate custom-duties existing in 1787 were repealed, and simple and intelligible ones substituted in their stead.

In the report of the Lords' Committee on Foreign Trade in 1820, it is stated that the laws under which the commerce of the country was regulated amounted to upwards of 2000, of which 1600 were in force in 1815. After this report was printed, Mr Huskeyson introduced great reforms into the laws affecting shipping and navigation. And since his time the repeal of a vast number of custom-duties and the many important and beneficial changes effected by Sir Robert Peel, have vastly simplified our commercial legislation. Various improvements have also been introduced by the late chancellor of the exchequer, Mr Gladstone; and the Customs Consolidation Act of 1853 has brought the various laws relating to the customs into a concise and simple form. It comprises the whole law respecting the importation, exportation, warehousing, smuggling, &c., of goods, with the regulations to be observed in the coasting and colonial trades, &c., and is at once brief, comprehensive, and so clear as to be level to the comprehension of those least acquainted with such matters. Besides condensing and simplifying the various laws respecting the customs, this act has also introduced some most important changes. The merchant is now no longer obliged, when successful in a suit, to pay his own expenses, as was formerly the case; nor are goods in dispute now detained till the point be inquired into and decided, but are given up on the amount claimed being deposited. If the claim is found to have been unjust, the sum overcharged is returned, with interest at the rate of 5 per cent., and the expenses of the suit. The merchant may also, if he consider himself aggrieved by the decision of the board, have the case brought into open court before a commissioner, where he may meet the officer, and learn by examination the real facts of the case. The evidence so taken is reported to the board, who may thereupon confirm or modify their decision; it being optional with the merchant either to abide by it, or to carry the case before a competent tribunal. If the duty or penalty claimed be under L.100, or the case be of a simple kind, it may be tried before magistrates, county courts, or other inferior tribunals.

Shipping.

In order to promote the shipping interest in Britain the navigation laws were passed, which were long considered the safeguards of British commerce. By these laws certain enumerated articles, which in fact comprehended everything that was of importance in commerce, could be brought to our shores only in British ships, or in the ships of the country of which the goods were the produce, or in ships of the country from which the goods were to be brought. Experience proved that these restrictions which were intended for the benefit of British commerce, operated only as fetters upon trade. By the act passed in 1849, the restrictive provisions of the old acts were repealed from and after the 1st of January 1850. Great alarm was created among the shipbuilders and others, by the change, which as they apprehended was fraught with ruin to the trade and commerce of the country; but instead of that, the trade increased more rapidly than before. The amount of tonnage built in 1849 was 121,266, in 1851 it was 149,599, and in 1853 it was 203,171.

The increase has been more remarkable in steam than in sailing vessels: in 1850 the number of steam-vessels built was 36, and their tonnage 3835; in 1853 the number of steam-vessels built was 153, and their tonnage 45,215. Another circumstance which is remarkable, is the recent extraordinary substitution of iron for wood in the construction of steam-vessels. Of the 158 built in 1853, no less than 117 were iron. Dr Strang, in a communication made to the British Association in 1852, states, that during the last seven years there have been constructed, or were constructing, in Glasgow and neighbourhood, 123 vessels, 122 of which were iron. At Greenock and Port-Glasgow, during the same period, there were constructed 66 steam-vessels, 13 of which were of wood and 53 of iron.

The subjoined tables give a complete view of the shipping belonging to the different ports of the British empire, and of the navigation with foreign countries, in 1852 and 1853.

Statistics. *A Return of the Number and Tonnage of Sailing Vessels Registered at each of the Ports of Great Britain and Ireland, including the Isle of Man and the Channel Islands; distinguishing those under and those above Fifty Tons Register, on the* 31*st December* 1853:—*Also, a similar Return of Steam Vessels and their Tonnage.* Statistics.

ENGLAND.	Sailing Vessels.				Steam Vessels.			
	Under 50 Tons.		Above 50 Tons.		Under 50 Tons.		Above 50 Tons.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
Aberystwith	121	4,034	123	11,247	...	...	...	...
Arundel	50	1,372	44	5,901	...	...	...	...
Barnstaple	51	1,724	29	3,300	...	...	...	...
Beaumaris	139	4,286	118	17,330	...	...	...	...
Berwick	30	1,015	29	3,112	...	...	1	219
Bideford	60	1,891	77	9,061	...	...	1	74
Boston	112	4,176	49	3,286	1	18	...	...
Bridgewater	55	1,965	69	11,476	2	21	...	...
Bridport	3	124	14	1,843	...	...	...	...
Bristol	165	4,974	229	61,354	12	308	18	3,728
Caernarvon	114	3,738	298	23,506	1	49	1	88
Cardiff	23	614	36	6,128	7	179	2	187
Cardigan	128	3,819	92	8,742	...	...	...	...
Carlisle	12	398	20	1,488	1	38	1	231
Chepstow	42	1,155	13	1,096	1	17	1	53
Chester	59	2,219	59	4,063	7	246	4	907
Colchester	191	3,981	69	7,907	1	23	...	...
Cowes	126	3,259	47	5,136	1	22	...	...
Dartmouth	166	4,591	253	28,291	1	19	...	...
Deal	19	346	...	...	...	...	...	...
Dover	48	1,369	21	2,503	...	...	1	54
Exeter	41	1,197	146	19,533	...	...	...	...
Falmouth	50	1,393	73	7,364	1	14	...	...
Faversham	225	4,936	82	10,355	1	9	...	...
Fleetwood	16	480	14	3,424	...	...	5	904
Fowey	38	1,365	109	10,696	...	...	...	...
Folkstone	7	137	7	900	...	...	...	...
Gainsborough	6	257	5	363	1	49	4	307
Gloucester	275	7,687	74	11,200	2	54	...	...
Goole	116	8,824	396	25,041	2	27	7	680
Grimsby	74	2,151	14	1,251	4	71	2	1,030
Hartlepool	3	17	124	26,777	6	124	...	...
Harwich	72	2,170	54	5,171	...	...	...	...
Hull	228	8,223	223	48,438	12	291	30	7,418
Ipswich	51	1,453	112	12,180	5	192	4	447
Lancaster	36	1,389	53	5,479	...	...	7	1,085
Liverpool	232	8,019	1,786	704,342	24	873	102	24,325
Llanelly	40	1,098	36	3,329	3	62	...	...
London	749	24,621	2,209	654,694	116	3,759	291	109,598
Lowestoft	40	1,093	23	1,862	1	17	5	2,123
Lyme	7	217	13	1,754	...	...	...	...
Lynn	55	1,769	122	18,569	2	26	...	...
Maldon	111	3,196	48	4,741	...	...	...	...
Maryport	19	562	88	16,088	2	34	1	199
Milford	73	1,979	70	8,494	1	48	...	...
Newcastle	7	3,164	695	147,782	89	1,624	9	2,226
Newhaven	10	216	15	2,405	...	...	...	...
Newport	19	766	59	11,378	2	67	1	52
Padstow	69	2,558	54	6,846	...	...	...	...
Penzance	27	693	63	7,497	...	...	...	...
Plymouth	250	7,394	200	36,759	4	105	2	266
Poole	33	871	75	13,429	1	22	...	...
Portsmouth	170	4,221	74	8,335	4	142	3	180
Preston	79	3,007	42	3,929	5	145	4	768
Ramsgate	95	2,564	37	3,485	1	10	...	...
Rochester	324	10,091	62	7,745	4	154	1	62
Rye	81	1,848	45	4,657	...	...	...	...
Saint Ives	63	1,380	98	11,038	...	...	4	726
Scarborough	62	1,767	134	32,079	...	...	...	...
Scilly	15	403	45	6,216	...	...	...	...
Shields	17	545	763	201,104	82	1,646	...	...
Shoreham	54	1,027	62	11,277	...	...	...	...
Southampton	136	3,588	85	10,744	8	265	13	1,864
Stockton	22	578	135	27,830	25	555	1	53
Sunderland	93	2,776	832	208,891	38	671	...	...
Swansea	73	2,116	94	14,301	6	141	6	519
Teignmouth	2	60	14	2,638	1	19	...	...
Truro	12	431	38	3,381	...	...	...	...
Wells	120	2,614	79	7,226	2	30	...	...
Weymouth	29	825	55	6,487	1	31	2	122
Whitby	48	1,649	341	59,274	3	85	...	...
Whitehaven	14	402	181	31,359	1	37	4	879
Wisbeach	25	930	79	10,796	3	70	2	482
Woodbridge	30	1,008	38	2,718	...	...	...	...
Workington	3	88	90	18,394	1	18	...	...
Yarmouth	328	9,332	289	32,991	5	87	3	282
TOTAL, ENGLAND	6,588	204,195	12,443	2,771,806	504	12,514	543	162,138

Statistics.

SCOTLAND.	Sailing Vessels. Under 50 Tons. Vessels.	Sailing Vessels. Under 50 Tons. Tonnage.	Sailing Vessels. Above 50 Tons. Vessels.	Sailing Vessels. Above 50 Tons. Tonnage.	Steam Vessels. Under 50 Tons. Vessels.	Steam Vessels. Under 50 Tons. Tonnage.	Steam Vessels. Above 50 Tons. Vessels.	Steam Vessels. Above 50 Tons. Tonnage.
Aberdeen	19	539	212	46,411	1	41	7	3,116
Alloa	28	884	51	13,693	1	25	4	302
Arbroath	17	704	94	13,409	...	...	...	...
Ayr	16	486	26	4,472	...	...	1	70
Banff	49	1,666	96	11,343	...	...	...	...
Borrowstounness	29	942	44	4,891	...	...	..	...
Campbeltown	26	883	1	576	...	...	2	259
Dumfries	73	2,327	51	8,437	...	...	...	...
Dundee	34	1,161	284	55,466	3	94	7	1,686
Glasgow	78	2,744	382	152,528	17	610	91	26,963
Grangemouth	8	297	38	7,955	4	81	3	747
Greenock	220	6,209	184	65,677	2	47	12	1,965
Inverness	169	4,195	79	6,536	...	...	2	535
Irvine	41	1,194	77	17,714	...	...	3	476
Kirkcaldy	63	2,020	36	7,096	...	...	1	62
Kirkwall	22	560	21	1,925	...	...	...	...
Leith	79	2,350	102	22,007	13	274	15	3,672
Lerwick	54	1,231	8	755	...	...	...	...
Montrose	10	437	88	14,359	...	...	1	76
Perth	10	316	44	4,262	1	19	2	116
Peterhead	8	246	40	9,485	...	...	...	...
Port Glasgow	38	1,442	16	4,827	1	14	12	2181
Stornoway	42	1,131	14	1,477	...	...	...	...
Stranraer	5	548	28	856	...	...	...	...
Wick	23	665	16	1,281	...	...	...	...
Wigtown	36	1,236	16	1,543	...	...	1	316
Total, Scotland	1,197	36,413	2,048	478,981	43	1,205	164	42,542
IRELAND.								
Ballina	2	36	1	215	...	...	...	...
Belfast	159	5,428	322	75,536	2	28	10	2,186
Coleraine	11	272	...	...	...	...	...	...
Cork	158	3,696	228	41,626	7	214	16	4,827
Drogheda	7	193	41	5,166	...	...	5	1,787
Dublin	291	8,407	127	21,588	3	119	43	11,656
Dundalk	5	181	18	1,431	1	24	2	844
Galway	12	359	3	502	...	...	...	...
Limerick	59	1,761	40	10,315	...	...	1	300
Londonderry	10	256	14	4,171	3	125	4	1,339
Newry	78	2,401	39	5,293	...	...	3	873
Ross	2	69	16	5,756	...	...	...	...
Skibbereen	94	2,285	3	202	...	...	...	...
Sligo	13	401	19	3,739	1	44	1	67
Strangford	32	1,053	21	2,406	...	...	...	...
Tralee	12	306	4	729	...	...	...	...
Waterford	60	1,524	94	12,964	...	...	19	5,791
Westport	4	87	1	120	...	...	...	...
Wexford	28	1,006	70	7,660	...	...	...	...
Total, Ireland	1,037	29,721	1,061	199,419	17	554	104	29,670
Isle of Man	318	7,422	39	2,947	...	...	5	1,197
Channel Islands	207	5,445	286	43,743	1	21	4	271

VESSELS REGISTERED.

An Account of the Number of Vessels, with the amount of their Tonnage, and the Number of Men and Boys usually employed in Navigating the same, that belonged to the several Ports of the British Empire, on the 31*st December* 1851, 1852, *and* 1853 *respectively.*

	On the 31st December 1851. Vessels.	On the 31st December 1851. Tonnage.	On the 31st December 1851. Men.	On the 31st December 1852. Vessels.	On the 31st December 1852. Tonnage.	On the 31st December 1852. Men.	On the 31st December 1853. Vessels.	On the 31st December 1853. Tonnage.	On the 31st December 1853. Men.
England	19,404	2,803,052	145,222	19,600	2,907,999	147,252	20,078	3,150,653	152,184
Scotland	3,587	536,266	29,587	3,450	535,008	29,512	3,451	559,141	29,563
Ireland	2,203	262,411	14,155	2,178	254,997	13,902	2,219	259,364	14,083
Isles of Guernsey, Jersey, and Man	849	60,615	5,798	858	61,274	5,978	860	61,046	5,701
British Plantations	8,201	669,741	46,166	8,316	665,114	46,868	8,701	734,218	52,365
Total	34,244	4,332,085	240,928	34,402	4,424,392	243,512	35,309	4,764,422	253,896

Statistics.

A Return of the Number and Tonnage of Sailing Vessels Registered at each of the Colonies of the United Kingdom respectively, distinguishing those under and those above 50 Tons Register, on the 31st December 1853:—A similar Return of Steam Vessels and their Tonnage.

Statistics.

	Sailing Vessels.				Steam Vessels.			
	Under 50 Tons.		Above 50 Tons.		Under 50 Tons.		Above 50 Tons.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
Africa—								
Bathurst	49	923	14	1,270	...	...	...	...
Sierra Leone	11	270	8	746	...	...	...	...
Cape of Good Hope	7	228	46	6,839	...	...	...	...
Mauritius	60	1,747	49	7,344	...	...	2	171
Australia—								
Sydney	150	3,805	141	26,321	6	191	9	1,487
Melbourne	65	1,584	55	7,327	1	44	5	460
Hobart Town	106	2,773	221	21,088	2	69	1	52
Launceston	32	834	32	6,344	...	...	...	...
New Zealand	117	2,400	29	1,918	...	...	...	...
America (British Northern Colonies)—								
Newfoundland	458	13,774	490	49,720	1	40	1	96
Canada	257	8,628	437	73,181	22	789	69	8,564
New Brunswick	428	10,568	375	102,029	10	358	14	1,633
Nova Scotia and Cape Breton	1,167	52,998	1,773	135,989	3	96	...	...
Prince Edward Island	213	6,002	132	19,831	...	...	1	57
British West Indies—								
Antigua	80	1,191	4	411	...	...	...	...
Barbadoes	26	626	9	738	...	...	...	...
Dominica	16	333	4	243	...	...	...	...
Grenada	46	484	...	...	...	...	...	...
Jamaica	75	1,798	9	1,054	...	...	...	...
Montserrat	1	13	1	59	...	...	...	...
Nevis	11	127	...	...	...	...	...	...
St Christopher	18	245	...	...	...	...	...	...
St Lucia	12	332	2	335	...	...	...	...
St Vincent	35	623	7	656	...	...	...	...
Tobago	8	228	1	97	...	...	...	...
Tortola	34	205	2	182	...	...	...	...
Trinidad	51	886	4	305	1	48	...	...
Bahamas	135	2,900	31	2,615	...	...	...	...
Bermuda	14	421	30	2,754	...	...	...	...
Demerara	32	868	9	670	...	...	1	69
Berbice	17	273	2	133	...	...	...	...

A Return of the Number of Vessels, with their Tonnage (distinguishing Steam from Sailing Vessels), that were Built and Registered in the United Kingdom, distinguishing Timber from Iron Vessels, in the Year 1853.

	Timber.		Iron.	
	Vessels.	Tonnage.	Vessels.	Tonnage.
Sailing Vessels	635	146,380	10	8,576
Steam Vessels	36	3,305	117	44,910
Total	671	149,685	127	53,486

From the statistics of Glasgow, published by Dr Strang in 1855, we learn that the tonnage of steamboats built on the Clyde during thirty years, from 1820 to 1850, amounted to 103,270, while in the three years 1851, 1852, 1853, it amounted to 141,713 in 206 vessels, which were almost entirely of iron. And to show the magnitude of this great department of Scottish industry, he adds that, during a period of twelve months, embracing the greater part of 1853, the tonnage of all vessels built in the ports of the Clyde was 64,114 tons, whereas the total tonnage of vessels built in London in 1853 was only 62,745, and in Liverpool 45,682.

Statistics. *A Return of the Shipping employed in the Trade of the United Kingdom, exhibiting the Number and Tonnage of Vessels that entered Inwards and cleared Outwards (including their repeated Voyages), separating British from Foreign Vessels, also Steam from Sailing Vessels, and distinguishing the Trade with each Country, in the Year* 1853 (*in continuation of Parliamentary Paper No.* 299, *of Session* 1852-3). Statistics.

		Inward.				Outward.			
		British.		Foreign.		British.		Foreign.	
		Ships.	Tonnage.	Ships.	Tonnage.	Ships.	Tonnage.	Ships.	Tonnage.
Russia	Steam	27	13,489	...	...	22	12,225	1	1,800
	Sailing	1,790	397,775	1,881	377,754	1,353	295,037	1,089	200,010
Sweden	Steam	38	11,383	2	190	36	10,872	...	...
	Sailing	223	44,814	1,089	200,187	164	31,216	887	145,817
Norway	Steam	13	3,185	...	...	16	3,920	...	...
	Sailing	110	13,624	1,765	284,908	126	19,306	1,849	292,764
Denmark	Steam	101	44,188	19	4,799	29	11,393	8	2,304
	Sailing	84	7,966	2,120	157,789	406	75,779	5,034	529,957
Prussia	Steam	...	...	11	2,638	...	...	10	2,350
	Sailing	958	154,855	2,573	416,194	817	130,304	1,708	308,725
Germany	Steam	432	153,096	124	41,659	419	150,254	117	31,365
	Sailing	1,126	202,124	1,783	164,150	1,146	203,794	1,984	195,484
Holland	Steam	825	246,627	184	38,566	605	176,056	185	38,434
	Sailing	958	133,305	1,146	225,593	913	118,076	612	47,740
Belgium	Steam	290	85,515	126	29,213	289	85,779	121	27,858
	Sailing	345	40,441	480	70,987	272	18,254	200	23,695
Channel Islands	Steam	326	51,599	...	...	320	53,818	...	...
	Sailing	1,526	121,603	38	3,648	1,166	74,728	...	...
France	Steam	1,576	290,158	15	1,597	1,491	275,303	15	1,597
	Sailing	2,926	302,449	4,367	420,130	2,651	301,791	4,061	342,092
Portugal, Azores, and Madeira	Steam	29	9,856	...	...	23	8,451	...	...
	Sailing	607	62,386	179	22,644	626	68,785	548	94,063
Spain and Canaries	Steam	1	403	12	2,510	1	500	11	2,279
	Sailing	516	55,450	252	32,198	1,014	174,401	683	116,821
Gibraltar	Steam	36	14,247	...	...	37	15,273	2	650
	Sailing	24	3,766	3	210	174	21,728	67	11,955
Italian States	Steam	32	14,212	...	...	33	14,877	1	150
	Sailing	464	66,037	257	57,265	708	130,583	575	130,229
Malta	Steam	...	...	...	...	2	756	...	...
	Sailing	38	6,383	16	3,490	170	41,600	172	44,657
Ionian Islands	Sailing	43	5,773	5	1,212	40	8,183	31	8,636
Greece	Sailing	68	10,263	23	4,857	21	3,740	65	17,685
Turkey	Steam	51	30,674	...	...	50	30,408	...	...
	Sailing	272	56,335	277	68,964	245	53,458	581	153,994
Wallachia and Moldavia	Sailing	242	42,106	315	55,600	73	12,489	50	6,558
Syria	Steam	3	968	...	...	5	1,756	...	...
	Sailing	28	5,377	14	3,146	36	7,244	10	1,997
Africa	Steam	47	36,410	...	...	44	37,465	...	...
	Sailing	563	158,438	291	81,098	581	173,109	260	61,931
Asia	Steam	16	24,172	...	...	41	26,553	...	...
	Sailing	834	476,983	68	44,390	1,515	739,492	408	214,437
America—									
British Northern Colonies	Steam	4	1,791	...	...	2	1,281	...	...
	Sailing	1,877	775,446	443	225,753	1,329	537,767	92	29,548
British West Indies	Steam	1	321	...	...	1	321	...	...
	Sailing	690	184,027	42	10,058	612	168,748	44	11,285
Foreign West Indies	Steam	25	38,527	1	250	26	44,354	...	...
	Sailing	150	43,224	239	60,926	204	56,949	342	90,229
United States	Steam	79	86,354	27	37,390	86	88,428	36	49,397
	Sailing	441	266,408	889	697,857	860	470,848	1,175	932,605
Central and Southern States	Steam	16	14,731	...	...	16	17,338	...	...
	Sailing	693	229,399	171	37,830	590	189,282	266	62,910
Falkland Islands	Sailing	2	562	...	...	3	1,352	1	116
Arctic Regions	Sailing	...	...	...	...	2	574	...	...
Whale Fisheries	Sailing	62	16,113	1	113	67	16,982	...	...
Total		21,628	5,055,343	21,248	3,887,763	21,478	5,212,980	23,301	4,234,124

Statistics. Statistics.

These Returns embrace Vessels belonging to the Channel Islands, but not Vessels registered in the British Plantations.

1.—*Return of the Number and Tonnage of British Registered Vessels employed solely as Home-Trade Ships in the Years* 1849, 1850, 1851, 1852, *and* 1853, *with the Number of Men employed; distinguishing Sailing Vessels from Steamers.*

YEARS.	Sailing Vessels.			Steam Vessels.		
	Number of Vessels.	Tonnage.	Number of Men employed.	Number of Vessels.	Tonnage.	Number of Men employed.
1849	9,298	665,726	40,208	312	54,089	4,442
1850	8,830	666,957	38,527	320	54,196	4,491
1851	8,898	685,641	36,906	368	78,820	6,048
1852	8,776	701,803	35,793	358	66,606	5,182
1853	8,477	689,342	36,051	374	85,471	6,689

2.—*Return of the Number and Tonnage of British Registered Vessels employed partly as Home-Trade Ships, and partly as Foreign-going Ships, in the Years* 1849, 1850, 1851, 1852, and 1853, *with the Number of Men employed; distinguishing Sailing Vessels from Steamers.*

YEARS.	Sailing Vessels.			Steam Vessels.		
	Number of Vessels.	Tonnage.	Number of Men employed.	Number of Vessels.	Tonnage.	Number of Men employed.
1849	1,897	281,951	12,715	20	5,539	262
1850	1,487	222,341	10,291	20	5,298	396
1851	1,489	242,656	8,570	18	4,926	282
1852	1,063	147,867	6,875	42	15,244	944
1853	970	156,800	7,134	28	7,250	560

3.—*Return of the Number and Tonnage of British Registered Vessels employed solely as Foreign-going Ships in the Years* 1849, 1850, 1851, 1852, and 1853, *with the Number of Men employed; distinguishing Sailing Vessels from Steamers.*

YEARS.	Sailing Vessels.			Steam Vessels.		
	Number of Vessels.	Tonnage.	Number of Men employed.	Number of Vessels.	Tonnage.	Number of Men employed.
1849	6,612	2,040,344	91,242	82	48,693	3,742
1850	7,149	2,143,234	93,912	86	45,186	3,813
1851	7,277	2,287,897	85,801	134	60,995	4,330
1852	7,431	2,365,995	103,618	149	83,369	7,151
1853	8,120	2,665,685	111,821	237	125,539	10,270

4.—*Aggregate Returns,* 1, 2, *and* 3, *showing the Total Number of British Registered Vessels employed in Trading in, from, and to Great Britain and Ireland, in the Years* 1849, 1850, 1851, 1852, *and* 1853, *with their Tonnage and Number of Men.*

YEARS.	Sailing Vessels.			Steamers.*		
	Number of Vessels.	Tonnage.	Number of Men employed.	Number of Vessels.	Tonnage.	Number of Men employed.
1849	17,807	2,988,021	144,165	414	108,321	8,446
1850	17,466	3,032,532	142,730	426	104,680	8,700
1851	17,664	3,216,194	131,277	520	144,741	10,660
1852	17,270	3,215,665	146,286	549	165,219	13,277
1853	17,567	3,511,827	155,006	639	218,260	17,519

* River steamers are not included in this return.

Statistics.

IX.—*Establishments for Religion and Education.*

Rank of the clergy.

The Church of England has two archbishops and twenty-six bishops, twenty-four of whom are peers of the realm, and all indebted for their appointment to the crown. The province of York comprises six bishoprics, viz. Durham, Carlisle, Chester, Manchester,[1] Ripon, and the Isle of Man; all the rest, to the number of twenty, are in the province of Canterbury. The clerical dignitary next to the bishop is the archdeacon, whose duty, though very different in different dioceses, may be termed that of a representative of the bishop in several of his less important functions. The number of archdeacons in England and Wales, including the Channel Islands, is—in the province of Canterbury 56, in the province of York 15, in all 71. The number of deaneries is 463—in the province of Canterbury 397, and in the province of York 66. The name of Dean (*Decanus*) was probably derived from his originally superintending ten canons or prebendaries. Each bishop has a chapter or council appointed to assist him, and each chapter has a dean as its president; but there are in the Church of England many deaneries of other descriptions. Rector is, in general, the title of a clergyman holding a living of which the tithes are entire; vicar is understood of a living where the great tithes have passed into secular hands. The very general name of curate signifies sometimes (as *curé* in France) a clergyman in possession of a living, but more frequently one exercising the spiritual office in a parish under the rector or vicar. The latter are temporary curates, their appointment being a matter of arrangement with the rector or vicar; the former, being more permanent, are called perpetual curates, and are appointed by the impropriator of the tithe in a parish which has neither rector nor vicar. The name of priest is, in general, confined to the clergy of the Church of Rome; in the Church of England the corresponding term is a clerk in orders. A parson (*persona ecclesiæ*) denotes a clergyman in possession of a parochial church. Deacon is, in England, not a layman, as in Calvinist countries, but a clergyman of limited qualifications, entitled to preach, baptize, marry, and bury, but not to give the sacrament. Readers are not regular clergymen, but laymen of good character, licensed by the bishop to read prayers in churches or chapels where there is no clergyman. (See Adolphus *on the British Empire*, vol. i.)

The division of the country ecclesiastically into *dioceses*, *archdeaconries*, and *deaneries*, took place in very early times. Most of the present bishoprics were founded in the Saxon period: originally there were three archbishoprics—of Canterbury, York, and Caerleon in Wales; the latter was suppressed by Henry I., and the territory annexed to the see of Canterbury. Most of the dioceses, on their first formation, had their limits co-extensive with the boundaries of the kingdoms of the sovereigns who formed them; subdivisions soon, however, were discovered to be necessary; and the Council of Hertford, convened by Archbishop Theodore, decreed that, as the faithful grew to be more numerous, the number of sees should also be increased. The first subdivision was made by this prelate in the diocese of York; and the various princes subsequently made repeated alterations, until at length the whole arrangement settled into its existing shape, excepting the addition made by Henry VIII., and by the recent acts of parliament. Henry, with a portion of the proceeds of the confiscated monasteries, founded seven new bishoprics, viz:—Gloucester, Bristol, Peterborough, Oxford, Westminster, Chester, and Man. The bishopric of Westminster, however, only lasted until 1550, when it was again incorporated with the see of London; and the act of 6th and 7th Will. IV., cap. 77, united into one the sees of Gloucester and Bristol, and created two additional—Manchester and Ripon. By this statute, the Ecclesiastical Commissioners were authorized to alter the limits of nearly all the rest, by effecting a transference of parishes from one to another, with a view to the more convenient distribution of territory and population.

Archdeacons anciently were only members of chapters without territorial jurisdiction. The assignment of specific limits for archdeaconries took place soon after the Conquest.[2] The act of 6th and 7th Will. IV., cap. 77, gives power to the ecclesiastical commissioners to re-arrange the boundaries of the ancient, and to form certain new, archdeaconries. The new ones formed in exercise of this authority are Bristol, Maidstone, Monmouth, Westmoreland, Manchester, Lancaster, and Craven.

Deans are principally of two kinds: (1) those attached to cathedrals, who are the heads of the different chapters; and (2) rural deans, who perform certain functions as assistants to the bishops, in particular definite portions of the several dioceses. These *Rural Deaneries* were recognised ecclesiastical divisions of a diocese in Saxon times. They seem to have been designed to correspond with *hundreds* in the political division of the country, as archdeaconries were possibly intended to correspond with counties. The etymology of the word (*Decanus*) favours this idea; and it is not improbable that all such deaneries originally embraced districts with *ten* churches, and no more; their boundaries, once settled, never having been disturbed, although increase of population caused an increase in the number of religious edifices. Some of them still contain ten churches only. These deaneries gradually fell into disuse from the period of the Conquest; but recent legislation tends to their revival.

The clergy are in theory supposed to assemble in convocation during the sitting of parliament to consult on ecclesiastical subjects. The convocation is summoned by writ from the crown directed to each archbishop, but it cannot constitute any canons without license from the crown: consequently the assembly since the time of Henry VIII. has been a mere form; no business is transacted. Lately, however, attempts have been made to revive this obsolete court, and on the last meeting (1854) the assembly sat a short time during the day, and entered on some formal proceedings.

A clerical education in England is much less extensive than in Calvinist countries; in Scotland, Holland, Switzerland, or the north of Germany, after going through a course of classics and philosophy, a second course is required for theology solely; but in England the former is sufficient. The degree of bachelor of arts requires an examination and a university residence of three or four years; but to qualify for the acceptance of a curacy, a certificate of attending a single course of lectures in divinity is all that is necessary.

Livings.

The total number of benefices in England and Wales is 11,728, of which 9669 are in the province of Canterbury and 2059 in the province of York. From this multiplicity of benefices, and from the general smallness of the incomes, have arisen two great irregularities, pluralities and non-residence, both forbidden by the ancient statutes of the church, but both long sanctioned by usage. Many clergymen hold livings without doing duty at any of them; others do duty in one or in two which are adjacent to each other, and have a curate for the more distant; whilst curates frequently do duty at two and sometimes at three distinct places of worship. To prevent, or at least to lessen, the abuse of non-residence, an act of parliament was passed in 1813, directing that every non-resident incumbent should nominate a curate at a salary of not less than L.80 a-year, unless the

---

[1] By the act 10th and 11th Vict., cap. 108, a new bishop (of Manchester) was created, but the act declares that the number of lords spiritual sitting in parliament shall not be increased by this creation. The bishop of Sodor and Man, who was formerly appointed by the Duke of Athole, is now appointed by the crown; he has no seat in the House of Lords, and his salary is only L.2000. The bishops of London, Durham, and Winchester, rank immediately after the archbishops; the others according to priority of consecration; and the last appointed bishop has no seat in the House of Lords.

[2] The first assignment was by Archbishop Lanfranc, A.D. 1165.

Statistics.

entire living should be less. The effect of this act was to reduce the number of non-resident clergymen by 800 fully; they had previously been about 4700; but in 1815 the official return to parliament of the incumbents in England and Wales was as follows:

Non-resident from the following causes:

Sinecures	52
Vacancies	164
Sequestrations	40
Recent Institutions	87
Dilapidated churches	32
Held by bishops	22
Law-suits, absence on the Continent, &c.	122
Livings from which no report	279
	798
Incumbents non-resident from other causes	3,856
Incumbents resident	5,847
	10,501

Returns for the year 1850, made by the respective archbishops and bishops in England and Wales, give—

The total number of benefices in which the incumbents were resident	8,077
Ditto, ditto non-resident	2,952
Miscellaneous cases	699
Total	11,728
The number of benefices on which there was a glebe-house was	8,214

Of these 11 are under the annual value of L.10; 19 from L.10 to L.20; 32 from L.20 to L.30; 235 from L.30 to L.50; 1629 from L.50 to L.100; 1602 from L.100 to L.150; 1354 from L.150 to L.200; 1979 from L.200 to L.300; 1326 from L.300 to L.400; 830 from L.400 to L.500; 954 from L.500 to L.750; 323 from L.750 to L.1000; 134 from L.1000 to L.1500; 32 from L.1500 to L.2000; 16 of L.2000 and upwards. Among the last are the rectory of Stanhope in Northumberland, and that of Doddington in Cambridgeshire, the former being of the annual value of L.4863, and the latter of L.7306.

Churches.

The income of the Church of England is derived from lands, tithes, church-rates, pew-rents, Easter offerings, and surplice fees. The distribution of these revenues, according to the report of the commissioners for inquiring into ecclesiastical revenues, was, in 1831, as follows:—

Bishops	L.181,631
Deans and Chapters	360,095
Parochial Clergy	3,251,159
Church-rates	500,000
	L.4,292,885

The total number of churches and chapels of the Church of England was then 11,825; and from that time to 1851, 2029 new churches had been built. The value of church property had also much increased, so that the total income of the church in 1851 was estimated to be considerably above L.5,000,000. The number of beneficed clergy in 1831 was 10,718, and consequently the gross average income of each would be about L.300 a-year; the number of curates was 5230, whose stipends amounted in all to L.424,695, averaging L.81 per annum to each. As many incumbents possessed more than L.300 a-year, and some curates more than L.81, the remuneration of others was below these sums respectively. For the purpose of raising the incomes of incumbents of the smaller livings, the governors of "Queen Anne's Bounty" annually receive the sum of L.14,000, the produce of first-fruits and tenths, which were formerly paid to the Pope, but were at the Reformation appropriated to the sovereign, and by Queen Anne granted "for the augmentation of the maintenance of the poor clergy." The ecclesiastical commissioners also apply to the same object a portion of the surplus proceeds of episcopal and capitular estates.

Statistics. Tithes.

Tithes necessarily fluctuated with the state of agriculture, and, during the distress of 1815, the deficiency in this respect became alarming. Application was made to parliament, and the subject was for some time under serious discussion; but the rise of corn in 1816 and 1817 prevented any other measure than an act founded on a committee report of 18th June 1816, authorizing the possessors of tithes, laymen as well as clergymen, to grant leases of them for a term not exceeding fourteen years.

By Act 6th and 7th Will. IV., cap. 71, a board of commissioners called the "Tithe Commissioners for England and Wales" was appointed, the object of which was to convert the tithes into a rent-charge, payable in money, but varying in amount according to the average price of corn for seven preceding years. The amount of the tithes was to be calculated on an average of the seven years preceding Christmas 1835; and the quantity of grain thus ascertained was to remain for ever as the annual charge upon the parish; and the annual money value was ascertained from the returns of the comptroller of corn, who publishes annually in January the average price of an imperial bushel of wheat, barley, and oats, computed from the weekly averages of the corn returns during the seven preceding years. The commissioners report in 1851, that voluntary commutations had been commenced in 9634 tithe districts; 7070 agreements had been received, of which 6778 had been confirmed; and 5529 drafts of compulsory awards had been received, of which 5260 had been confirmed. Thus in 12,038 tithe districts the rent charges had been finally established by confirmed agreements or confirmed awards.

Clerical terms.

A prebend is a provision in land or money given to a church *in præbendum*, that is, for the support of a clergyman whose title may be either prebendary or canon. Advowson (*advocatio*) is the right of presentation to a living, and was first vested in those laymen who were founders of or benefactors to livings. A living is held *in commendam* when, to prevent its becoming void, it is committed (*commendatur*) until it can be conveniently provided with a pastor. The *modus* (*modus decimandi*) is a composition for tithes; it may be either perpetual or during the lives of the contracting parties. The lay impropriators of tithe, so frequent in England, date from the dissolution of the monasteries in the reign of Henry VIII.; patrons were then allowed to retain the tithes and glebe in their own hands, without appointing a clergyman; in cases of such appointment, the clergyman was called *vicarius*, or representative of the patron.

By the census of 1851, the clergymen in Great Britain of the Established churches amount to 18,587—17,320 in England and Wales, 143 in the Islands of the British Seas, and 1124 in Scotland; the other Protestant ministers to 8521; the Roman Catholic priests to 1093; theological students, and various real or pretended religious teachers, to 1477. The total number in the class is 30,047. The churches have connected with them a considerable number of subordinate officers, whose time is, however, only very partially engaged; so that they have generally other occupations under which they are returned. Thus only 2386 men are referred to the head "parish clerks;" 815 are called sextons, 756 church officers; and the whole *sub-class* comprehends 4573 males, 901 females.

The Dissenters in England are, first, the Presbyterians, who nearly coincide with the Church of England as to doctrine, but differ in church-government, allowing no hierarchy in individuals; next the Independents, who go further, and disclaim hierarchy in synods and other collective assemblies; thirdly, the well-known sect of Quakers, who date from the middle of the seventeenth century; and, lastly, the more numerous Methodists, who date from 1729. Of the Baptists, the chief characteristic is their not receiving baptism till they become adults. The Catholics in England are not numerous, but comprise a large proportion of wealthy families.

Statistics.

Proportion of Accommodation provided by each Religious Body in England and Wales.

Religious Denominations.	Number of Places of Worship and Sittings.		Proportion per cent. of Sittings.	
	Places of Worship.	Sittings.	To Population.	To total number of Sittings provided by all bodies.
PROTESTANT CHURCHES:				
Church of England	14,077	5,317,915	29·7	52·1
Scottish Presbyterians:				
Church of Scotland	18	13,789	·1	·1
United Presbyterian Church	66	31,351	·2	·3
Presbyterian Ch. in England	76	41,552	·2	·4
Reformed Irish Presbyterians	1	120	...	...
Independents	3,244	1,067,760	6 0	10·5
Baptists:				
General	93	20,539	·1	·2
Particular	1,947	582,953	3·3	5·7
Seventh Day	2	390	...	...
Scotch	15	2,547	...	...
New Connexion General	182	52,604	·3	·5
Undefined	550	93,310	·5	·9
Society of Friends	371	91,599	·5	·9
Unitarians	229	68,554	·4	·7
Moravians	32	9,305	...	·1
Wesleyan Methodists:				
Original Connexion	6,579	1,447,580	8·1	14·1
New Connexion	297	96,964	·5	1·0
Primitive Methodists	2,871	414,030	2 3	4·0
Bible Christians	482	66,834	·4	·7
W. M. Association	419	98,813	·5	1·0
Independent Methodists	20	2,263	...	...
Wesleyan Reformers	339	67,814	·4	·7
Calvinistic Methodists:				
Welsh Calvinistic Methodists	828	211,951	1·2	2·1
Lady Huntingdon's Connexion	109	38,727	·2	·4
Sandemanians	6	956	...	...
New Church	50	12,107	·1	·1
Brethren	132	18,529	·1	·2
Isolated Congregations	539	104,481	·6	1·0
Lutherans	6	2,606	...	...
French Protestants	3	560	...	...
Reformed Church of the Netherlands	1	350	...	...
German Protestant Reformers	1	200	...	...
OTHER CHRISTIAN CHS.:				
Roman Catholics	570	186,111	1·0	1·8
Greek Church	3	291	...	...
German Catholics	1	300	...	...
Italian Reformers	1	150	...	...
Catholic and Apostolic Church	32	7,437	...	·1
Latter Day Saints	222	30,783	·2	·3
Jews	53	8,438	...	·1
Total	34,467	10,212,563	56·9	100

Education.

In regard to the mode of education in England, there is much both to commend and to censure. Scotland has for a century past been in possession of a larger proportion of parish schools; but the utility of these is much lessened by an established routine of teaching Latin to almost all youths, whatever be their intended line of life. In England this absurdity is less prevalent, because most of the schools are private undertakings, the managers of which are necessarily guided by considerations of utility. The youth destined for a life of business are thus saved a serious waste of time; their education, if imperfect, is not supererogatory; but, on examining the higher seminaries of England, we find much ground for disappointment, and many marks of a blind adherence to ancient usage. The universities of Oxford and Cambridge are evidently inadequate for the education of the nobility, the gentry, and the clergy of so populous a country. Their course of study, also, is quite unsuitable to the future occupations of many of the students. They were originally designed for the education of churchmen; and, to this day, Latin, Greek, and mathematics, form the chief objects of instruction. In 1850 a parliamentary commission was appointed to inquire into the state, discipline, studies, and revenues of the universities of Oxford and Cambridge; and in the session of 1854 a bill was passed by which various important reforms were introduced into the management and government of these valuable institutions.

Statistics.

Education of the poor

No country rivals England in the magnificence of her academical buildings. Whilst in France, Germany, or Holland, a university possesses only a single pile of building, Oxford and Cambridge can boast for every college a large, commodious, and generally an elegant structure. The endowments appropriated to them are very various, both in their origin and destination, but these arise chiefly from land, and, having increased with the rise of rents, are in many cases very ample. The destination of these funds is regulated by the bequest of the donors and the established usage of the colleges; part going to the students under the name of exhibitions or scholarships; part to the head and fellows; and a further part consisting in livings, which devolve on the fellows, and lead to their removal from the university. A hall is an inferior college; an academical establishment not incorporated or endowed, but possessed of exhibitions or other provisions for students. Oxford has nineteen colleges and five halls; Cambridge has twelve colleges and four halls.

Two institutions, the London University and King's College, have recently been founded in the metropolis, with the view of obviating the defects complained of at Oxford and Cambridge, and of cheapening and diffusing the advantages of an academical education.

Boys in England are taught the classics, either in the lesser schools established at every town of consequence throughout the kingdom, or at the great public schools. Of the latter, the principal are Eton, Westminster, Winchester, and Harrow; also the Charter-house, St Paul's, and Merchant Tailors' School. These seminaries, at present so expensive, and attended by youths of the first family, had their origin in a fund or provision set apart for scholars of humbler birth. This has served as the basis of a stately superstructure, each school having attracted, by the advantage of situation or the repute of the teachers, a much greater number of pupils in independent circumstances. But in each a proportion of the scholars are still on the foundation. At Eton there are seventy thus provided for; and the same number at Winchester.[1] This subject will be resumed and treated in detail under the article UNIVERSITIES.

There are 304 collegiate and grammar schools supported by endowments the annual revenue of which is L.128,693; and there are 1607 other schools possessing endowments which amount to L.160,293. This, however, gives a very inadequate idea of the annual value of the endowments which have been from time to time left for the purpose of education. Lord Brougham estimated the annual amount at L.500,000, and recent writers consider that the estimate is not too high. A board was appointed by parliament to investigate the misappropriation of these funds, but the powers of the commissioners are either too limited, or they seem to be unwilling to exercise them with sufficient vigour to make the funds available.

[1] *Reports of the Education Committee*, 1817 and 1818.

Statistics.

Popular education in England is almost entirely the creation of the present century. Before 1801, the total number of public and private schools was only 3363; in 1851 they were 44,836. In 1781, Mr Raikes of Gloucester with difficulty collected the first Sunday school; in 1851 they numbered 23,137. In 1818 the scholars attending the day schools were 674,883; in 1851 they were 2,144,378. The Sunday scholars in 1818 were 477,225; in 1851 they 2,407,642. The records of the condition of society a century or even half a century ago describe a state of ignorance and immorality both gross and general. The happy transformation which has since taken place is attributable in no small degree to the great extension of education. Nevertheless the state of education is much below what it ought to be, both in quantity and quality.

It is generally assumed that one-eighth of the whole population would be a satisfactory proportion for attendance at the day schools, after making due allowance for practical impediments. This proportion of the population of England and Wales (17,927,609) gives 2,240,951 as the number that should have been under school instruction in 1851. But Mr Horace Mann, in his report to the Registrar-General, assuming that the school instruction of a child should not be procrastinated after five years of age, and should not be relinquished earlier than twelve (the legal period in Prussia is from five to fourteen), calculates, after making every deduction for ill health, employment, receiving education at home, &c., that there should be 3,015,405 children attending day schools. According to this estimate, as the total number of children attending school according to the census of 1851 was 2,144,378, there must have been 871,027 receiving either a mere fraction of education or none at all.

The following classification of the 29,425 private schools in England will give some idea of the quality of the education:—

1. Superior—Classical, Boarding, Proprietary, Ladies, &c.	4,956
2. Middling—Commercial, &c.—teaching, Arithmetic, English Grammar, and Geography	7,095
3. Inferior—Principally dame schools, only Reading and Writing taught, the latter not always	13,879
Underscribed	3,495
	29,425

In the case of 708 out of these 13,879 the returns were respectively signed by the master or mistress with a *mark*. The same is noticeable with respect to 35 *public* schools, most of which had small endowments.

The following table will show that not only has popular education in this country been promoted mainly by a religious influence, but that it is now becoming rapidly a matter of denominational activity. This tendency, so far as the Dissenters are concerned, has only recently been evidenced; for schools upon the British system (which discourages sectarian teaching) satisfied their wants till about ten years ago. The controversies of that period, however, when it seemed to the Dissenters that the government designed to place too much of the education of the poor in the hands of the Established Church, produced very great exertions on the part of the various bodies to counteract this supposed design.

Schools supported by Religious Denominations.	Number of Schools and Scholars. Excluding Schools in which the Endowment exceeds the Subscriptions of Religious Bodies.		Including all Schools receiving Support to any amount from Religious Bodies.	
	Schools.	Scholars.	Schools.	Scholars.
Denominational—				
Church of England	8,571	801,507	10,555	929,474
Church of Scotland	5	946	5	946
United Presbyterian Church	3	217	3	217
Presbyterian Church in England	25	2,447	28	2,723
Scottish Presbyterians	1	345	1	345
Presbyterians	7	1,321	13	2,030
Independents	431	47,406	453	50,186
Baptists	115	8,665	131	9,390
Society of Friends	23	2,247	33	3,026
Unitarians	30	3,736	39	4,306
Moravians	7	366	7	366
Wesleyan Methodists	363	39,764	381	41,144
Methodists, New Connexion	13	1,815	14	1,851
Primitive Methodists	25	1,297	26	1,342
Bible Christians	8	367	8	367
Wesleyan Association	10	1,112	11	1,176
Calvinistic Methodists	41	2,814	44	2,929
Lady Huntingdon's Connexion	9	644	10	714
New Church	9	1,551	9	1,551
Dissenters	43	5,392	49	5,805
Isolated Protestant Congregations	14	1,144	14	1,144
Lutherans	1	157	2	221
French Protestants	1	15	1	15
German Mission	1	100	2	116
Roman Catholics	311	38,583	339	41,382
Jews	10	1,234	12	2,361
Undenominational—				
British	514	82,597	514	82,597
Others	4	1,062	4	1,062
Total	10,595	1,048,851	12,708	1,188,786

Day Schools, Sunday Schools, and Evening Schools for Adults.
Summary of England and Wales.

Schools.		Scholars. Belonging to the Schools or on the Books. Total.	Sex. Males.	Sex. Females.	In actual attendance on the day of the Census. Total.	Sex. Males.	Sex. Females.
Day Schools	46,042	2,144,378	1,157,685	986,693	1,786,324	968,580	817,744
Public Day Schools	15,518	1,422,982	801,156	621,826	1,126,987	642,690	484,297
Private Day Schools	30,524	721,396	356,529	364,867	659,337	325,890	333,447
Sunday Schools	23,514	2,407,642	1,193,788	1,213,854	1,817,499	903,545	913,954
Evening Schools for Adults	1,545	...	...	...	39,783	27,829	11,954

Up to 1853 all that had been accomplished for national education was the fruit of private liberality acting principally through the *British* and the *National* educational societies, but in 1833 government first proffered its assistance by voting an annual grant of L.20,000, which was continued till 1839, when it was raised to L.30,000. In 1842–3–4 it was L.40,000; in 1845, L.75,000; in 1846–7, L.100,000; in 1848–49–50, L.150,000; and in 1853, L.260,000.

None of this money was given towards the expense of maintaining schools, but only towards the cost of buildings, the purchase of school apparatus, or in aid of the salaries of efficient teachers. But certain sections of the Dissenters, who object to the interference of the state either in the church or the school, felt themselves precluded by the principles they had adopted from accepting any aid from the government grants, and therefore depend entirely upon voluntary liberality for the maintenance of their schools.

Statement of the Expenditure from the Education Grant, from 1839 *to* 31*st December* 1853, *and of the Expenditure for the year ended* 31*st December* 1853.

Classified according to object of Grant.	For Year ended 31st December 1853. L.	s.	d.	From 1839 to 31st December 1853. Amount Granted. L.	s.	d.	Results.
In building, enlarging, repairing, and furnishing Elementary Schools	26,100	15	3	466,081	1	8½	2,972 Schools.
In building, enlarging, repairing, and furnishing Normal or Training Schools	6,578	8	6	124,678	2	6	24 Colleges.
In providing Books and Maps	2,894	14	10	12,688	0	8½	3,993 Schools aided.
In augmenting the Salaries of Certificated Schoolmasters and Schoolmistresses	26,777	10	10	76,696	9	2	2,297 Certificated Teachers.
In paying the Salaries of Assistant Teachers	81	0	10	81	0	10	95 Assistant Teachers.
In paying the Stipends of Pupil Teachers, and Gratuities for their special instruction	139,040	4	0	382,409	12	9	6,912 Pupil Teachers.
In Annual Grants to Normal Schools	19,196	19	3	72,273	8	11½	27 Colleges.
Industrial Schools	281	5	10	609	0	4	50 Industrial Schools.
Pensions	138	6	8	278	6	8	18 Pensions.
Inspection	26,260	0	6½	149,352	8	6	38 Inspectors.
Administration (Office in London)	1,812	13	2	17,091	12	6	
Poundage on Post-Office Orders	902	18	3	2,499	10	9	
Agency for Grants of Books and Maps	594	0	4	2,209	9	10	
	250,658	18	3½	1,306,948	5	2½	

Classified according to Denomination of Recipients.	For Year ended 31st December 1853. L.	s.	d.	From 1839 to 31st December 1853. L.	s.	d.
On Schools connected with the Church of England	165,824	8	8	880,960	6	7¼
Ditto ditto British and Foreign School Society	23,579	15	5¾	117,000	17	11¾
On Wesleyan Schools	11,286	15	0½	46,113	8	6¾
On Roman Catholic Schools, Great Britain	9,789	7	10½	24,372	15	0¼
On Workhouse Schools	9,507	3	11½	81,784	12	11
On Schools in Scotland connected with the Established Church	13,848	1	8	78,673	11	5½
Ditto ditto Free Church	14,300	3	6	59,745	6	9¾
Ditto ditto Episcopal Church	664	6	6¾	993	6	6¾
Other Schools	46	2	4½	212	6	9½
Administration as in Table (A.)	1,812	13	2½	17,091	12	6
	250,658	1	3½	1,306,948	5	2½

Statistics.

X.—*Establishments for purposes of Charity—Poor Rates.*

The public charities of England are very numerous; the bequests of benevolent founders in this country exceeding those of the zealous Catholics of France or Spain, as well as those of the once affluent Protestants of Holland. Our limits do not admit of a notice of the great variety of charitable institutions which abound in the country. In the metropolis alone there were, in 1853, 530 charitable institutions, which disbursed during the year the aggregate amount of L.1,805,635. Among these, grammar-schools and educational establishments, such as Merchant Tailors' and St Paul's, are not included, nor miscellaneous endowments in the gift of city corporations and parishes.

Amongst the principal *Hospitals* are—Bethlem Hospital; St Luke's, Old Street; St Bartholomew's, West Smithfield; Guy's, in Southwark; the Lock Hospital, Hyde Park Corner; the London Hospital, Whitechapel Road; the Magdalen Hospital, St George's Road; the Middlesex Hospital, Berner's Street; St Thomas's; the Foundling Hospital.

A *College*, in the sense of a charity, is an alms-house on an enlarged scale, under the direction of a master and other incorporate officers. There are only three in the neighbourhood of London, namely, Bromley, Morden, and Dulwich Colleges.

Alms-Houses.—These are very numerous, viz., the Haberdashers', Mercers', Skinners', E. India Company's, &c.

School Charities.—These institutions are also very numerous. Amongst the most remarkable are—Christ's Hospital, or the Blue Coat School; Marine Society; School for the Indigent Blind; &c.

Poor-rates. A compulsory provision for the support of the poor has existed in England for a lengthened period. Its introduction dates from the reign of Henry VIII., and it was perfected in that of Elizabeth; the famous statute of the 43d Eliz., cap. 2, having embodied all the principles, with many of the regulations, still to be found in the system. The law has, however, been repeatedly modified, and very great alterations have taken place in its administration. These changes will be fully detailed in our article on the POOR-LAWS; and in it also the reader will find an examination of the important and difficult question as to the policy of a compulsory provision for the support of the unemployed poor. Here we have only to state what has been the amount of the rates levied on account of the poor, from what sources they have been derived, and how they have been distributed.

Paupers. *Paupers.*—According to the returns of the poor-law board, the number of paupers in receipt of relief both in-door and out-door in England and Wales was 862,827 on 1st January 1851, and 813,089 on 1st July 1851. At the time of the census 126,488 paupers were inmates of workhouses in England and Wales, being in the proportion of one in-door pauper to every 142 inhabitants, or 7 in every 1000. Out-door paupers are often in receipt of relief for very short periods on account of sickness or temporary distress; but those received into the workhouses are for the most part supported for long periods—frequently for the remainder of their days.

In Scotland the number of poor on the relief register on 14th May 1851 was 76,906. At the census there were 5438 in-door paupers, chiefly in the southern Scottish counties, where poor-houses have been established by means of funds raised by rate in many parishes; while in the northern counties the progress of the new system of legal assessment has been but partial.

Years ended at Lady-day.	Total Expenditure for the Relief of the Poor in England and Wales.	Rate per Head on Population.	
	L.	s.	d.
1845	5,039,703	6	0¾
1846	4,954,204	5	10½
1847	5,298,787	6	2½
1848	6,180,764	7	1¾
1849	5,792,963	6	6½
1850	5,395,022	6	1
1851	4,962,704	5	6½
1851 (In Scotland)	535,944	3	8¾

The relative numbers of the *sexes* of in-door paupers do not, on the whole, differ greatly. In England, 64,294 are males, and 62,194 females; in Scotland, the females are most numerous, being 3239 to 2199 males. To every 10,000 males and females respectively living in Great Britain there are 65 males and 61 females in workhouses.

The following statements rest mainly upon the authority of the masters of workhouses. Almost every branch of employment—professional, commercial, agricultural, manufacturing—is represented, and the returns include some large numbers of particular classes. Of agricultural and other labourers there are 17,700, of whom 8113 appear at the ages above 60; domestic servants 15,036, all but 679 of whom are females, and a large proportion in advanced life—a fact which points significantly to the want of a suitable provision for this class when worn out or otherwise incapacitated for service; charwomen, 2001; washerwomen, 1799; milliners and dressmakers, 2464; shoemakers, 1901; tailors, 1022. A large number, 70,943—of whom 50,197 are under 15 years of age—are returned without any specific statement as to their occupations. In the workhouses are found some of the oldest people in the country; 18,489 in-door paupers are upwards of seventy years of age, including 360 aged ninety and upwards.

Besides the poor-rates the total county rate expenditure of England in the year ending Michaelmas 1850 was in round numbers L.1,400,000; of this sum L.257,000 was defrayed by allowances from the Treasury in aid of the expenses of prosecutions and prisoners, and L.138,000 was paid out of the parish poor-rates for the maintenance of lunatics in county asylums. The sum actually raised as county rate from the rate-payers, amounted only to L.796,000; and as this sum was levied upon an assessment of L.64,598,831, the average poundage of the county rate throughout England, which measures the real pressure upon the rate-payer, was less than 3d. in the pound.

Prisoners. *Prisoners.*—The statistics of crime in Great Britain presented in the criminal returns prepared at the home office furnish a digest of the nature of the offences, the number of offenders, and the result of the proceedings in each year. At the census, information was obtained which enables us to state the numbers confined on a particular day, with their ages and occupations—points of much interest, as supplemental to those embraced in Mr Redgrave's tables.

The total number of persons in the different prisons, bridewells, convict-depôts, and hulks in Great Britain on the 31st March 1851, was 26,855; 22,451 males, and 4404 females. Of these some were debtors, others were untried; but the majority were convicted and undergoing sentence. The proportion of prisoners is, therefore, 1 in 785 of the general population. Owing partly to the government convict establishments and the hulks, the proportion is higher in England than in Scotland; and in London, Hampshire, and other localities, it, for the same reason, exceeds the average of England.

To every 100,000 males and as many females in Great Britain, there are respectively 220 males, and 40 females confined in prisons. In London the proportions are as high as 450 males and 90 females; while in the Welsh division they are only 68 males and 17 females in 100,000.

According to the criminal returns, the number of persons committed in Great Britain in 1851 was 31,961—25,283 males, and 6678 females. In Scotland the committals of females are proportionately more numerous than in England.

With respect to the *ages* of prisoners, it appears that 6833, or 25 per cent. of the whole number, are under twenty years of age, while 134 are aged seventy and upwards. The returns of *occupations* present a great variety of items, and will doubtless be examined with attention by all interested in the various questions affecting the criminal class which have proved so difficult of solution both to the statesman and the philanthropist. Amongst the employments furnishing the largest numbers are—agricultural labourers, 3026; labourers not particularly described, 5062; domestic servants, 1174, of whom 220 are males and 954 females; shoemakers, 891; tailors, 533; hawkers and itinerant venders, 614; engaged in the cotton manufacture, 694; carpenters, bricklayers, masons, slaters, plasterers, and plumbers, together, 1381. The occupations of 24,189 prisoners are described; the residue, we presume, represents the incarcerated class of *professional* criminals.

Lunatics. *Inmates of Lunatic Asylums.*—The public and private

Statistics.

establishments for the insane are subject to definite regulations, enforced by the inspection and control of the proper authorities; the number of patients is restricted within the limits of the accommodation afforded, and every private asylum is duly licensed. The physiology of mental disease has likewise engaged the attention of eminent medical men, and generally a gentle and humane treatment has been successfully adopted, in the place of harshness and unnecessary restraint.

At the period of the census there were in the various lunatic asylums, and other institutions for the reception of the insane in Great Britain, 18,803 persons; 8999 males, and 9804 females. Lunatic paupers in the insane wards of workhouses are not included, as they are not usually distinguished from other paupers in the returns. By the establishment of county lunatic asylums, however, the number of insane and fatuous paupers in workhouses has been greatly reduced.

The proportion which the lunatics in asylums bear to the general population is 1 in every 1115 inhabitants in Great Britain. To every 100,000 males and 100,000 females living, there were 88 males and 91 females in these institutions.

The former occupations of lunatics will be examined with interest. It will be seen that the educated and professional classes furnish many cases of insanity: of clergymen and ministers, 84 are returned; barristers and solicitors, 88; physicians and surgeons, 108; officers of the army and navy, 95; the East India service, 118; schoolmasters and teachers, 258. Amongst the largest items are—labourers, 1794; female domestic servants, 1753; shoemakers, 364; weavers, 240; and tailors, 224. No information is given as to the employments, if any, of 7674 lunatics of all ages.

Patients in hospitals.

Patients in Hospitals for the Sick.—Although of late years additional hospital accommodation has been provided in towns, it may be doubted whether the habits and feelings of the people of this country render necessary an extended provision, independent of the poor-law system, for the reception and care of the sick. In the principal cities and towns, hospitals and infirmaries, supported chiefly by the voluntary subscriptions of the benevolent, are established with great advantage to the working classes; and in many market-towns and large country parishes, for want of these institutions for their reception, persons of the same rank in life, when suffering from malignant fevers and other contagious diseases, often remain in small dwellings or single chambers, where the healthy and the sick are crowded together, aiding the progress of infection, until the disease spreads itself on every side. Still, the removal of the sick to infirmaries is not unattended with disadvantages; and the strong inclination on the part of their relatives to keep them at home, where they can be watched and attended by those connected with them by family ties, is both natural and commendable. To domestic servants and persons living away from their relations, or having no homes to resort to in sickness, these institutions are of great benefit.

The census returns show only 9876 persons of both sexes—5525 males, and 4351 females—in general hospitals for the sick on the night of 30th March 1851. Patients in the military hospitals are not included. More than one-third of the whole number of the patients is returned in the various hospitals in London, where the sick are driven by their wants, or attracted by the extent of accommodation, the high professional standing of the medical officers, and the immediate attention that is given in cases of accident and emergency.

In Great Britain 1 in every 2122 of the whole population is sick in a general hospital; and of 100,000 males and as many females living, there are respectively 54 male and 41 female patients.

Amongst the occupations furnishing the largest number of patients are the following:—domestic servants, 1797, of whom 157 are males and 1640 females; agricultural and other labourers, 1495; seamen, 197; milliners and seamstresses, 262; charwomen and washerwomen, 166; shoemakers, 173; carpenters, 123.

The following table shows the proportion which the inmates of the public institutions adverted to bear to the male and female population:—

Proportion of Paupers in Workhouses, Prisoners, Lunatics in Asylums, and Patients in Hospitals, to the Male and Female Population in Great Britain, 1851.

	To every 10,000 living, the Proportion of							
	Males.				Females.			
	Paupers.	Prisoners.	Lunatics.	Patients in Hospitals.	Paupers.	Prisoners.	Lunatics.	Patients in Hospitals.
Great Britain and Islands in the British Seas	65·4	22·0	8·8	5·4	61·3	4·1	9·1	4·1
England and Wales	73·2	23·3	8·9	5·5	68·0	3·7	9·4	4·1
Scotland	16·0	14·2	8·8	4·8	21·4	6·9	7·6	3·5
Islands in the British Seas	58·5	11·7	1·0	3·9	50·7	2·1	2·2	5·4

The blind.

The Blind.—In Great Britain and the Islands of the British Seas there are 21,487 persons—11,273 males and 10,214 females—returned as totally blind. The number in England and Wales is 18,306 of both sexes; in Scotland, 3010; and in the Islands of the British Seas, 171 persons. These numbers furnish a proportion relatively to the whole population of 1 blind in every 975 persons in Great Britain—1 in every 979 in England and Wales, 1 in 960 in Scotland, and 1 in 837 in the Channel Islands and the Isle of Man.

These results admit of favourable comparison with the relative numbers in Ireland, which, according to the census, are 1 in every 864 inhabitants. In the level portions of Europe, comprising Belgium, Hanover, parts of Germany, and the plains of Lombardy and Denmark, the proportion is stated to be 1 blind in every 950 inhabitants—but slightly differing from the average of Great Britain. In more elevated regions the proportion is considerably lower; but in Norway it is found to be 1 in every 482 inhabitants.

Payment of wages out of poor-rates.

It is obvious, from the preceding tables, that, allowing for the increase of population, the increase of the rates has not been nearly so great as is commonly supposed. The pernicious practice of ekeing out wages by means of contributions from the rates began in 1795; and formed one of the principal evils in the state of the English poor.

"The price of corn, which, at a medium of the three years ending with 1794, averaged 48s. 2d., rose in 1795 to 75s. 2d. As wages continued stationary at their former elevation, the distress of the poor was very great; and many able-bodied labourers, who had rarely before applied for parish assistance, became claimants for relief. Instead of meeting this emergency, as it ought to have been met, by temporary expedients, and by grants of relief proportioned to the exigency of every given case, one uniform system was adopted. The magistrates of Berks, and some other southern counties, issued tables, showing the wages which, as they affirmed, every labouring man should receive, according to the number of his family, and the price of bread; and they accompanied these tables with an order, directing the parish officers to make up the deficit to the labourer, in the event of his wages falling short of the tabular allowance! As might have been expected, this practice did not cease with the temporary circumstances which gave it birth, but continued to be acted upon down to the passing of the Poor

Statistics.

Law Amendment Act. It was in fact very generally established in the southern half of England, in large districts of which there were no longer any independent labourers to be found; and produced an extent of artificial pauperism and moral degradation that could hardly have been conceived possible. (M'Culloch's *Principles of Political Economy*, 4th edit. p. 463.)

XI. *Crimes in England and Wales.*

The criminal tables for the year 1853 complete a series of twenty years, compiled from the same authentic materials and upon precisely the same principles. They form an accurate comparison of the state of the commitments for trial during that period; the only disturbing causes being some changes in the laws constituting crimes and fixing punishments.

These totals, comparing the first year with the last, show an increase of 20·5 per cent., while the increase of the population in the same period is 27 per cent.; comparing the total of the last ten years with the total of the first ten years, the increase amounts to 8 per cent. only. In each of the last three years the commitments have slightly decreased, and since 1842 the tendency to decrease has been almost uninterrupted.

In the last year the decrease of the commitments was 1·8 per cent. only; but it extended over twenty-eight English counties, including all the agricultural districts. It seems unnecessary to enumerate the details of this trifling decrease. They show little variation which calls for particular remark; but it may be observed generally, that the decrease extends to all the violent offences, both those against the person and those against property.

TABLE, *Showing the number of Persons committed for Trial or Bailed in each of the last Ten Years.*

OFFENCES.	1844.	1845.	1846.	1847.	1848.	Total of Five Years, 1844-48.	1849.	1850.	1851.	1852.	1853.	Total of Five Years, 1849-53.
Offences against the Person	2,306	1,966	2,249	2,023	2,234	10,778	1,846	1,886	2,218	2,241	2,100	10,291
Offences against Property, committed with violence	1,759	1,471	1,507	1,732	2,172	8,641	2,076	2,014	2,060	1,975	1,696	9,821
Offences against Property, committed without violence	20,425	19,506	20,035	23,571	23,910	107,447	22,053	21,253	21,906	21,309	21,545	108,066
Malicious offences against Property	347	149	209	186	191	1,082	293	236	305	271	219	1,324
Forgery, and Offences against the Currency	548	438	406	525	684	2,601	676	680	808	899	850	3,913
Other offences not included in the above Classes	1,157	773	701	796	1,158	4,585	872	744	663	815	647	3,741
Total	26,542	24,303	25,107	28,833	30,349	135,134	27,816	26,813	27,960	27,510	27,057	137,156

On the 1st September 1853, an act came into force (16th and 17th Vict., cap. 99), substituting for transportation a sentence of "penal servitude" in the United Kingdom, in all cases where a sentence of transportation for a term of less than fourteen years might have been passed; and, at the discretion of the court, when the offence warrants a longer term of transportation.

The sentences passed in 1853, are given in greater detail in the following table, and are compared with those in the nine preceding years:—

	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.
Death	57	49	56	51	60	66	49	70	60	55
Transportation :—										
For Life	180	79	101	46	67	60	84	124	43	48
Above fifteen years	50	22	29	30	28	31	39	38	31	38
Fifteen years and above ten years	543	405	322	23 0	291	255	281	217	229	215
Ten years and above seven years	1,126	1,119	946	769	843	933	805	895	797	662
Seven years	1,421	1,273	1,407	1,731	2,022	1,565	1,369	1,526	1,435	1,405
Imprisonment :—										
Above three years	1	...	...	...	...	...	...	...	...	...
Three years and above two years	13	3	2	4	6	...	4	4	3	12
Two years and above one year	454	360	332	455	513	548	551	591	565	700
One year and above six months	1,927	1,654	1,933	2,355	2,648	2,485	2,770	3,120	3,081	3,034
Six months and under	12,574	12,035	12,635	15,498	16,008	14,728	14,277	14,703	14,792	14,384
Whipped, Fined, and Discharged	566	398	372	373	404	330	308	255	268	203

XII. *Establishments for the purposes of War and Defence.*

These consist, of course, principally of the army and navy. But as detailed accounts, derived from the very best sources, are given, under the articles ARMY and NAVY in this work, of all the most important particulars relating to the history and present state of each of these grand departments of the public force, it would be quite superfluous to enter into any details with respect to them in this place.

Complete returns of the men engaged in the defence of the country were furnished by the war departments, the admiralty, the ordnance, and the offices for half-pay and pensions, to the census commissioners; from which it appears that the army and navy had on 31st March 1851—exclusive of the East India Company's army and navy, and officers of the staff of the army, not serving with their regiments and militia—178,773 effective men; namely, 142,870 in the army, 35,903 in the navy; besides 83,797 non-effectives on half-pay or pensions—63,305 from the army, 20,492 from the navy. The *effectives* of the *army* comprised 6593 officers, 136,277 men; and the 142,870 were composed of—cavalry, 12,911; infantry, 115,567; artillery, 12,006; engineers, 2386: of whom were stationed in England and Wales, 36,504; Scotland 2655; the Islands in the British seas, 993; Ireland, 26,272; the Colonies, 44,402; India, 29,096; on passage out or home, 2948.

Ireland, comprising so much of the Celtic, and Scotland, so much of the Celtic and Scandinavian populations, con-

tribute largely to the army. England, with its Anglo-Saxon and Scandinavian people, whose "home is on the deep," furnishes seamen to the navy.

Birthplace of Soldiers and Seamen.

	England and Wales.	Scotland.	Ireland.	Islands in the British Seas, and Abroad.
Army (all ranks)	67,647	15,300	53,169	6,754
Navy, exclusive of Marines (all ranks)......	20,125	1,078	2,532	1,168
	Proportion in 100.			
Army (all ranks)	47	11	37	5
Navy, exclusive of Marines (all ranks)......	82	4	10	4

In the middle of 1851 there were 5,610,777 men of the age of twenty and upwards of *Great Britain;* of whom 183,255 belonged to the army and navy—120,407 as effective force, and 62,848 on half-pay, or as pensioners liable to serve under certain contingencies. The active force is 2 per cent. of the men of great Britain, or 1 in 47; and if 13,673 men and boys under the age of twenty are added, making 134,080, 1 in 158 of the *total population* of Great Britain is found to be engaged in the army and navy.

One-fourth part of the active force of the *United Kingdom*, employed in Ireland, is left out of the calculation; as well as the East India Company's army and navy.

Exclusively of the army and navy, great numbers of individuals in all parts of the country are enrolled as special constables, who may be called upon by the magistrates and other civil authorities to assist in suppressing disorders and in preserving the public peace. In London, and in other great towns, strong bodies of police are also employed, constituting a sort of half military half civil force.

XIII.—*Revenue and Expenditure.*

The various taxes, the produce of which forms the public revenue of the kingdom, will be described in the article TAXATION in this work, where also their real incidence and practical operation will be pointed out. The subjoined table gives an account of the income and expenditure of the empire for the year ending 5th January 1854.

An Account of the Net Public Income of the United Kingdom of Great Britain and Ireland, in the Year ended the 5th day of January 1854 *(after abating the Expenditure thereout defrayed by the several Revenue Departments), and of the Actual Issues or Payments within the same Period, exclusive of the Sums applied to the Redemption of Funded or paying off Unfunded Debt, and of the Advances and Repayments for Local Works, &c.*

Income or Revenue.	Total. L.	s.	d.	Expenditure.	L.	s.	d.	L.	s.	d.
ORDINARY REVENUE & RECEIPTS—				FUNDED DEBT—						
CUSTOMS	20,902,734	4	8	Interest and Management of the Permanent Debt	23,623,756	17	8			
EXCISE..................................	15,337,724	4	6							
STAMPS	6,975,416	19	9	Terminable Annuities	3,812,436	10	8			
TAXES (Land and Assessed).........	3,153,867	6	5							
PROPERTY TAX........................	5,588,171	18	8	Total Charge of the Funded Debt, exclusive of L.12,773, 1s. 11d., the Interest on Donations and Bequests	27,436,193	8	4			
POST-OFFICE	1,104,000	0	0							
CROWN LANDS.........................	402,888	9	3							
One Shilling and Sixpence, and Four Shillings in the Pound on Pensions and Salaries	4,634	10	4							
				UNFUNDED DEBT—						
Small Branches of the Hereditary Revenues of the Crown	16,669	13	1	Interest on Exchequer Bills	368,650	16	2			
								27,804,844	4	6
Surplus Fees of Regulated Public Offices	105,070	10	8	Civil List..............................	399,572	10	0			
	53,591,177	17	4	Annuities and Pensions for Civil, Naval, Military and Judicial Services, &c., charged by various Acts of Parliament on the Consolidated Fund	352,435	2	5			
				Salaries and Allowances............	268,710	0	7			
				Diplomatic Salaries and Pensions..	149,777	19	8			
				Courts of Justice	1,107,094	13	2			
				Miscellaneous Charges on the Consolidated Fund.......................	233,225	12	10			
								2,510,815	18	8
				Army....................................	6,763,488	5	1			
				Navy....................................	6,640,595	19	6			
				Ordnance..............................	2,661,590	11	11			
				Civil Services, chargeable on the Annual Grants of Parliament..	4,463,690	3	8			
OTHER RECEIPTS—				Kaffir War	260,000	0	0			
								20,789,365	0	2
Produce of the Sale of Old Stores, and other extra Receipts..........	484,308	17	0							
Imprest and other Monies	294,857	15	2					51,105,025	3	4
Money received from the East India Company	60,000	0	0	Unclaimed Dividends (more than received).....				69,814	11	7
Unclaimed Dividends (more than paid)	...							51,174,839	14	11
				Excess of Income over Expenditure...............				3,255,504	14	7
	54,430,344	9	6					54,430,344	9	6

XIV.—*National Debt.*

The national debt consists, as every one knows, of sums borrowed to make up deficiencies of revenue. It originated during the wars carried on by William III. against France. Its contraction was then not a matter of choice, but of necessity; for, owing to the numerous adherents the exiled family of Stuart had in the country, it would have been impossible to have imposed such an amount of taxes as would have sufficed to defray the expenses of the war, without inflaming the popular discontent to such a degree as would most probably have been subversive of the new government.

Statistics.

At first it was usual to fund the amount of stock equal to the sums borrowed; but since the reign of George II. a different practice has obtained; and it has been judged advisable to fund generally in a stock bearing a low rate of interest, by proportionally increasing its amount. Thus, suppose interest were five per cent., and that government wished to borrow in three per cent. stock; in such a case they would give L.166⅔ of stock for every L.100 money paid into the exchequer. By affording, in consequence of the increase of the stock, greater scope for speculation, this practice is supposed to have enabled government to borrow on rather lower terms at the time; but, by disabling them from reducing the interest on such loans at the close of a war, when the market rate of interest uniformly falls, it has proved most signally injurious. It is not going too far to say that this blunder costs the public at this moment L.7,000,000 a-year.

Since 1817 a deduction has been made of L.90,331,196 from the principal of the debt, and L.6,594,920 from the interest on its account. This diminution has been principally effected by taking advantage of the fall in the rate of interest since the peace, and offering to pay off the holders of the different stocks unless they consented to accept of a reduced payment; and had it not been for the highly objectionable practice already adverted to, of funding large capitals at a low rate of interest, the saving in this way would have been incomparably larger.

	Principal.	Interest.
Debt at the accession of Queen Anne in 1702	L.16,394,702	L.1,310,942
Debt at the accession of George I. in 1714	54,145,363	3,351,358
Debt at the accession of George II. in 1727	52,092,238	2,217,551
Debt in 1763	138,865,430	4,852,051
Debt at the commencement of the American war in 1775	128,583,635	4,471,571
Debt at the conclusion of the American war in 1784	249,851,628	9,451,772
Debt at the commencement of the French war in 1793	239,350,148	9,208,495
Debt 5th January 1817, when the English and Irish exchequers were consolidated	848,282,477	33,854,466
Debt 5th January 1854	757,951,281	27,259,546

We subjoin an account of the funded and unfunded debt of Great Britain and Ireland, as at 5th January 1854.

An Account of the State of the Public Funded Debt of Great Britain and Ireland, and the Charge thereupon, at the 5th January 1854, *exhibiting the Capitals as they stood on that Day after the Reduction of Capitals by Payment in Money, or Commutation into other Stocks, under the operation of the Act* 16*th Vict., cap.* 23, *of all those Stocks the Dividends on which were payable at 5th January and 5th July in each Year.*

N.B.—The effect, which took place on 5th April 1854, under that Act, on the Old South Sea Annuities, and Reduced Annuities, payable on 5th April and 10th October, is shown in a Note at the foot of this Account.

DEBT.		Capitals.	Capitals transferred to and standing in the Names of the Commissioners.	Capitals Unredeemed.
		L. s. d.	L. s. d.	L. s. d.
GREAT BRITAIN—				
New Annuities	at 2½ per cent.	1,833,893 5 11	18,769 18 10	1,815,123 7 1
*Old South Sea Annuities	at 3 per cent.	2,759,778 9 10	13,101 16 3	2,746,676 13 7
Debt due to the Bank of England	...	11,015,100 0 0	...	11,015,100 0 0
Consolidated Annuities	...	368,934,857 7 3¼	1,068,204 15 2	367,866,652 12 1¼
*Reduced Annuities	...	116,067,768 17 5	1,532,209 18 7	114,535,558 18 10
Total, at 3 per cent.	...	498,777,504 14 6¼	2,613,516 10 0	496,163,988 4 6¼
Annuities	at 3¼ per cent.	216,200,835 10 5	424,969 7 8	215,775,866 2 9
New Annuities	at 3½ ...	174,751 7 4	...	174,751 7 4
New Annuities	at 5 ...	431,749 14 4	624 15 0	431,124 19 4
Total, Great Britain,	...	717,418,734 12 6¼	3,057,880 11 6	714,360,854 1 0¼
IRELAND—				
New Annuities	at 2½ per cent.	8,229 15 7	...	8,229 15 7
Consolidated Annuities	at 3 ...	6,049,366 3 8	...	6,049,366 3 8
Reduced Annuities	at 3 ...	118,757 15 2	...	118,757 15 2
Annuities	at 3¼ ...	31,723,424 3 4	...	31,723,424 3 4
Debt due to Bank of Ireland	at 3½ ...	2,630,769 4 8	...	2,630,769 4 8
New Annuities	at 5 ...	2,000 0 0	...	2,000 0 0
Total, Ireland		40,532,547 2 5	...	40,532,547 2 5
Total, United Kingdom, at 5th January 1854		757,951,281 14 11¼	3,057,880 11 6	754,893,401 3 5½

CAPITALS CREATED on 5th April 1854.	New 3¼ per Cents.	New 2½ per Cents.	Exchequer Bonds.
	L. s. d.	L. s. d.	L. s. d.
* The result of the commutation of the following Capitals (the Interest on which did not cease until 5th April 1854) is not shown in the above Account; but on 5th April 1854 the sum of L.2,759,778, 9s. 10d., Old South Sea Annuities, ceased, L.2,020,545, 8s. 7d. was paid off and cancelled, and L.739,233, 1s. 3d. was cancelled and converted into	34,142 12 4	764,002 17 6	3,300 0 0
The above-stated sum of L.116,067,768, 17s. 5d. reduced 3 per cents. was, on the 5th April 1854, reduced to L.115,633,972, 3s. 10d, and the balance of L.433,796, 13s. 7d. cancelled, and converted into	31,852 8 5	432,836 9 0	1,700 0 0
Total	65,995 0 9	1,196,839 6 6	5,000 0 0

Statistics. | Statistics

An Account of the Charge upon the Public Funded Debt of Great Britain and Ireland at 5th January 1854.

CHARGE.

		In Great Britain. L. s. d.	In Ireland. L. s. d.	Total Annual Charge of Unredeemed Debt. L. s. d.
Due to the Public Creditor—				
Annual Interest of Unredeemed Debt		21,970,685 18 5¾	1,308,437 13 4¼	
Long Annuities, expire 1860		1,157,091 6 2	135,546 15 0	
Annuities per 4th Geo. IV., cap. 22, expire 1867		585,740 0 0	...	
Annuities for a limited term of years, per 59th Geo. III., cap. 34; 10th Geo. IV., cap. 24; and 3d Will. IV., cap. 14, which expire at various periods: viz.				
Granted up to 5th January 1854,	L.1,704,682 2 0			
Deduct, Expired and Unclaimed up to ditto, including L.106,100 Waterloo Annuities, 59th Geo. III., cap. 34	803,806 19 3			
	L.900,875 2 9	*viz.* 838,875 2 9	62,000 0 0	
Payable at the National Debt Office. Life Annuities, per 48th Geo. III., cap. 142; 10th Geo. IV., cap. 24; 3d Will. IV., cap. 14; and 16th & 17th Vict., cap. 45: viz.				
Granted up to 5th January 1854,	L.2,664,743 1 0			
Deduct, Expired and Unclaimed up to ditto	1,602,555 16 6			
		1,062,187 4 6	...	
Tontine, and other Life Annuities, per various Acts	English	15,986 5 4	...	
	Irish	28,771 17 9	6,319 1 5	
		25,659,337 14 11¾	1,512,303 9 9¼	
Management		87,904 19 4	...	
Total Annual Charge, exclusive of L.95,855, 4s. 11¾d., the Annual Charge on Capitals and Long Annuities, and Annuities for terms of years, per 10th Geo. IV., cap. 24, standing in the names of the Commissioners on account of Stock unclaimed ten years and upwards, and of unclaimed Dividends, and also on account of Donations and Bequests		25,747,242 14 3¾	1,512,303 9 9¼	27,259,546 4 1

ABSTRACT.

				ON ACCOUNT OF	
			APPLICABLE BETWEEN	The Sinking Fund.	Donations and Bequests.
On account of Donations and Bequests	L.433,552 19 9	The Act 10th Geo. IV., cap. 27, which came into operation at the 5th July 1829, enacts, That the sum thenceforth annually applicable to the Reduction of the National Debt of the United Kingdom, shall be the sum which shall appear to be the Amount of the whole actual annual surplus Revenue beyond the Expenditure of the said United Kingdom; and the following sums have been accordingly received by the Commissioners for the Reduction of the National Debt, including sums on account of Donations and Bequests; viz.	5th April and 5th July 1853	604,389 16 6	2,415 16 4
Ditto of Stock unclaimed 10 years and upwards	580,818 8 5		5th July and 10th Oct. 1853	615,185 9 0	3,951 13 10
Ditto of unclaimed Dividends	2,043,509 3 4		10th Oct. 1853 and 5th January 1854	892,156 4 2	2,512 3 1
	L.3,057,880 11 6		5th January and 5th April 1854	811,855 17 11	3,951 13 10
				2,923,587 7 7	12,831 7 1

Sinking fund.

A sinking fund for the extinction of the public debt was established by Sir Robert Walpole as early as 1716; but it was virtually subverted in 1733. It was again instituted by Mr Pitt in 1786; and, singular as it may now appear, it was for a lengthened period supposed that, by means of the *legerdemain* operation of compound interest, the public debt might be reduced by borrowing money to pay it off. Dr Hamilton of Aberdeen has the merit of having dissipated this extraordinary delusion, the grossest, certainly, by which any civilized nation ever suffered itself to be imposed upon. He showed that the excess of revenue over expenditure is the only real sinking fund—the only means by which any portion of the public debt had ever been, or ever could be, paid off; and that all sinking funds operating at compound interest or otherwise, excepting in as far as they happened to be founded on this principle, were mere quackery and delusion. In fact, upon examining into the matter, it was found that the public debt would have been decidedly less had the sinking fund never been heard of. After such an exposition, the existence of the sinking fund was impossible; and having undergone various modifications, it was finally abolished by the 10th Geo. IV., cap. 27, which enacts that the sum thenceforth annually applicable to the reduction of the public debt shall consist of the *actual surplus revenue beyond the expenditure.*

XV.—*Population.*

The population of England and Wales at periods antecedent to 1801 can only be determined by computations founded on the returns obtained under poll and hearth taxes, and on the registers of births and deaths. Unfortunately, however, none of these affords data from which the amount of population can be accurately deduced. During the latter part of last century the uncertainty in which this subject was involved afforded materials for a keen controversy, which was carried on by Dr Price on the one hand, and by Mr Howlett, vicar of Dunmow in Essex, and Mr Hales, on the other. The former contended that population had been declining in England from the Revolution downwards, and that it did not in 1777 exceed 4,763,000. Mr Howlett, however, showed conclusively that no reliance could be placed on either Dr Price's facts or arguments; and that there could be no reasonable doubt that the population had materially increased in the interval between 1700 and 1780. The returns obtained under the population acts put an end to this controversy, and proved the general accuracy of Mr Howlett's conclusions. The population, as deduced from them, after allowing for their defects and inaccuracies, is as follows:—

Years.	Population of England and Wales.	Years.	Population of England and Wales.
1700	5,475,000	1780	7,953,000
1710	5,240,000	1790	8,675,000
1720	5,565,000	1801	8,892,536
1730	5,796,000	1811	10,164,256
1740	6,064,000	1821	12,000,236
1750	6,467,000	1831	13,896,797
1760	6,736,000	1841	15,914,148
1770	7,428,000	1851	17,927,609

The population for 1801 was determined by actual enumeration; and since then censuses have been taken in 1811, 1821, 1831, 1841, and 1851, the results of which are embodied in the following comprehensive table:—

Statistics.

Population, and its Rate of Increase, and Value of Property, in the Counties of England and Wales, 1801–1851.

Counties.	1801.	1811.	1821.	1831.	1841.	1851.	Increase per Cent. in 50 Years.	Annual Rate of Increase per Cent.	Value. Amount of Real Property Assessed to the Property and Income-Tax, for the Year ended April 5, 1851.[1]	Value. Amount of Property Assessed to the Relief of the Poor for the Year ended March 25, 1850.[2]
England and Wales	8,892,536	10,164,256	12,000,236	13,896,797	15,914,148	17,927,609	101	1·41	L.94,809,106	L.64,700,153
England	8,350,859	9,553,021	11,281,883	13,090,523	14,997,427	16,921,888	102	1·42	90,820,728	64,826,092
Wales	541,677	611,235	718,353	806,274	911,705	1,005,721	85	1·24	3,988,378	2,874,061
England.										
Bedford	63,393	70,213	84,052	95,483	107,936	124,478	96	1·36	566,029	418,693
Berks	110,480	119,430	132,639	146,234	161,759	170,065	54	·87	977,386	784,859
Buckingham	108,132	118,065	135,133	146,977	156,439	163,723	51	·83	875,350	711,047
Cambridge	89,346	101,109	122,387	143,955	164,459	185,405	107	1·47	1,138,314	869,918
Chester	192,305	227,031	270,098	334,391	395,660	455,725	137	1·74	2,062,283	1,593,157
Cornwall	192,281	220,525	261,045	301,306	342,159	355,558	84	1·23	1,349,959	926,512
Cumberland	117,230	133,665	156,124	169,262	178,038	195,492	66	1·02	963,077	708,096
Derby	161,567	185,487	213,651	237,170	272,202	296,084	83	1·22	1,999,550	1,058,351
Devon	340,308	382,778	438,417	493,908	532,959	567,098	66	1·01	2,736,361	2,014,925
Dorset	114,452	124,718	144,930	159,385	175,054	184,207	61	·96	970,858	751,173
Durham	149,384	165,293	193,511	239,256	307,963	390,997	160	1·93	1,679,938	1,053,315
Essex	227,682	252,473	289,424	317,507	344,979	369,318	62	·97	1,961,308	1,684,506
Gloucester	250,723	285,955	336,190	387,398	431,495	458,805	82	1·21	2,235,627	1,964,671
Hereford	88,436	93,526	102,669	110,617	113,272	115,489	31	·54	816,336	667,308
Hertford	97,393	111,225	129,731	142,844	156,660	167,298	72	1·09	870,179	736,116
Huntingdon	37,568	42,208	48,946	53,192	58,549	64,183	71	1·08	389,677	305,751
Kent	308,667	371,701	427,224	479,558	549,353	615,766	98	1·37	3,152,173	2,402,874
Lancaster	673,486	828,499	1,052,948	1,336,854	1,667,054	2,031,236	201	2·23	8,640,695	6,616,707
Leicester	130,082	150,559	174,571	197,003	215,867	230,308	77	1·15	1,364,270	970,375
Lincoln	208,625	237,634	283,058	317,465	362,602	407,222	95	1·34	3,009,456	2,221,415
Middlesex	818,129	953,774	1,145,057	1,358,330	1,576,636	1,886,576	130	1·68	13,867,829	8,118,969
Monmouth	45,568	62,105	75,801	98,126	134,368	157,418	244	2·50	710,733	489,442
Norfolk	273,479	291,947	344,368	390,054	412,664	442,714	62	·97	2,463,893	1,865,216
Northampton	131,525	141,353	163,097	179,336	199,228	212,380	61	·96	1,297,200	974,439
Northumberland	168,078	183,269	212,589	236,959	266,020	303,568	79	1·17	1,560,876	1,256,799
Nottingham	140,350	162,964	186,873	225,327	249,910	270,427	93	1·32	1,198,843	937,180
Oxford	111,977	120,376	138,224	153,526	163,127	170,439	52	·84	1,012,365	708,946
Rutland	16,300	16,380	18,487	19,385	21,302	22,983	41	·69	160,284	128,679
Salop	169,248	184,973	198,311	213,518	225,820	229,341	36	·61	1,563,311	1,195,032
Somerset	273,577	302,836	355,789	403,795	435,599	443,916	62	·97	3,111,703	2,047,336
Southampton	219,290	246,514	282,897	313,976	354,682	405,370	83	1·22	1,820,316	1,451,719
Stafford	242,693	294,540	345,962	409,480	509,472	608,716	151	1·85	2,833,602	1,948,790
Suffolk	214,404	233,963	271,541	296,317	315,073	337,215	57	·91	1,834,252	1,366,648
Surrey	268,233	323,851	399,417	486,434	584,036	683,082	154	1·88	3,964,049	2,392,003
Sussex	159,471	190,343	233,328	272,644	300,075	336,844	111	1·50	1,795,721	1,360,794
Warwick	206,798	228,906	274,482	336,645	401,703	475,013	130	1·68	2,430,861	1,749,508
Westmoreland	40,805	45,922	51,359	55,041	56,454	58,287	43	·72	353,032	278,984
Wilts	183,820	191,853	219,574	237,244	256,280	254,221	38	·65	1,474,625	1,184,796
Worcester	146,441	168,982	194,074	222,655	248,460	276,926	89	1·28	1,427,746	1,002,594
York (*East Riding*)	111,192	133,975	154,643	168,891	194,936	220,983	97	1·36	8,180,661	5,908,447
... (*City*)	16,846	19,099	21,711	26,260	28,842	36,303	116	1·55		
... (*North Riding*)	158,927	170,127	188,178	192,206	204,701	215,214	35	·61		
... (*West Riding*)	572,168	662,875	809,363	984,609	1,163,580	1,325,495	132	1·69		
Wales.										
Anglesey	33,806	37,045	45,063	48,325	50,891	57,327	68	1·05	173,040	124,020
Brecon	32,325	37,735	43,826	47,763	55,603	61,474	90	1·29	229,376	198,523
Cardigan	42,956	50,260	57,784	64,780	68,766	70,796	65	1·00	216,855	165,961
Carmarthen	67,317	77,217	90,239	100,740	106,326	110,632	64	·99	385,660	344,853
Carnarvon	41,521	49,655	58,099	66,818	81,093	87,870	111	1·50	288,893	179,225
Denbigh	60,299	64,249	76,428	82,665	88,478	92,583	54	·86	431,504	284,804
Flint	39,469	45,937	53,893	60,244	66,919	68,156	72	1·09	399,261	222,161
Glamorgan	70,879	85,067	102,073	126,612	171,188	231,849	223	2·38	850,440	552,095
Merioneth	29,506	30,854	34,382	35,315	39,332	38,843	32	·55	168,236	121,975
Montgomery	48,184	52,184	60,245	66,844	69,607	67,335	40	·67	340,192	280,833
Pembroke	56,280	60,615	73,788	81,425	88,044	94,140	66	1·02	358,849	288,604
Radnor	19,135	20,417	22,533	24,743	25,458	24,716	29	·51	146,072	111,007

[1] From a Return furnished by the Board of Inland Revenue.

[2] From Parliamentary Paper, No. 539, Session 1852.

Population and Extent of the British Empire.

	Population 1811.	1821.	1831.	1841.	1851.	Area in English Square Miles.
Great Britain—						
England	9,538,827	11,261,437	13,091,005	14,995,138	16,733,947	50,387
Wales	611,788	717,438	806,182	911,603	1,188,821	7,425
Persons travelling at night, June 6th	...	...	...	5,016	...	...
Scotland	1,805,688	2,093,456	2,365,114	2,620,184	2,870,784	32,167
	11,956,303	14,072,331	16,262,301	18,531,941	20,793,552	89,979
Ireland	5,937,856	6,801,827	7,767,401	8,175,124	6,515,794	32,512
Islands in the British Seas—						
Guernsey, &c.	...	20,827	26,128	28,521	33,645	50
Jersey	...	28,600	36,582	47,544	57,155	62
Man	...	40,081	41,000	47,975	52,116	220
Army, Navy, &c.	640,500	319,300	277,017	188,453	167,604	...
Total of United Kingdom	18,534,659	21,282,966	24,410,429	27,019,558	27,619,866	122,823

Colonies and Foreign Possessions.

		Population 1851.	Area in English Square Miles.
In Europe.	Gibraltar, Malta, Gozo, Heligoland	143,928	229
Asia.	East India Company's Territories, Presidencies of Bengal, Madras, and Bombay, the north-west Punjaub, and Scinde Provinces	95,300,000	659,270
	Ceylon and Hong Kong	1,370,015	24,687
Africa.	Cape of Good Hope, Mauritius, Sierra Leone, Cape Coast Castle, Accra, Gambia, St Helena, Ascension	612,114	201,403
North America.	Canada, Hudson Bay Territory, New Brunswick, Nova Scotia, Cape Breton, Prince Edward Island, Newfoundland	2,480,730	754,577
South America.	British Guiana, comprehending Demerara, Essequibo, and Berbice; Falkland Islands	128,195	89,000
West Indies.	Jamaica; The Windward Islands—Barbadoes, St Vincent, Grenada, Tobago, St Lucia, and Trinidad; the Leeward Islands—Antigua, St Christopher, Aniguilla, and Montserrat; Nevis, Dominica, Virgin Isles, Bahamas, Bermudas, Honduras	839,116	78,384
Australasia.	New South Wales, South Australia, Western Australia, Van Diemen's Land, New Zealand, Norfolk Island	429,309	560,000
	Total of the British Empire	128,923,273	2,490,373
	Protected States and Tributaries.		
	Ionian Islands	223,349	1,041
	Tributary and Protected States in India	45,000,000	433,500
		174,146,622	2,924,914

Rate of mortality, &c.

Notwithstanding the defective state of the registers of marriages, births, and deaths, the results deduced from them are such as to establish beyond all question the fact of an extraordinary improvement having taken place in the healthiness of the mass of the people. Although about 919,000 were added to the population of England and Wales in the interval between 1780 and 1800, the annual average number of burials did not differ materially during that period.[1] It appears from the returns, that in 1780 the rate of mortality in England and Wales was one in forty; meaning by this, that one fortieth part of the whole population died annually. In 1790 the rate of mortality was reduced to one in forty-five. During the five years ending with 1800, it was one in forty-eight; during the five years ending with 1810, one in fifty-one; and during the five years ending with 1820, it had sunk to one in fifty-seven. During the five years ending with 1830, it seems to have slightly increased; having been, at an average of that period, one in fifty-four, but in 1851 it was one in fifty-six.

This extraordinary decrease of mortality is no doubt owing to a variety of causes; such as the greater prevalence of habits of sobriety and cleanliness; the better lodging, feeding, and clothing, of the labouring classes; improvements in medical science, &c. But to whatever it may be owing, it affords unquestionable evidence of the signally improved condition of the population.

The increase of longevity has been particularly conspicuous in London and other great towns. During the first half of last century, the mortality in the metropolis is believed to have been as high as one in twenty-four; and it required, down to the American war, large supplies of recruits from the country to keep up its numbers. But from 1770 the rate of mortality has been gradually diminishing. In 1790 the births for the first time exceeded the burials; and since then the city would have gone on increasing, though it had not been indebted to the country for a single immigrant. In Manchester, Bristol, &c. the improvement has been equally striking.

The proportion of births and marriages to the population has continued pretty nearly stationary since 1790. We subjoin abstracts from the tables of births, marriages, and deaths, registered in England during the year 1852.

Abstract of Marriages, registered in England, pursuant to the Act of 6th and 7th Will. IV., cap. 86, in the year ending December 31, 1852.

Marriages registered in Quarter ending last day of	
March	32,977
June	40,092
September	38,400
December	47,313

[1] Preliminary Remarks to Census of 1821, p. 26.

Statistics.

Marriages contracted between

Bachelors and spinsters	130,672
Bachelors and widows	6,696
Widowers and spinsters	14,044
Widowers and widows	7,370

Marriages of

Widowers	21,414
Widows	14,066

Marriages of Persons not of full age.

Men	8,551
Women	26,978

Signed Marriage Register with marks.

Men	48,421
Women	70,772

Cases in which

Both signed	26,636
One signed	45,921

Married according to rites of Established Church	133,882
Not according to do.	24,900
Total	158,782

In 1851 there were in Great Britain, of the age of twenty years and upwards, 5,458,815 males, of whom 1,689,116 were bachelors, 3,386,811 husbands, and 382,888 widowers; and 5,998,384 females, of whom 1,767,194 were spinsters, 3,435,917 wives, and 795,273 widows.

Abstract of Births registered in England in the Four Quarters ending 31st March, 30th June, 30th September, and 31st December 1852 (exclusive of Still-born).

Registered in Quarter ending last day of

	Males.	Females.
March	82,605	79,198
June	81,227	77,804
September	77,532	73,690
December	77,672	74,262
Total	319,036	304,954

Illegitimate Births in the several Quarters.

	Males.	Females.
March	5,640	5,497
June	5,380	5,234
September	5,334	4,915
December	5,380	5,111
Total	21,734	20,757

Abstract of Deaths (exclusive of Still-born).

Registered in the Quarter ending the last day of

	Males.	Females.
March 1852	54,178	52,180
June	51,310	49,315
September	51,108	49,277
December	50,446	49,324
	207,042	200,096

PART III.[1]

GOVERNMENT AND LAWS.

I.—Government.

Formal constitution.

"By the constitution of a country, is meant so much of its law as relates to the designation and form of the legislature; the rights and functions of the several parts of the legislative body; the construction, office, and jurisdiction of courts of justice." This is the definition given by Paley. It seems necessary to add also, "whatever prerogatives are vested in the executive;" at least, in case any powers and privileges are conferred on it beyond what, from being indispensable to the administration of the public affairs of a community, must be common alike to all executives. Even with this addition, the mere mechanism of a government, in the three principal relations which it bears to its subjects, is all that is here described. Yet something more is generally understood by a constitution, and would seem to be properly comprehended under that name. A government, it is true, may and must be influenced in a hundred ways by independent circumstances, and by manifold considerations, which are no part of it. But when certain specific tendencies and principles are directly and designedly moulded into its original conformation as so many distinct ends and maxims, or when they are subsequently developed by it or incorporated with it, so as to guide and qualify its spirit, they become entitled to the character of constitutional as much as the organization itself. There is no doubt that the mechanism of a government, if left to itself, will mainly determine the nature and direction of its movements; yet this mechanism consists of a moral and intellectual agency. It is accordingly capable of accommodating itself, and of working in subjection to whatever rules and impulses may be impressed upon it by the society whose instrument it is.

No society can be so stationary but that changes must take place, sooner or later, for the better or for the worse, in some one or other of the conditions, whether of principle or of organization, which make up its constitution. When these happen to take place, hardly any society can have been so judiciously constructed from the first, or be so fortunate in all its future circumstances, that lawyers shall be able at once to call every change which is for the worse unconstitutional, and which is for the better constitutional. An approximation to this favourable situation has been one of the great and innumerable advantages of the uniform and gradual progress by which the English constitution has been distinguished. Its history is the history of the internal policy of a people, who at every advance in civilization succeeded in occupying one advanced post after another, fortifying their free position at every remove. The early prospect would have discouraged the most sanguine philosopher. But the evil tendencies were suppressed, and the good ones brought forward, until the process appears to resemble the natural development by which a germ grows up into a plant, with but little occasional help from the pruning hand of man. Precisely the reverse might have happened. It is what takes place during that imperceptible decay, which, by a foolish analogy to vegetable and animal life, it has been supposed that institutions are also destined to undergo. The bulk of mankind more easily perceive that abrupt and extensive changes, the innovations by which new principles, or a new organization, are introduced, amount in fact, as far as they go, to a new constitution. This may be done legally or illegally. If illegally, it is a revolution; a case which by the supposition has nothing to do with law. If legally, the letter of the law and the forms of the

[1] For this part of the article the Editor is indebted to William Empson, Esq. Professor of the Laws of England at the East India College.

constitution may be used for the purpose of substituting a worse as well as a better government to the extent that the ancient constitution is displaced. The question, what name will most properly describe any specific measure of this class? must depend upon the nature and degree of the measure. There is on these occasions another question for a people, prior in time, and far more important than discussions about a name. It is their duty to ascertain whether the proposed change is, under all the circumstances, a practicable improvement, and to fix where the authority for deciding this point can, upon the whole, be most safely lodged. A comparison of the different methods by which the latter problem can be solved will show what little cause there is for maintaining, as some modern writers are disposed to do, that the course adopted in England is too loose and arbitrary to be consistent with the positive character implied in a constitution.

Three very different systems may prevail in this respect. The two first are alluded to rather than recognised in English history. Its whole tenor proceeds upon the last.

Every country has at one time or another given more or less countenance, upon some favourite points, to the delusion of fundamental laws and unalienable rights; meaning by these, laws and rights incapable of alteration, except by a violence or decay equivalent to the suspension, if not dissolution, of society. Confounding the principle of moral and of legal obligation, Chief-Justice Hobart, from the bench, and Blackstone, calmly writing in his closet for the instruction of the eighteenth century, concur in stating that the supreme power of every state is necessarily subject to one condition. By this condition, all legislative commands against natural justice must be void in themselves, that is, void in law. With much less latitude than has often been given to the law of nature and to the rights of man, this exception might be made to cover extensive and dangerous ground. Lord Coke, for example, has said, that a statute against Magna Charta, or one to prevent the Irish from coming into England, would be void. In this manner the Stuarts were taught by servile judges to believe that most of the prerogatives anciently affixed to the crown were irrevocable even by act of parliament. A similar opinion, grounded on the doctrine of the three estates of the realm, was formerly propagated concerning the episcopal right of sharing in the legislature. At the Reformation, Bishop Gardiner conceived, that in consequence of the forced absence of himself and his brethren, its proceedings would be of none effect. The example was followed, but equally in vain, when, during the violent re-action provoked by Charles I., who considered himself as so pre-eminently a Church of England king, the bishops protested against all acts passed in their absence by a parliament no longer free. Charles I. held the very act by which the bishops were excluded, although some of them attended and voted against it, to be *ipso facto* null. The more intelligent a nation really becomes, the less likely is it thus to presume in favour of the political optimism of its own or of former times. No fiction can be more gratuitously mischievous than the creed that there can be any thing in the force of invading arms in 1066, or in the authority of national wisdom in 1688, or in any length of prescription whatsoever, to disable successive generations from exercising their own discretion respecting the propriety of their existing institutions.

Another plan is to set apart, in a written charter or declaration, certain excepted cases. The high matters which are the chosen objects of this deliberate sanction, are conceived to acquire thereby the privilege of being placed beyond the control of the ordinary legislature, and of being reserved for the direct volition of the body of the people. Locke, in treating of the right of popular resistance, seems to have stated too broadly, that the power of a community can never be exercised in this manner under any form of government, because such a proceeding, he says, presumes the government to be dissolved. Blackstone (vol. i. p. 161) expresses himself still more strongly to the same effect, adding, that no government will presuppose its own destruction. The contemplated occasions are neither as extreme in theory nor as impracticable in execution as this language would represent. There is really no question in this case about resistance, nor what can reasonably be called dissolution. Whilst, on the one hand, the law has nothing to do with possibilities belonging to the ultimate and latent right of resistance; on the other, the idea of a supreme power which may be lawfully resisted in points where it is called supreme, is of course a contradiction. Thus in an absolute government society must be remitted to its first principles before the right of popular interposition can be recognised by it. An ordinance of Louis XIV. declared that the extinction of the family of Bourbon would raise a case of this kind, and that on the occurrence of such event the right of electing to the crown of France would revert to the French people. But limited governments stand in an entirely different position. Minor contingencies, far short of the transgressions which justify an appeal to arms, or of the accident which summons a nation to the *Champ du Mars* to agree upon a successor to a vacant throne, are part of their necessities. The entire legislature may be only supreme *sub modo*. For under the doctrine both of fundamental laws and constitutional charters, every variety of restriction may be imposed upon the legislature. The prudence of these restrictions is more than problematical. But wherever a government consists of several parts possessing co-ordinate authority, the demand for some external control necessarily arises; since encroachments of one part on the other must be expected; and means ought to be arranged beforehand for bringing them back peaceably within their proper limits.

In this manner, wherever the doctrine of fundamental laws is admitted, a sufficient authority, as, for instance, a high court of justice, should be created for the purpose of inquiring into and correcting any violation of them with which the ordinary legislature may happen to be charged. It will be necessary, besides, to chalk out, as in primary assemblies or otherwise, the extraordinary course by which the policy of the fundamental laws themselves may be reviewed, as occasion shall require. Both these precautions have been introduced and satisfactorily applied by the founders of the United States. But they are not wanted for this purpose by the English constitution. For, notwithstanding a few fanciful conjectures, as above, at times incautiously or intemperately hazarded, the English constitution is not established on any strictly fundamental laws, and still less are any specific questions reserved by it for the direct intervention of the people. But there are analogous dilemmas which may arise under it as a limited and a mixed monarchy. Many, indeed most, of these dilemmas appear to be left open to the chances of unnecessary aggravation, by the want of some similar arrangement. A government, composed of several members with distinct powers, can only exist as such on the supposition that they each remain content with their own share, or that, in case one should trespass on the other, the irregularity can be set right by recurring to expedients legally providing for the emergency. Every one of the triple divisions of the English legislature has in its turn made experimental encroachments, against which there exist but imperfect and often very circuitous guards in the constitution. By the law of constructive contempts, once so flagrantly abused, either house of parliament is armed

Government and Laws.

with a despotic weapon. This weapon is beginning to gather a prudential rust in the sheath at present; but the want or the jealousy of a superior court is a poor excuse for allowing it to continue there at all. The mysticism belonging to the maxim that the king can do no wrong, coupled with the recognised absence of any remedy against the crown for any possible amount of misgovernment, proved the ruin of the Stuarts. It encouraged them in the opinion that the supreme power was lodged, not merely in part, but wholly, in the sovereign, and that it might be abused with legal impunity. The 16th Charles II., as renewed by 6 William and Mary, declares that a new parliament shall be called within three years of the determination of the former; but no measures are taken by either statute for the assembling of a parliament in case the king should not choose to call one. The security is left to the old indirect check, the stoppage of the supplies, and to the new one, which, by means of the annual mutiny act, has been derived from a source where an aid to freedom could hardly have been expected, namely, the innovation of a standing army. There is at present abundance of rectifying principle and of auxiliary appliances in the sounder portions of the English constitution, which will prop up the rest, and hold the feebler part to its work. Otherwise the history of the Habeas Corpus act is a striking proof of the inadequacy of all general declarations. In doubtful times these are merely waste paper, unless accompanied by positive arrangements for carrying them into execution, and subjected to proportionate penalties on their infringement and neglect. The act of 16 Charles I. had provided, that if the king neglected to call a parliament for three years, the peers might assemble and issue writs for choosing one; and, in case of neglect by the peers, the constituents might meet and elect one themselves. This act was repealed with great ignominy at the Restoration. But it seems to have left the crown its due precedence, and to have provided, with as little impatience as possible, for the securing an object which all parties are agreed it is absolutely necessary some way or other to secure. The debates upon the command of the militia previously to the breaking out of the civil war, are a memorable instance of the folly of leaving great constitutional rights in obscurity up to the fatal hour when they can no longer be settled calmly and on reasonable terms. If it be important to define rights in times of tranquillity, it is no less so to provide the particular forms by which, in case of violation, the remedy may be applied. It is true that these collisions approach to the character of revolutions. When a king has so far separated himself from his parliament, there is little chance of their returning to that harmony by which alone a constitutional monarchy subsists. No previous arrangements can completely meet the crisis after it has occurred; but they may mitigate its severity, and, by the mere fact of their known existence, may do the still more acceptable service of preventing its occurrence.

According to the third and remaining plan, the constitution recognises the existing legislature as supreme for all purposes whatsoever. To this plan the English nation has always stedfastly adhered. From the time when the commons of England were adopted into the legislature (49 Hen. III.), or shortly afterwards, the legislature has, without any deviation worth mentioning, been the parliament; that is, the king, lords, and commons, in parliament assembled. The popularity of parliaments has been so paramount throughout, that the public have never until recent times been tempted to look elsewhere for rules, inclinations, or opinions. The supremacy of parliament kept its hold, like an anchor which nothing could shake, in the most stormy seasons, and under every variety of circumstance. The impossibility of complying with the customary forms was satisfied as often as it occurred, by the nearest approximation which could be obtained. This was no less remarkable in the course taken as far back as the supposed resignations of Edward II. and Richard II., than on the later occasions of the imperfect convention parliaments. Nobody suggested the propriety of calling together the people to restore Charles II., or to instal William III. into the vacant throne. Mr Hallam observes, that in the combination of gift, descent, and popular election, which took place on the accession of Henry IV. in the year 1399, there was as great formality as in 1688, making due allowance for times and men. The semblance of election remained with the members of the *quasi*-parliament. They had been summoned by the king's writ, but, from not having his commission, they did not take that solemn name, and only called themselves the estates of the realm. Wherever it was possible to preserve by fictions the appearance of a regular parliament, fictions were called in. Thus, during the infancy of Henry VI. the shadow of the royal infant, then only nine months old, opened his first parliament, and made appointments during pleasure. On the derangement of George III. the regency was appointed under the great seal. To keep up the entireness of the body politic of the state, the co-operation and personal will of the king were necessarily assumed in the very act which was to supply his personal incapacity. It was from the court of parliament that Richard III. obtained a confirmation of his alleged title. He rested upon it as "the known quieter of men's minds;" and the Earl of Surrey appealed to it as the one conclusive authority, when taunted afterwards by the successful competitor for the crown upon Bosworth Field. Though Wolsey, "hating parliaments," which therefore hated him, "had been the means that none was holden in the realm but one for the space of fourteen years;" yet Henry VIII. told them that he was informed by his judges that he was never so great as when sitting there in his estate royal. The great test of the omnipotence of parliament was its power of altering the succession. This, which was the established doctrine of the prior period, it was by a statute of Elizabeth made treason to deny. At the beginning of the civil wars, Charles I. called the peers together at York; and the cavalier members seceded from the House of Commons. Under these circumstances a metaphysical question might easily have been raised, as to which was the real parliament. But the locality of Westminster was like keeping the field of battle. It decided the direction of that wonderful and superstitious homage, which made Clarendon complain that "an implicit reverence for the name of parliament was the fatal disease of the whole kingdom." The substance and vitality, however, of the institutions to which the entire authority of national legislation is transferred, are still more important than the name. For this purpose their independence as intelligent deliberative assemblies must be secured. No question can be made concerning open violence. Any attempt by intimidation to force the repeal of a law or a change of measures, or to overawe either house, is treason. But, further than this, no minority or fraction of the people must be allowed to exercise over the legislature an influence of opinion, which the constitution does not attribute to the people at large, or at least does not provide them with the means of exercising. This is a subject of great delicacy; but still there must be some limits. Accordingly, both in law and practice, limits more or less elastic have been put on the nature and degree even of the moral pressure which may be urged on parliament from without.

Tumultuous petitions having been carried to a great

Government and Laws.

excess during the long parliament, the statute 13 Charles II. in consequence, imposed several restrictions upon petitions for any alteration in church or state. But notwithstanding the opinion of Mr Dunning, and the present practice, these restraints have been judicially determined not to be affected by the bill of rights. Mr Hallam says that he has traced public meetings for the debate of political questions no higher than the year 1769, and, subject to very few exceptions, petitions simply political not quite so high. Rights of this kind, guaranteed to the body of the people, and liberally construed, appear to be supplemental to a representation which stops short of annual parliaments and universal suffrage. They are the democratical counterpart to addresses of loyalty to the throne, and of confidence in the government, which are said by Evelyn to have come in even in the time of Cromwell. The right will probably not be used, certainly not used frequently, till a want of sympathy between the representative body and the people, or particular classes, begins to be suspected. The sense of the public, so taken, may often be found to clash with the sense of particular constituencies. In this case, two questions necessarily arise for a member's consideration: first, what weight either one or the other ought to have as mere authority in overruling his own opinion; and, next, which of them, in the event of competition, is entitled to a preference. The same constitutional answer will apply to both difficulties. The inclination on the part of the English constitution appears to have settled down, after some previous oscillation, to one consistent course, as soon as the commons began to feel and act up to their real dignity and strength. A member must necessarily be returned for a particular place. The question is, Are his duties therefore local? The terms of the writ of summons had all along plainly signified that, although chosen by a single district, he was chosen for the wants and service of the realm. Nevertheless many instances formerly occurred of the commons begging for time to consult with their constituents. It may naturally be presumed that this was nothing more than a timid way of evading unreasonable requests. Because their ancestors, afraid of Edward III.'s designs upon their subsidies and fifteenths, had declined to be made consulting parties to his wars, it was absurd in James I. to imagine that he could altogether call away from politics the English gentry of his day. Yet at so late a period no less a person than Burghley condescended to argue against the propriety of the interference of the House of Commons in matters of war and peace; and to take the distinct ground that its members by its institution had minds only of a compass each for the place which he served. But parliament had already heard the contrary within its walls. The movement of society which had made it impossible to execute the statute requiring the member of a district to be an inhabitant, had brought out, in the reign of Elizabeth, the first parliamentary declaration in behalf of the complete legislative authority of members of the House of Commons, in full accordance with the letter and conditions of the ancient writ. In the declaration that members were to act not only for their constituents, but for the whole kingdom, it was evident that a great principle was proclaimed. If sycophants then contested it, Mr Hallam, speaking of modern days, says very truly, that it is one which at present "none but the servile worshippers of the populace are ever found to gainsay." The weightiest arguments in Burke's letter to the sheriff of Bristol, against particular instructions, are little more than the application and extension of this principle. The necessity of going back to their constituents for a specific assent, was one of the main grounds of that incompetency to the duties of a representative assembly which facilitated the ruin of the states-general of France. A few votes beyond what a question would have obtained upon its general merits may thus be stolen, and a few individuals may thus push themselves forward into temporary notice. But public opinion can never be truly ascertained, any more than the public interest comprehensively promoted, by desultory and individual pledges. For this purpose the public must act in concert. With this view, kings of England have sought to satisfy themselves and the House of Lords with regard to the reality of the public sentiments, by a dissolution addressed to specific points. On the occasion of Mr Fox's India bill, the new members were expected to bring to the House of Commons an answer concerning the royal choice of particular men as ministers; and on the occasion of the Reform Bill, concerning the policy of a particular measure. This is the utmost advance which the English constitution has made towards admitting the doctrine of the will of the people or the instructions of constituents. So narrowed, it is a proper, and at times an indispensable part of every rational system of representation. It is practically quite consistent with the general rule that the select body of electors are trustees for the entire community; and that their representatives are the only organ by which the public will is on all subjects ultimately and conclusively expressed.

This then is the English system. It seems to be an extreme and fanciful subtilty to doubt whether the title and character of a constitution can properly belong to it. It is something in its favour that it can appeal to experience as practically embodied in a government, now of ancient standing, at once the most progressive and the most permanent which the world has ever yet seen. Why is it less a constitution because it gives to its ordinary contemporary legislature the most plenary attributes of supreme political power, and because it disclaims the supposition that its early constitutional legislation had or could have the sanction of any higher authority? The assent of any one generation can be of neither greater nor less value than that of another. It is not wonderful that a society, setting up for itself for the first time, or obliged by circumstances to begin anew in an enlightened age, should try to build upon the basis of fundamental laws. But it is fortunate for a constitution, of which the first stone was laid in haste and ignorance, and in the dark, and which nevertheless always kept so far in advance of its contemporaries, as to serve other nations for the model whence the criticisms have been derived by which its irregularities were afterwards to be condemned, that it started with no similar pretensions. If it were to suit the ages through which it was to endure, it could only do so by a plastic mode of conformation. In this manner its people were educated along with it and up to it, the two acting and re-acting upon each other. Hence an instinctive intelligence and conformity, otherwise almost unattainable, appear to have been secured, which political changes have hitherto slightly disturbed. Some bad logic, and a few incidental anomalies, are a small price to pay for conciliating opinions and smoothing over the transitions through which, in the course of centuries, an improving nation has to pass. But the mode in which these alterations have been made is objected to. The body of the people, it is said, ought to have legislated upon them in their own persons. It is surely a sufficient answer that it would be difficult to name a year, when in point of fact more would not have been lost than gained by tying up the hands of parliament, and putting its legislature to the circuity of an appeal to the freeholders of the county courts. The nature of things does not admit of there being any greater security for good government than can be given by a legislature of which a popular representative assembly, pro-

Government and Laws.

perly chosen and seasonably renewed, is a member. To call in the people to council, is to abandon to that extent, under circumstances too of great probable excitement, the advantages of representation; and for no countervailing benefit, unless on the singular supposition that a people incapable of choosing able and honest representatives, will be found capable of being able and honest legislators themselves. The device is much more likely practically to delay improvement than to check encroachments; since, for the latter purpose, the restraints it imposes are either unnecessary or insufficient. There can be no substitute for the spirit of a people. With that spirit, these precautions are not wanted; without it they are vain. The two cases which look most suspicious in English history (one in substance, the other in form) are the proclamation-statute of Henry VIII. and the septennial bill. The parliament of Henry VIII. gave royal proclamations in certain cases the force of law. The extent of the innovation has often been exaggerated. But, with regard to the present question, there can be no doubt, that a generation which by royal order changed its religion four times in twelve years, would, on the subject of royal proclamations, have as readily acceded to his majesty's desires. A few corporations petitioned against the septennial bill. But an observer of the prior, contemporary, and subsequent conduct of the body of the people on this point, and a reader of Burke's speech against triennial parliaments, will perhaps see little reason to believe or to wish that the people, if calmly consulted, would have come to a different conclusion. It should be recollected, that the question is one of pure argument only, and not of history. By the common law a parliament, unless dissolved, lasted for the king's life. In 1694 this duration was first shortened to three years; but in 1717 these three years were lengthened to seven. Thus, the law of triennial parliaments, spoken of by some as an almost vital part of the English constitution, was never known in England but for neither more nor less than the space of twenty and three years.

Every government is characterized by the ends which it proposes as its primary objects, and by the means which it applies for the attainment of its ends. These objects represent what is vaguely called its spirit. The only means properly at its command refer to the making, interpreting, and executing laws. It follows that the most important distinctions in this respect between one government and another, must be found in the specific provisions which determine the formation and distribution of the legislative, judicial, and administrative power. The English constitution is a limited or mixed monarchy; limited, by the maxim that the king has no rights but those which are prescribed and ascertained by law; mixed, by the fact that the parliament, in which the sole legislative authority resides, consists of the king and the three estates, the nobility, clergy, and commonalty of the realm, as comprised in the two houses of Lords and Commons. The suppression of partial interests is sought to be attained, and the practical recognition of the great end of government, namely, the happiness of the whole body of the people, has been principally developed and enforced by the share which the people exercise more or less in the government. This takes place in the legislative department, by means of their representatives; in the judicial, by the agency of the jury; in the administrative, by the doctrine of official responsibility, and from the example and control of a great diversity of popular local municipal institutions.

A more considerate legislation is promoted by a second legislative assembly. A great addition is also made to the political stability of a limited monarchy, by forming the members of this second assembly into an hereditary nobility. A mixed government has, however, a still greater advantage. It naturally leads to and facilitates a division of powers, which is the most important of all the checks that mere arrangement can produce. According to this division, the authority of parliament is strictly confined to the original enactment of the laws. The duty of the judges is as strictly judicial. They have no more to do with the politic administering of the law than with the making of it. The law being thus made, and thus interpreted, the entire charge of carrying it into effect is vested immediately or mediately in the crown. Whilst the several parties who make, interpret, and execute the laws, are kept, in this manner, perfectly distinct, it becomes exceedingly improbable that any confusion, either unintentional or wilful, should arise between the principles properly belonging to their several operations. This is a caution which the cause of public liberty, as well as that of civil justice, alike imperatively require. Blackstone[1] has expressed a strong opinion as to the propriety of the executive being only a branch, and not the whole, of the legislative; also[2] that the judicial authority should in some degree be separated from both. This was one of the points on the paramount importance of which Jefferson and Adams were agreed when they came to apply the experience of the English constitution to the construction of their own.

Eastern nations, notwithstanding their supposed immemorial civilization, appear never to have got much nearer than the inhabitants of the South Sea Islands to a conception of the just foundation on which alone the rights and duties of sovereignty rest. On the other hand, the citizens of Greece and Rome were fully aware that political society was grounded on the advantage of its members. Their patriotism was not more exalted by the pride of national independence than by the consciousness of being responsible only to the law. Nevertheless, the real condition of these great commonwealths was for the most part in lamentable contradiction to the individual ability and virtue by which their history has been made famous throughout all ages. The glory of free and classical antiquity was frequently clouded, and was brought at last to an abrupt and final termination. This is apparently to be attributed to the defective mechanism of their institutions, more than to any other cause. Their construction and division of the legislative, judicial, and executive authority were all along so imperfect, that their negligence of the means of a better political arrangement can only be accounted for by their ignorance of its necessity. There is nothing to this effect, even in their theoretical works upon government, when carefully examined. Polybius, it is true, gives the preference to a combination of monarchy, aristocracy, and democracy, as being in a degree more stable than the simple forms. Cicero also agrees with him in saying, that this was the true Roman constitution; but he most unwisely adds, in compliance with the Roman jealousy of kings, that wherever the executive is placed in a single hand, the government is mixed only, not tempered, and must be ruined by the vices of the individual. Different writers appear to have meant different things by the same word. Aristides denominated the government a mixed one as late as the time of Marcus Aurelius. Tacitus saw through the fictions, and thought that the word implied more, otherwise he would scarcely have said that such a combination may be more easily praised than effected, and that were it effected it

[1] *Commentaries*, vol. i. p. 146 and 154.

[2] *Ibid.* p. 269.

Government and Laws.

could never be lasting. In case, however, the constitution had done nothing further than realize the above combination in the general sense which alone these philosophical statesmen were contemplating, it would have stopped infinitely short of the principal benefits which it has conferred. The separation of the three great branches of political authority into distinct departments, as it is one of the most probable consequences of a mixed monarchy, so is it beyond all comparison the most valuable. Unfortunately it had not taken place under the imperfect specimens of mixed government with which they were acquainted. It is not surprising, therefore, that in theory the philosophical truth of such a corollary should never have occurred to them. If that consequence had been duly presented to his mind, Tacitus must surely have seen reason to question the cycle of Polybius, and to feel greater confidence in the political contrivance by which the efficiency and the durability of states have both been found in practice to gather equal strength. No political phenomenon can be more interesting than the circumstances and the method by which a government has thus arrived at the high distinction of first uniting improvement and stability, liberty and order, and has been enabled to combine the greatest of all ends with what, from the failure of the most celebrated experiments, it may be well supposed were means very difficult both to discover and to apply. Sanguine spirits often appear to imagine that as good a constitution as can be devised may be struck out and fitted upon at a moment's notice. The history of the English constitution may teach them greater caution. A distinct examination of its respective parts will show, not only how slowly they have been formed, but to what extreme risks at different periods the existence and the principle of each have been, and perhaps must be, severally exposed.

The English constitution is more historical than philosophical. It has been the gradual development of national good sense, shown in a spirited and prudent improvement of tendencies and events, without any of the ambition of a regular, preconcerted system. Its object was never stated in a declaration of the abstract rights of man, nor its organization derived from a metaphysical analysis of the elements of human nature. He must have been indeed a prophet, who, at the time of the Norman conquest, could have foreseen the course by which it would outstrip the feudal monarchies which resembled and surrounded it. The difference lay in this: For successive centuries, circumstances played favourably for a people who had the merit or the good fortune to profit by them as they occurred. M. Rey is so far right. England has experienced the truth of Aristotle's observation with regard to Crete. An insular position has great advantages for political experiments. Assistance has also frequently come in from the most unlikely quarters, and the scale has more than once been turned by causes to which, as far as we can observe, no nobler name than that of accident is to be assigned. At one time the very strength and concentration of the monarchy of England, as compared with the weakness of the monarchy of France, brought the barons, the people, and even the church, into a closer union for their defence. At a later period the impoverishment of the crown by foreign wars, and the alienation of the crown lands, brought it into dependence upon, what was most fortunately, one national parliament instead of several distinct provincial assemblies. The separation of the greater from the lesser barons, the assembling of the commons and the lords in different chambers, the transit through which the exemptions claimed by the clergy became disqualifications, the conversion of the jury from their original character (whatever that may have been) into a popular tribunal, have turned out to be the hinges on which English freedom has ultimately turned. They are instances of incidents, in themselves at first comparatively trifling, diverted by circumstances into a deeper channel, or transmuted by a noble alchemy into a much higher purpose than what was their original purview and intent. Although the English government was from the first a limited monarchy, it was not for nothing that monks and lawyers lent a hand in the pious frauds of forging tales about Alfred, Kentish privileges, and imaginary Saxon laws, or in encouraging the more recent fiction of the notorious anti-tallage statute. . The stoutest antiquarian who ever argued that the title of William the Conqueror represented merely the feudal *conquisitio*, and not the conquest of the nation, nevertheless must admit from time to time great historical distinctions. The nature and degree of the limitations practically needed and applied to the powers and mechanism of the several component parts of the government varied exceedingly at different periods. The importance even of the grand division between the legislative, judicial, and executive authorities, was far from being at once recognised and observed.

Changes in society and opinion.

A constitution upon paper and in practice are such very different things, that we must look into the history as well as the laws of a country, in order to know at any given time what was the real contemporary character of its government. English antiquarians have been more or less successful in tracing back the dates of their most popular institutions. But the sense in which the same institutions were in point of fact understood and administered at different periods, and the security which they were capable of affording, are distinct and much more interesting questions. A people and their government, it is true, are always cause and effect to each other; and none more so than those of England. In the present instance, however, there can be no doubt but that the narrative of English parliaments and of English juries establishes their existence, as a matter of pedigree, long before there was spread throughout the community either the spirit, the knowledge, or the means to turn them to their legitimate account. The systematic regularity of modern governments was unknown even to the ancient republics. No wonder, therefore, that it was wholly unthought of either by the feudal chieftains themselves, or by the rude vassals who attended to do suit and service at their courts. Our ancestors were satisfied, we are told, with the rough standard of measurement taken from parts of the human body, though differing in different men, till Henry I. ordered the *ulna* or ell, which answers to our modern yard, to be made the precise length of his own arm. To lay down any thing like a precise standard for civil obedience, was left for later times, and for arms still stronger than those of any king. Even long after the golden rules and metewand of the law were recognised at Westminster, acts of violence were frequent over the kingdom, with more or less remonstrance; so that *judicandum est legibus non exemplis* is a maxim which the constitutional inquirer is obliged to keep constantly before him.

The history of England opens with a society divided into castes. The distinctions taken by the law were onerous and severe. There is a great difference between Glanville and Beaumanoir. Nevertheless, the blot upon Magna Charta itself, in the limitation (*liber homo*) cannot be explained away. The later threat of Richard II. after the unsuccessful insurrection to which the peasantry had been driven by oppression, is equally intelligible. Their condition, he told them, should be made yet more miserable. The statute of labourers, which was passed in the reign of Edward III., was in the same spirit. It continued to be a no less absurd than wicked favourite with after-

Government and Laws.

times. It is impossible to look over the whole intermediate legislation concerning the lower orders down to the reign of Elizabeth, without perceiving that most of its provisions are as much statutes of police as of trade. They have the air of being expressly directed to the object of preventing the consolidation of the different degrees of society into one people. When we compare the laws of England in this respect with those of the continent, we cannot estimate too highly the comparative equality of ranks, and the absence of exclusive privileges. Nevertheless the laws were bad, and public opinion worse. The dialogue on the Exchequer, written towards the close of the reign of Henry II., observes, that in all cases of secret slaying, whether of English or Norman, the penalty should be levied on the hundred, "unless there are plain *indicia* of the servile condition of the deceased." The petition of the commons to Richard II. that villeins might not be put to school and so get on in the church, "for the honour of all freemen," was re-echoed two hundred years later, in the cry against the Lord Cromwell, on account of his "villein blood." The class was then about to disappear. It is evident that it was only by its extinction that prejudices incompatible with real equality under a free constitution could be removed. The gradual elevation of the entire population into the condition of freemen, put all ultimately in possession of rights which had been wrested from the crown by feudal leaders and independent yeomen with a much more partial object. It took ages to compass this emancipation, and to reverse the proportional shares of the national wealth, as held by the king, the church, the nobility, and the commons. If all the land of the kingdom had continued to be the portion of the church, the king, and the immediate tenants of the crown, who, according to the list in Domesday-book and Brady, did not exceed seven hundred in number, this consummation would never have been accomplished. Civil wars and commerce, by scattering properties and displacing chivalry, broke up the feudal system much more effectually than any positive enactment. The possession of property gave leisure; leisure, especially when the reformation and the press stirred up the human mind with new and more liberal excitements, gave knowledge. Even without the strength of numbers, the combined influence of property and knowledge must give power. Until the body of a people has obtained the intelligence necessary to understand something of their own interests, and the power of making an attention to their interest and feelings a matter of prudence on the part of the higher classes, it is in vain to expect that just principles of government will be steadily acknowledged, much less that they will be steadily put in practice.

The king appears in the law-books as the source of almost every institution and every right. There is no other independent political existence save his baronial court. Nevertheless, as far at least as concerned the people, the king was originally still more powerful in fact than even in law. There was always a legal control upon him. But it was lodged at the beginning in an assembly where as yet the people bore no part. Bracton, who wrote under Henry III., probably not long before Leicester's writs to knights, citizens, and burgesses, appears to have as little anticipated them as he could have anticipated their effect. In his perversion of the imperial law to the purposes of a limited monarchy, he declares that the will of the prince must be according to his counsellors; that is, of "his court of earls and barons." He terms them his "associates," and makes them his superiors; for he adds, "were the king without a bridle from the law, they ought to put one on him." The court of peers, or royal council of France, by the non-attendance of the tenants in chief, sunk into the great judicial tribunal of the country, and became known by the name of parliament, after the time of St Louis. The peers of England were not so confident of their feudal exemption from supreme legislative control; consequently, when, about the same time, or a little earlier, the *aula regis* or great council of England assumed a new form, it separated into two compartments; one judicial, or the supreme courts of justice; the other legislative. The last consisted originally of the earls and barons only. By the time that the incipient House of Commons became its colleague, the name of parliament was appropriated, and, from its omnipotence over the feelings of the English nation, has become almost consecrated in their behalf. It was long before the parliament felt its strength, or knew how to use it. In the mean while the constitution, directly or indirectly, within doors and without, kept making head. During the struggles which the crown, reign after reign, was maintaining, sometimes with different members of the royal family, at others with the aristocracy, and at others against the church and papal usurpations, the people became important as allies. The people appear on the whole to have judiciously sided, where, according as the temporary pressure was felt to bear, it was for the interest of the public that they should side. It is difficult, owing partly to the uniformity which prevails at present, to comprehend the sudden turns which this instinctive policy might call upon them to make.

A sagacious and honest yeoman may have been with King John to-day, and with his barons to-morrow. To look merely at property: the Conqueror retained in his own hands fourteen hundred manors, the reserved rents on which Burke, in his Abridgment of English History, reduces to L.70,000 of the money of that period. The resumption of the grants of Henry VI. was prefaced by a public declaration that his ordinary income did not amount to more than L.5000. In the next reign we find Edward IV., independently of parliamentary supplies, the owner of above a fifth of the lay property of the kingdom. Within half a century the scale had again changed its balance. Wholesale confiscations, succeeded by the minuter and more politic arts of Henry VII. humbled the pride and broke the combinations of the nobility. Although the nominal rental of the royal demesnes was reduced to L.32,000 at the accession of James I., yet the idea of any danger to the monarchy from aristocratical competition was almost a faint tradition at the time of Lord Russell's trial. He justly exclaimed, in allusion to the apprehension, "We have no great men now." Previously to this revolution in society, it depended for the most part on the personal capacity and character of the sovereign, whether the contingencies to which a wise constitutional jealousy ought to have been most alive, would come from the turbulent intrigues of the aristocracy, or from monarchical ambition. The royal prerogative attracts the first and the liveliest attention, as its power is always present and most promptly felt. Besides, it was absolute in language, prominent in form, and often irritating in the subject and occasion of its exercise. But all the great points whence a cloud might have arisen over the freedom of the nation had been soon foreclosed, and, in spite of occasional, indeed numerous violations, were closely watched. There is no denying that many remaining prerogatives were absurd and even odious. Still the nature and the danger of the grievances to which the people were legally and practically exposed from them are usually overrated. The Stuarts let no prerogative drop willingly; and it is well known that they laboured hard to revive some that were obsolete. Yet Lord Bacon declared, on presenting an address to King James, that there was no grievance in the kingdom "so general, so continual, so sensible, and so bitter, as the preroga-

tive of purveyance." Nevertheless, what did it amount to when represented in money? From one cause or another, the commons receded from their negotiation, rather than buy off this their master grievance, and that of military tenures into the bargain, at the cost of an annuity of L.200,000. In the interval which elapsed between the depression of the nobles and the rise of the commons, the monarch had the stage comparatively to himself. The crown also at that critical moment passed into a line of able and haughty princes. Mr Hallam observes, that constitutional freedom was consequently retrograde from Henry VI. to VIII.; yet it is evident, from what passed during that period, that the hardy plant was not only alive, but safe. Bills in the form of acts, instead of petitions, which by adding to or diminishing from what the commons had petitioned for, had been for ages scandalously abused, begin with the reign of Henry VI. The first writ of habeas corpus, apparently so simple a result of Magna Charta, was obtained against Henry VII., the wiliest of the Tudors. Elizabeth had her father's spirit, and can scarcely be suspected of relaxing a hold which she could have decently retained. Yet in 1586 the House of Commons first succeeded in bringing the inquiry into election returns from out of chancery before themselves. By unfairly selecting the arbitrary passages from the reign of Elizabeth, and misrepresenting them as the ordinary course of her government, Hume gave both colour and currency to sophisms, which betrayed a much greater passion for ingenious paradox than for historical truth. The English people are wrong, it seems, in charging the Stuarts personally with the misgovernment which provoked the great rebellion. That misgovernment is represented to be nothing more than a continuance of the ancient English constitution, such alone as their ancestors had known it. According to this statement, the fault of the Stuarts would have consisted in carrying down the prior constitutional misrule into times which would no longer bear it. If such had been the fact, it is a fact which those times must certainly have known. But the understanding of contemporary parties was plainly all the other way. History has preserved the positive admission of Charles I. to the contrary, in a reference too remarkable not to prove that he was himself conscious of, and was aware also that his subjects knew, the whole extent as well as spirit of his innovations. What a satire on his own and on his father's government, that he should, in 1640,[1] hold it out to his parliament as a boon, that he would return to the precedents of a sovereign whom they had already endeared to the people as "Good Queen Bess;" whose reign, however, we know, notwithstanding, to have abounded with tyrannical executions, gross and frequent enough, it might have been thought, to have satisfied any of her successors. It is not the less true, that the time had come when the authority as well as the ceremonies of the court must undergo mutations, at which minds, with much larger views of government than that of Clarendon, would be startled, and perhaps annoyed. The state of society required popular changes to be admitted, for which no precise precedent could be found. Under these circumstances, men like Selden, for instance, a little too apt not to look for liberty beyond their law-books, must often have felt embarrassed how to act. The Stuarts, however, did as much as could well be done towards relieving their subjects from difficulties of this description.

Unluckily for the Stuarts, none of the innovations which they attempted, nay not even the consistent system to which it had been their object to bring the practice of their government, were so new and so outrageous as the principles on which they professed to reign. No country set a higher value than England, whether it was pleaded on behalf of the prerogative royal, or in the much more reasonable case of civil possessions, on the somewhat too stationary title of prescription. The coronation oath on the one hand, and the oath of allegiance on the other, the theory of the feudal system, and many passages in their annals, had accustomed them to look to a rough notion of contract as the criterion of submission. The divinity studies of the early lawyers, and the usages of the puritans, tended to influence the thought and language of modern times by the course of authorities in the Old Testament. But these views were common property. All went there for what they wanted, and all found it. The partizans of despotism and freedom, Hobbes and Locke, Bossuet and Algernon Sidney, discovered, the two first in Chronicles, the two last in Deuteronomy, arguments for their opposite systems. It was far otherwise with the novelty which the Stuarts took up, and made the creed of their supporters. The new creed was precise and positive, and the whole spirit of English history was in contradiction to it. No later than the 13th Elizabeth, a statute had been passed, declaring it treason to maintain in any wise that the king and parliament had not the power to limit the succession. It was natural to lament that the feeling of feudal attachment was decayed. But the doctrine of a divine hereditary patriarchal right was a strange invention to replace it withal. The cavalier loyalty of Ormond belonged to former days, and had nothing in common with the superstition of Mainwaring and Sancroft. Principles utterly inconsistent with all that had been ever written on the subject, almost with all which had been ever done, became the favourite and insulting theme of speeches, proclamations, sermons. Thence the dread of the convocation sitting after the dissolution of parliament; thence the unanimous resolution that their new canons would not bind even the clergy; thence the protests against the new pulpit law, to make the king more absolute than his predecessors. Roman Catholic ecclesiastics had put their hands to Magna Charta. The Oxford decree was the boast of the Church of England. The latter books of Hooker, on account of their heretical latitude, were to be made out to be fabrications; whilst Jeremy Taylor, the great ornament of his profession, pronounces that there are few cases of conscience in which a man may hope for half as much conviction as on passive obedience and non-resistance. Non-resistance was soon improved into absolute compliance. It became, in other words, the indefeasible legitimacy of modern days. These prodigies of doctrine defeated themselves. They misled the governors and provoked the governed, and, in James the Second's expostulation with the seven bishops, returned

[1] "At the opening of parliament, the king very frankly delivered himself to the lords and commons, and was resolved to follow their advice in repairing the grievances at home, which he confessed the necessities of the times had brought upon his people. All those, whether in church or state, he was willing should be removed, and desired that all things might be reduced to the good order and practice of Queen Elizabeth; which to the people of England were sure looked upon with the greatest reverence." (1. Clarendon, 519.) This important passage is printed for the first time in the last edition. It is one of the worst omissions in the former garbled text. The speech is imperfectly given in the parliamentary history, with a rather later date. It is in itself a complete answer to the comparison laboured by Hume. The truth is, that the Stuarts had a dread of English history, for its testimony against them. Bishop Nicholson observes, in his *Historical Library*, that the publication of the second part of the Glossary of even the orthodox Spelman was supposed to be delayed, because he had called Magna Charta, *Libertatum Anglicarum diploma et sacra anchora;* and that in 1614 the Society of Antiquaries was suppressed on account of the jealousy manifested by James I.

them their poisoned chalice to their own lips. A limited monarchy and unconditional allegiance are a contradiction in terms. The only consequence of allowing to a brave and thinking people rights and privileges in the statute-book, and yet closing up every practicable channel through which, if they are violated, a legal remedy can be obtained, is the generating a spirit which sooner or later must force itself a way by some great convulsion. Another revolution, and the example of a new dynasty, were made necessary to establish the truth of the opinion which Gourville expressed in vain to Charles II.: "A king of England who will be the man of his people, is the greatest king in the world; but if he would be any thing more, he is nothing at all." So evident, indeed, has it ever been since the Revolution, that no king can long carry on the government upon any other terms than by becoming the man of his people, as represented in parliament, that the royal legislative negative has fallen into abeyance for a century and a half. Elizabeth, at the close of one session, rejected forty-eight bills which had passed both houses. The last exercise of this prerogative was in 1692, when William III. refused his assent to the bill for triennial parliaments. With the modifications, and under the circumstances in which alone the negative of the president of the United States can be interposed, it is easy to see how the head of that republic may prudently venture on the exercise of a power to which it would be the height of imprudence in a king of England so far to put himself in opposition to both houses as to revert. It cannot be said that the change is in the mode of operation only, and that the king does now by influence what he used to do by prerogative. It is notorious that, on several occasions since 1692, influence has failed in doing that which the acknowledged prerogative would have done by its single word. The result is, that the king, who for many centuries was more powerful in fact than in law, is more powerful in law than in fact at the present time.

If under the same forms the rise of the commons has changed imperceptibly, but entirely, their relative position with regard to the crown, this has happened to a still greater extent between them and the barons. The power of the nobility consisted in their immense possessions, in the clan-devotion of their dependents, in their territorial jurisdictions, and in the original superintending authority of the supreme feudal court. The blow struck at their properties, both by force and artifice, speedily took effect. The shake once given was so certain of spreading further, that the formation of new aristocratical fortunes out of the monastic confiscations has never been made an imputation on the policy of Henry VIII. It was as the favourite of Elizabeth more than as the lord of Kenilworth, that Leicester succeeded in making the gentry of Warwickshire wear his livery. The original relation between lord and tenant implied protection on the one hand, and obedience on the other. If the tenant could not alien without the lord's license, the lord could not transfer the tenant's seignorial dependence without the consent of the tenant. The social movement, commencing at the top, naturally occasioned a relaxation in these duties and sympathies on the part of the lord in the first instance. This broke the charm. It soon became evident that king-maker could be the title of no future Warwick. There had been a series of concentric circles, through which the feudal feeling rose from the vassal of the mesne lord up even to the throne. But all gave way at once. It was clear that the mischievous distinction between a king *de facto* and a king *de jure* could not be recalled, nor the allegiance of the subject transferred from the regal office of the sovereign to his natural person and blood royal, when once the feudal feeling lower down the ladder had been so completely destroyed, that, in the words of the age of Selden, an English tenant would be the first person to lay his landlord by the heels. The landlords and the sovereign have been both amply indemnified in increased security, for whatever either may have lost. At the same time the constitution and the country have been infinite gainers by the general adoption of a more rational patriotism. The civil exemptions which the peers possessed in their individual character were all along insignificant. The judicial authority vested in their territorial jurisdictions was superseded by circuit judges, and by justices of the peace in every county. That which had been reserved to them collectively was of a kind more honorary than formidable, and one which there was little temptation to abuse. The small value which they attached to their power as a civil tribunal is proved by the intermission which took place of all writs of error to the lords from the time of Henry IV. till the accession of James I. Their criminal jurisdiction, except in the case of impeachment, was confined to the members of their own order. From the time that the commons were united with the lords, and their joint assent became equally indispensable to all legislative measures, the sole undivided glory of Bracton's baronial court was at an end. A statute of Edward II. declares that every legislative measure not sanctioned by the consent of king, lords, and commons, shall be void. It states also that this is according to custom. Nevertheless it was long before the commons had the courage to act upon this supposed equality. Sometimes they stultified themselves by way of policy, to avoid any possible responsibility. On ordinary occasions they felt themselves overshadowed by the neighbouring greatness of the lords. Thus they applied to them on great emergencies, begging that they would send some of their members to instruct them in their duty (as in 1st Richard II.), "on account of the arduousness of their charge, and the feebleness of their own power and understanding." In the same manner, on the insanity of Henry VI. they left the establishment of the regency with the peerage. "You, the peerage, in whom, by occasion of the infirmity, resteth the exercise of his authority." In the reign of Charles I. the commons are seen for the first time taking the lead, and carrying the lords along with them. Several of the lords in that crisis gave in their adhesion, and co-operated with the commons. Before this, the spectacle of their concurrence had always been, the commons walking in the train of the lords. New principles must accompany such a change. The House of Peers could no longer claim the privilege of legislating exclusively for the benefit of their order, nor proceed on the distinction that they sit in their own right, answerable only to themselves; whereas the House of Commons, as a representative body, is answerable to the people. The sophistical distinction can hardly serve at present to prop up the privilege of their proxy; a pretension not less incompatible than popular instructions with the first duty of a deliberative assembly. Fifty years ago, when Paley first published his Moral Philosophy, the peers had so far fallen into the back ground, and political reasoners had so far learned to look to reason only, that Paley defends the institution of a House of Lords as a part of the British constitution, on grounds which would have amazed Simon de Montfort, and perhaps somewhat scandalized John earl of Somers. His main argument is founded on the use of a second and totally distinct legislative assembly, in order to protect the state against popular caprice and fury. Ever since the Revolution, the *momentum* in English legislation has lain necessarily in the commons. The king and the lords have both sought to keep there a hold, by way of influence, so as to fight their

battle in that field always in the first instance, and thus procure an additional guard against the chances of more direct collision. The reform bill has to a certain degree stopped up the communications by which this arrangement had been in substance effected ever since, and, in fact, long previously to, the Revolution. Mr Hume remarks, on the existence of two legislative assemblies, separate from each other, yet each of them supreme, as one of the great anomalies of the Roman institutions. The characteristic danger of such a state of things exists also wherever the consent of two or more men is required in carrying on public business. The only difference is, that the danger in the latter case is often counterbalanced by greater advantages; and that the mischief will probably be less violent from their opposition in the passive shape of refusing to legislate in the same direction, than in the more active shape which their opposition might have assumed in Rome, that of positively legislating, one against another. It is evident, however, that a society, the elements of which, by the supposition, are not paralysed and torpid, must soon find out the means of evading the evils of a political stale-mate. The necessary unanimity can be only obtained by reciprocal compromises and forbearance. If we will have the benefits peculiar to such institutions, we must be content to pay the price. In the administration of justice, the limits which separate pertinacity and weakness is one of the difficult discretionary questions which judges and jurors have to settle with their respective colleagues. If every member of a jury or a senate were to be as impracticable as Cato is described to have been, institutions of this nature could in no country be allowed to last a week.

Mr Hume and Mr Bentham appear to agree in thinking, that in the case of numerous assemblies called upon to determine the much more extensive and variable questions which arise in the general conduct of political affairs, it would be unwise to rely upon the exercise of a similar discretion, as sufficient security for the analogous compromises which are nevertheless indispensable conditions to an efficient co-operation. For this purpose they both acknowledge the propriety of some species of influence, which shall make the one to a certain degree dependent upon the other. In such a case the only question which remains practically to be argued will be its nature and the mode and degree of its exercise. If Dr Paley gives too much countenance to influences approaching to a sordid bias, Mr Hallam, it may be feared, is somewhat too confident in the assurance that moral influences will of themselves always secure a just, or at least an adequate, concurrence.

Polybius has shown that the simple forms of government, however suited originally to this or that stage of society, necessarily become in time unsuitable. What he describes as the specific germ of decay, "congenite in each form," would be more properly described as an alteration in society itself. This alteration drags the government after it into the requisite modifications of its form. It is one of the great merits of a mixed government, that, without the violence of a revolution, it can accommodate itself to these changes in a community, and pass the initiative with comparative facility from one class to another, just as the leading shoot in society may happen to be making head. Under a nominal invariableness in the balance, some variance in the weights must always be going on. The crown was not easily content to resign the ascendency it once enjoyed. When the higher classes had to outward appearance ceded the political powers they had formerly possessed, they were enabled afterwards by circumstances to continue in the covert enjoyment of it, to a much greater extent and a much longer period than any one could beforehand have presumed. James I. probably was not aware of the tendency of the proclamation by which, on calling his first parliament, he directed the sheriffs to address the writs upon a principle substantially the same as the late reform bill. There can be no greater proof, on one hand, of the respect of the people of England for ancient forms, and, on the other, of the moderation by which the higher conciliated the jealousy of the middle classes, than the fact that the adoption of this principle was postponed during the next two hundred years. In those classes, including the gentry and independent commonalty of the realm, in whom for some time past the heart's blood of the country has mainly been formed, the reform bill has at last placed the command of the House of Commons. The power which this portion of the community before exercised indirectly over the whole parliament, and especially over that house, it now exercises directly. The consequence is, that there is a much greater security than before, that no measure detrimental to their interests, and in opposition to their feelings, will be agreed to by a House of Commons of which they are themselves now made the constituents. There need be no fear for the duration of moral frame-works like that of government, on the ground of their supposed analogy to the growth and decay of material forms. There seems also no better foundation for the inference drawn by Polybius, in his comparison between the governments of Carthage and of Rome as they existed at the time of the campaigns of Hannibal, where he says that a mixed government, in which the preponderance has passed from the monarchical and aristocratical to its popular members, has run its course, and is so much nearer to its termination. Difficulties enough remain inherent in the nature of all government, which no possible adjustment of the machinery can reach. But a mixed, though incomparably safer than a simple, government, has some difficulties peculiarly its own. It depends on a nicer balance of proportions, and it calls for a greater degree of temper, patience, and mutual concession from its members. A rational and public-spirited House of Commons must be in constant danger of offending one or other of the extreme parties in the state. Whilst its honest concurrence with the other branches of parliament must frequently incur the displeasure of the demagogue and his mob, the sovereign or the peerage, one or both, are often not unlikely to regard its general or particular opinions with equal jealousy. A constitution thus settled is only safe as long as the more intelligent part of society can take advantage of its intermediate position, and arbitrate between the extremes. A House of Commons, identified with the great arteries of the nation, contains within itself no inherent security for good government, beyond the power of stopping bad measures, and of sending good ones up for their acceptance to the other partners in the firm. If they accept, well; if they reject, a class of cases arises, on which all the good sense and good humour of a country may be wanted, in order to guide a people to discriminate aright on the course which it becomes them to pursue. Unless a power of rejection, according to a liberal construction of independent judgment, be conceded, the whole benefit of a second assembly will be altogether lost. The power of rejection may, however, be so exercised by a headstrong monarch or by a small hereditary body, especially when, in the case of the latter body, the greater part of the legislature have been recently raised to the peerage from the ranks of one political party only, as to amount to a declaration that they are looking only to themselves, their own interests and passions. A civil disseverance from the sympathies of the nation, like that of the Roman Catholic clergy, justifies the extreme remedy of removing the obstacle by whatever

Government and Laws.

means. The occurrence of such fatal obstinacy in the person of the sovereign, would be an exception to every presumption upon which hereditary monarchy is engrafted on a mixed government. The contingency of so remote and so insane a possibility could only be formally counteracted by some such expedient as is adopted with respect to the veto of the president of the United States. In the instance of a refractory House of Peers, the constitution has given the king the means of applying this remedy by a creation of additional peers. This course was taken by Queen Anne on a much more questionable occasion, namely, for the sake of a mere ministerial majority. It is not the less clear that a justifiable occasion might occur. If the king took courage to apply the constitutional remedy, all would proceed as usual. If he shrunk from it, the public would be remitted to those ultimate considerations of civil prudence which are always in reserve. They are the very same considerations which justify the sacrifices of natural liberty which men must make upon entering into a commonwealth. They may equally justify the sacrifice of social order which man is called upon to make whenever a commonwealth is overturned. It is to higher authorities than the precedents which are to be found in Rushworth, that freemen have recourse when they are compelled to seek new modes of legislation by forms which announce that the constitution has been destroyed.

The spirit and effect of institutions and of measures depend, as has been shown, in a great degree upon circumstances beyond themselves. The same institution at different periods produces very different results, whilst the collateral and unforeseen consequences of a measure are frequently much more considerable than the objects which its framers had in view. All that is most important in the present forms of the English constitution, is of a certainty to be traced, however obscurely and imperfectly, from a very early date. At the same time, it has become what it is, only by making the most of a series of fortunate contingencies. The English government may be advantageously compared with the Roman in its best characteristic, the tendency to progressive self-improvement. In the nature of the improvements there can be no comparison.

According to the process pursued, the substance has been in a course of much more extensive alteration than the forms. With regard to the latter, the change has chiefly consisted in removing partial impediments out of the way of certain movements, in strengthening particular springs to meet particular pressures, and in separating the several parts of the mechanism by more positive divisions, lest they should clash one with another. The manner in which the English clergy overreached themselves, by standing on their claim to exemption from temporal jurisdiction, and on their right to be taxed for temporal purposes, if at all, by themselves only, and in an assembly of their own, is very instructive and curious. They chose to remain apart, a separate estate; and resisted the attempt of Edward I. to incorporate the inferior clergy in the House of Commons, when that house as yet existed mainly for taxation. They procured their convocation about the same time instead of it. Afterwards, in its palmy state of general legislation, they discovered, when it was too late, that their exemption was turned into an exclusion. In 1663 the supreme head of the church of England found it no longer necessary to keep up appearances with a body already but a shadow. Without a law, a struggle, or even a word, convocations have died away. The clergy, on submitting to taxation by a temporal assembly, have acquired in return the humble privilege of voting for the members of a house in which they cannot sit. A few bishops in the upper house are all that remains in the English institutions, of that third estate which was so necessary a part of the diets and states-general of the continent, and which made so great a figure in our own original constitution. The suspension of the royal negative, and of ecclesiastical convocations, has, almost unobserved, become part of the modern English system. Yet the change which has been thus operated is far more important, though it is short of what it is sometimes represented, than many which have been the subject of fierce contentions, and introduced by the most deliberate enactments.

Legislature.

The transitions which we have hitherto been considering, are independent of and paramount to legislation. They follow slowly but necessarily the variations in the condition of society and in public opinion, which must decide nine tenths of the materials and spirit of every government. We proceed, therefore, to consider the principal alterations which positive legislation has successively effected in the three great divisions of political power.

The main objects of a government have been mentioned as being the making, interpreting, and executing the law; the first being the office of the legislature, the second that of the courts of justice, the third that of the executive administration. It will be proper to examine each shortly in detail, both as to its duties and its form. The English legislature, acting together as king, lords, and commons, is vastly too cumbersome to take upon itself the detail of the executive. This union, therefore, has never been thought of. Its incompetency either as a whole or in its parts to discharge judicial duties is not so soon perceived; consequently bills of attainder, of pains and penalties, and impeachments, are part of the legal history of the most recent times. In the infancy of courts of justice, and when the traditional supremacy of the *aula regis*, out of which both they and the legislature had emanated, was yet an active historical recollection, parliament in all extraordinary cases continued to claim an original judicial authority. But this pretension gradually dropped, and the appellate jurisdiction is now evidently near its close. Regarding the legislature in its legislative capacity only, it will be seen that its form has remained the same as a whole since the first admission of representatives from the commons. The changes which have taken place have been confined to the construction of its constituent parts, and to the view taken of the characteristic rights peculiar to each.

In considering the several members of the legislature, the king takes constitutionally the precedence. Nothing can be more superficial and incorrect than the view presented by Blackstone of early English history upon this part of the subject. It was not until the accession of Edward I. that the several titles of election, descent, and testament, on which the claims to the crown were before rested, as best served the occasion, became consolidated in that of hereditary descent. This appears to have taken place in analogy to the descent of land. The rival pretensions of the houses of York and Lancaster tended to throw the law once more into confusion. Being principally tried and determined upon the field of battle, the law had too much the appearance of giving way to force, or to its hollow consequence, a mere ostensible election. Yet, even in those times, there was no notion that the crown was left at the personal disposal of the monarch. William the Conqueror, it is true, had set up a donation from Edward the Confessor. But Richard II. on giving his signet to the Duke of Lancaster, as testifying his wish that the latter might succeed him, added, "but that did not depend upon his pleasure." The lords, in a remarkable lecture to the protector, the Duke of Gloucester, whose powers under the will of Henry V. had been limited by

Govern- ment and Laws.

the parliament (for lords and commons are mentioned in the act), say his desire was grounded neither in precedent nor law; " the which the king that dead is, in his life, nor might by his last will, nor otherwise, alter without assent of the three estates, nor commit or grant to any person government or rule of this land longer than his life." The extraordinary provision of 28 Henry VIII. c. 7, is the first and only instance of putting the crown into settlement, with a remainder " to such persons as the king by letters patent, or last will and testament, should limit and appoint." It is plain that the testamentary power so granted to her father had puzzled men's minds in the time of Elizabeth; and that temporary authority to bequeath the crown has to answer for the strange and almost oriental scene by which the death-bed of that princess was disturbed. Since the Revolution, however, the parliamentary title is the one established in fact. Since the reign of Elizabeth it had been the only one recognised in law. The king never had a legislative initiative, but only a simple concurrence. The change of the form from petitions to bills, took away no right, but only an abusive advantage. The real legislative authority of the crown still continues in point of law the same that it has ever been. It was at no time more than at present, at no time less. The right to make law by proclamations, and the right to unmake it, whether by the repealing *dissimulavimus* of Edward III., or by a dispensing and suspending power, were always arbitrary usurpations. For these are utterly inconsistent with the principle, and almost with the letter, of the statute of Edward II., which had declared the assent of the lords and commons to be as necessary as that of the king; since the maxim that the same solemnity which bound is required also to unbind, is a rule of English law. The disuse of the royal negative since the reign of William III. is purely matter of discretion; however paramount the political necessity by which that discretion is determined.

The peerage was formed, under the feudal system, upon the principle of tenure, that is, of land held directly of the king; the mitigated sense in which the soil of the western world was understood to belong to the sovereign having been always very different from the absolute ownership of the sovereigns of the East. At the first, all tenants in chief had a right of summons to parliament, not yet known, however, by that name. During the period which elapsed between the demise of John, the last year of whose reign is remarkable for the division of the greater and lesser barons, and the middle of the reign of Richard II., when peers were first created by letters patent, tenure began to be disregarded. The political principle had so far got the better of the feudal, that in the 49th Edward III. the ancient writ of summons was changed from homage to ligeance. The further difference in the form of this appointment, as whether it was to be made by writ or patent, was of little consequence. But the dispensation from the necessity of holding land in chief was an important innovation. On the one hand, mere territorial possessions, distinct from descent, ceased to confer a title to a writ of summons; on the other, the writ in its general form might easily in time, by multiplying cases of dependent poverty, have turned this august assembly into the lacqueys of a court. It was well that a sense of dignity took the other course; though disfranchisements on account of poverty, as the act degrading the Duke of Bedford in the reign of Edward IV., and the resolution against Lord Ogle in the reign of Edward VI., were precedents liable to be abused. The questions, where the power of creating peers should be lodged, and the terms on which it should be exercised, were likely in early times to be determined by other circumstances than reason. The mode finally adopted, by which the power is intrusted to the sole discretion of the crown, appears to be, upon the whole, the most desirable. Yet the prerogative was so unsettled in practice, and probably also in law, that down to the reign of Henry VII. the assent of parliament was generally expressed in patents of personal creation. Upon this usage West founded his theory, in opposition to Prynne, that such assent was a necessary condition. Whatever may have been understood to be the law, the practice was liable to all the objections so triumphantly urged against the bill twice proposed by Lord Sunderland in the beginning of the last century, for limiting the number of the peerage. Whilst a restraint upon the royal prerogative of creating additional peers would occasion more evils than it could cure, no similar risk accompanies the withholding from the crown a power of punishing by exclusions or of privileging by exemptions the actual members of that body. Accordingly, Lord Coke holds that even dispensations, answering to the excuses formerly besought by poor boroughs, granted by the king in relief of lords petitioning to be spared the burdensome service of attendance, were contrary to law. The mode in which the prerogative of creation was exercised varied with the times, but never seems to have been felt to be a grievance. The jealousy of the Stuart creations before the breaking out of the civil wars, and the remonstrance against the Scotch and Irish honours, was only a temporary ebullition. The degradation which the decay of families might have brought upon so much of the peerage as was called by a general writ of summons, came to a certain degree within the control of two principles: the one, that a patent without words of inheritance is simply a dignity for life; and the other, that peers might be summoned only to a single parliament. There are instances of ninety-eight laymen who were summoned only once, of fifty others who were summoned two, three, or four times. The present course, however, of descendible nobility, is as old as the reign of Elizabeth. The uniformity of our modern usage would be corroborated, amongst other causes, by the contemporary extinction of a corresponding variation which had previously subsisted in the summons of the ecclesiastical members of the House of Lords. The bishops are said to sit by a usage compounded of a triple title. They are supposed to be the representatives of the church, to have been more learned counseilors than the lay nobility, and to be the life-proprietors of the baronies attached to their sees. The last condition, however, is wanting in the sees erected by Henry VIII. But parliamentary bishops formed a small portion of the spirituality in the upper house. Out of one hundred and twenty-two abbots and forty-one priors, who occasionally sat previously to the dissolution of the monasteries, it appears that only twenty-five abbots and two priors were constantly summoned. There are numerous instances of the allowance of exemptions to abbots and priors after summons, by reason of their holding nothing of the king. This ground of exemption, as insisted on and admitted, shows *whence* the duty was derived. It does not follow but that the grounds of *right* on their part might be more extensive. It is according to this distinction that the writ requiring the attendance of the temporal nobility by summons, belongs to a period and style when its duties were an *obligation*, and were recognised as such; the patent to a period when they had become an *honour*. The most important parliamentary change, however, which collaterally resulted from the dissolution of the monasteries, was the subordinate condition to which it reduced the church numerically in the House of Lords. This alteration was likely to diminish the general political influence of the church much more than the subsequent cesser of the convocation in 1663.

Government and Laws.

The authority of the convocation being confined to the clergy, the public at large had little immediate interest in its operations beyond the share which they might therein please to assess themselves by way of ecclesiastical contribution towards the public burdens. In point of fact, the temporalities even of the church seem to have lost nothing from either cause; much less its substantial influence. Few will think, whilst the clergy have been shut out from the lower house of parliament, and are now represented by thirty spiritual peers only, that their friends have not done for them behind their backs quite as much as they could have done for themselves if present. The influence of the church of England in its apparently almost unrepresented and unprotected state, is a great proof how little comparatively depends on the means by which an end is to be produced, when a power, composed of a wealth, an intelligence, and an opinion competent to produce the end, is really in existence out of doors. Although the dignitaries of the Roman Catholic church varied in numbers from time to time, yet they always formed the actual majority of the House of Lords up to the Reformation, which, nevertheless, they could not stop. Here, again, with what prudent reserve did the Roman Catholic clergy husband for ages the political power which mere numbers vested in their hands; and how evident is it that, whatever form, even of superstitious incarnation, the dominant spirit of a government may assume, it is only by compromises that it can subsist. The Stuarts, the great examples of every species of political misrule, would have been ruined by this alone; they were bent on acting up to the very extent and margin of their powers. Nobody reading English history previously to the Reformation would have an idea that during all that time the temporal nobility were in a minority; that therefore their legislative importance existed only by permission; and that every act of the House of Lords might be said to be in strictness the will and pleasure of the church.

The number of the lay nobility has fluctuated considerably. It had advanced from fifty-five in the reign of Henry VIII. to one hundred and six in that of James I. It is at present 420. The aristocratical complaint made by Lord Delamere under James II., that, ever since the time of Henry VII., a systematic project had been pursued to humble the peerage, by means of multiplying its numbers, and by introducing into it persons of mean extraction, was particularly injudicious. Unless something of this kind had taken place, the extreme disproportion between the two houses, in their external as well as in their personal titles to consideration, would have deprived the peerage of a great part of its present strength. If the order was to be more than a pageant, it became most desirable to increase its numbers to the extent of giving them a better chance of bearing some comparison in ability and character with the select representatives of the rest of the nation. It was scarcely less so to recruit into their ranks those members of the commonalty who, whatever might be the obscurity of their pedigree, were most distinguished for their wealth or services. Thus alone could the body have been protected against the narrow sense of corporate pretension which must otherwise have infected it. The long recollections which feudalism has left, and the recent jealousy which has collected around corporations, notwithstanding their former usefulness, demonstrate the depth of the national re-action, which all invidious exclusiveness unavoidably provokes. In fact, no amount of popular opinions has been sufficient to save the combination of the great Whig families from a suspicion of aristocratical tendencies of this description. The popular criticisms on the corn-law legislation of landed proprietors are a proof of the keenness which watches every supposed connection between public policy and partial interests. An evil not quite similar, but equally, indeed in all probability more, destructive in its consequences to the object and safety of the peerage as a branch of the legislature, must follow, whenever its vacancies are too long filled up from a particular party in the state. It is self-evident that the chances of a difference of opinion between a House of Lords partially constructed, and a popular House of Commons, cannot be raised with impunity beyond a certain point. Under the most accurately-balanced government, the question, whether the Lords shall at any time interpose their legislative negative, must of course, as in the case of the king, depend at last on their own discretion. The difference in practice is found in their respective positions. There can scarcely remain a possible presumption in favour of the single opinion of a chief hereditary magistrate, when a majority of the nation, aware of that opinion, is found constitutionally ranged against him. On the other hand, abuse in their original appointments, and ignorance of the duties and necessities of their station, must have gone to an extravagant length indeed before a body of the nature of the House of Lords is put in equal peril by the rejection of whatever measures may be sent up to it by a majority of the House of Commons. Take either extreme; a House of Lords in constant collision with the Commons, or a House of Lords only occupied in registering its edicts. In the former case, it cannot exist long; in the latter, it is already existing only in name.

The popular part of the English constitution is lodged in the House of Commons, which originated in the year 1295; and, in its present extension, consists of the representatives of different interests or sections of the community, by individuals of their choice. It is very singular that the simple expedient of popular representation, an indispensable condition to every form of a free government in a great kingdom, never occurred to the legislators of antiquity. By this device, the experiment of a free government is entirely changed, and becomes, under all circumstances, infinitely more practicable, safe, and beneficial. According to the ordinary theory of the English constitution, the House of Commons is said to represent the whole population, as far as it is supposed to be by its circumstances independent. Of these, the knights, or the members returned by the freeholders of the county, are alleged to represent the interest concerned in agriculture; whilst the citizens and burgesses, or the members returned by certain towns, have been described as representing the interest concerned in trade. The basis of English representation, at first very limited, and long extremely fluctuating, was never so extensive as to answer to the first part of this theory; and time rendered it, by the rise of some places and the fall of others, still less so. The reform bill has probably more nearly approximated towards realizing the theory of a representation as universal as the independence and intelligence of the people, at the present than at any former period. The most that can be said of the latter proposition is, that some such division as it assumes between real and personal property, agriculture and trade, probably appeared originally between the two classes of members. This was the natural course as long as the duty of the House of Commons was confined to taxation. The original demarcation would probably continue visible as long as parliamentary attendance was considered as a burden rather than an honour. Historically, this and any similar distinction gradually fell into disuse soon after the 23d Henry VI. That statute required the knights of the shire to be actual knights, or such notable esquires and gentlemen (*generosi a nativitate*) as had estates sufficient to be

Government and Laws.

knights, and by no means of the degree of yeomen. We find that a county member who had been actually elected, was set aside because he was not of gentle birth. A great change must be commencing before the possibility of the want of such a precaution could be suggested; and still more before the precaution, when taken, should not immediately succeed. The change may be assumed to have begun as far back as the 19th Edward II. when there were twenty-eight county members who appear not to have been knights. Of course the arrangements and very elements of society must have been still further broken up, before a manufacturer could have a chance of a successful nomination with the freeholders of a county court. It is but little that positive legislation upon these points either accelerates or retards. It can recall nothing; and, to be effectual, must continue to be in harmony with the wants and character of the times. This was abundantly proved in the failure of the statute of Henry V. the object of which was to compel members to be inhabitants of the places for which they served. The attempt fixes the era when the deviation from the old connection was attracting general attention. Its pertinacious vitality in the statute-book is a striking instance also of the extreme reluctance with which the English people, so far from anticipating needless innovations, have consented to affirm the innovations made by time itself. Prynne shows that Cornish names were formerly returned in the elections for Cornwall, and northern from the north. Clarendon opens his memoirs by stating the little communication which passed between different parts of the country, even with the metropolis, almost to his own time, except in the circuits of the lawyers. The names of the members for the counties were aristocratical, those for the boroughs plebeian. A few burgesses begin to be called esquires in the returns of Edward IV. By this time the House of Commons was becoming of sufficient importance to render parliamentary influence with a borough an object of ambition to the nobility and gentry of its neighbourhood. The character of the borough representation opened and extended itself accordingly. It soon embraced every description of person who had a claim to enter into public life. The lawyers, to whom attendance was probably less personally inconvenient than to others, appear to have come in earlier for more than their reasonable share. But this expansion and adaptation beyond its original purpose could alone have made the inequalities and anomalies of the borough representation tolerated so long. The citizens and burgesses, though always more numerous, seem to have felt their social inferiority, and for a long time to have continued more humble minded than the knights. Of the three hundred members, the average number from the 23d Edward I. to Henry VIII., a third or more were returned by the boroughs. During this long interval the sheriff exercised a discretion, to the use or frequently to the abuse of which the parliamentary existence, by prescription, of many unincorporated boroughs is to be ascribed. Boroughs by charter, even from mesne lords, and towns, whether the ancient or the actual demesne of the crown, made up the list. Many boroughs were originally inconsiderable places; and others imperceptibly decayed. This latter cause would take effect from the reign of Henry VIII., the date at which the elective franchise became constitutionally too valuable to be left, when it had been once enjoyed, to the mercy of the sheriff, or to be allowed by its possessors to drop into disuse. The royal prerogative of new creations which existed in the House of Lords, existed also over the borough compartment of the House of Commons. Elizabeth indulged herself in the plenary exercise of it in England, as freely as her successor did in Ireland; but, supposing that her subjects had ventured to remonstrate, she was too wise to have ventured, in return, on his indecent answer: "The more the merrier, the fewer the better cheer." The prerogative of adding to the boroughs, however, is one which could not last in an enlightened age. The same reasoning which pleads against a parliamentary or popular appointment of the peerage, presumes a parliamentary or popular appointment of the commons. It is not so surprising, that after the shaking up of the political opinions of the nation during the civil wars, one instance only of borough creation (that of Newark) should have occurred, as that Charles II. should have made the experiment even of one. Borough creations were the great reservoir whence the successive accessions to the numbers of the House of Commons had been supplied. Nevertheless, owing to the course pursued previously to the passing of the reform bill, the interests engaged in commerce and manufactures appear, notwithstanding the vast contemporary augmentation of their wealth, to have had less power in parliament, or at least less influence on legislation, than in an earlier age. The House of Commons in the first parliament of James I. consisted of 470 members. The last unreformed and the present reformed representation, reckoning the additions derived from the Scotch and Irish unions, are not much more numerous. They both give a total of 658. The difference between the two lies in the proportions in which these numbers are divided amongst the several classes of the people. It has been calculated that a hundred and fifty-four persons returned a majority of the former house. Counties formed the only large constituencies, whilst scarcely a single large town was represented. At present the franchise is compounded of a ratio of property and numbers. Mere nomination is destroyed; and, on analysing the numbers, it will be seen that the members for counties are 253, the members for towns and the universities 403. This question of proportion, though it has been assumed by critical writers, was evidently never before seriously thought of. The necessity of entering on such comparisons had not yet arrived. The means of securing the impartiality of the sheriff, and the independence of the electors, was formerly a more immediate and important point. It is impossible, from the gross partiality of the sheriffs (officers annually appointed by the crown), to reason upon the old returns. The freeholders of a county court were of course placed comparatively beyond their reach; yet sheriffs contrived to aid in the virtual disfranchisement even of counties. According to Prynne, it appears by the indentures that, as late as the 8th of Henry VI. the attorneys of a few great people could dictate or manage on occasion the representation of Yorkshire itself. In the meanwhile political information was spreading. Reformers of all kinds sallied forth. The decayed boroughs, and the consequent flagrant inequality of representation, became the subject of a criticism, founded on theories more or less correctly derived from the practice of earlier times. The very word representation provoked observation, and was in many instances in ridiculous contradiction with the fact. It appeared impossible that this could be what the constitution intended by the name. Even James I. was struck by it on his accession. The charge given by him to the sheriffs, on calling his first parliament, not to direct a writ to any ancient town, being so ruined that there were not such sufficient residents as to make a proper choice, comprehended a most desirable reform. The fault was in the mode which he proposed for carrying it into effect. The supposed prerogative was more than could be safely entrusted to a sheriff of James I. The system grew more unreasonable every day, both in reality and in appearance; and, to complete its indefensibleness, the stain of corruption gradually crept in, and

Government and Laws.

deepened the offensive spectacle into a scandal and a nuisance. The reform bill has at last brought this long outstanding grievance to a satisfactory conclusion. The elective basis is so enlarged as to comprehend all the elements of sound national self-government, and the independence of the electors is amply secured against all danger but from themselves. The interference of the executive in elections may be more immediately dangerous to freedom; but a constitution undermined by corruption is infinitely more disgraceful to the parties who are guilty of it, and to their fellow-countrymen, who sit still in stupid connivance at their baseness. Lord Coke, mentioning the first case of bribery on record (in the 13th Elizabeth), denounces it "as poisoning the very fountain itself." The disease was communicated slowly. It is not yet a hundred years since it had reached the height and notoriety of being a public evil and a national dishonour. Clarendon, in his disdainful notice of the first ministerial intrigue in order to buy over a majority by bargaining and not by reasoning, leads us back to the origin and cause of all. He fastens on the government the first link of the chain, the length and burden of which naturally increased at every remove. Bolingbroke, the distinguished father of the modern Tories, lays the principal blame of it on Clifford. Members who could make money of their own votes, found it was worth while to pay for the votes of their constituents. Evelyn's *Memoirs* contain frequent ejaculations on the increasing expense and debauchery of elections, before and after the Revolution. In works of the date of Brown's *Estimate* and Chesterfield's *Letters*, it is noticed, for the first time, that the franchise of making laws for the English people was disposed of by boroughmongers under private pecuniary contract, or brought openly to market by burgesses and freemen, for the competition of public sale. The expense of elections, to say nothing of bribery, had become so ruinous, even in the earlier days of Burke, that in a speech on one of Mr Sawbridge's motions, he says, "the expense of the last election has been computed (and I am persuaded that it has not been overrated) at L.1,500,000—three shillings in the pound more than the land tax."

The antiquarian question of the origin and progress of the House of Commons is interesting, not merely as the title-deeds to English freedom, but as constituting an important chapter in the history of man and of society. It describes the germ and development of an institution which, in its extensive and permanent application, is an invention of modern times, and the most likely of all, not even excepting the steam-engine and the press, to influence the fortunes of the human race. In this view, the great consideration is not so much the steps by which its component parts were formed, as those by which its authority was obtained. There can be no doubt that the early summons to the commons was not honorary, but onerous. Long after the general right was perceived to be a national advantage, the particular exercise of it was felt to be an individual hardship. The real history of almost every people is in its exchequer. This is emphatically the case with England. Fiscal considerations lie at the bottom of its most celebrated institutions and enactments. Every body worth taxing was to be got at in some form or other. The right of arbitrary tallage upon towns was limited and invidious. It was abolished in the 25th Edward I. by the time that the new experiment was coming fairly into play. In the facilities which representation afforded to taxation, government soon found a compensation for the slight additional control and inconvenience which the co-optation of the commons into the legislature might by degrees and at times occasion. The yeomen owners of freehold lands were to give an account of their pecuniary capabilities in that character. Wherever property had grown up in other shapes, as in towns, it was also to be made amenable. Apparently when this was done by way of deputies, which was the ordinary mode in the estates and diets of the middle ages, no particular directions issued. There is not a word said in the writs concerning the qualifications of the electors, or the numbers to be elected, or the forms to be observed, either in counties or in boroughs. Two was the number fixed upon, probably to prevent subsequent confusion, either by prevarication, mistake, or sickness; and usage would soon turn the practice into law. Whilst taxation was the great object at stake, it was one in which all might equally be trusted for labouring to reduce the subsidy to the lowest point. The franchise in boroughs would easily devolve from the towns' people at large to a select council, when all that the voter got by insisting on the privilege, was a liability to pay his share towards the parliamentary wages of the member. The election struggles of a later age, indeed ever since the committee of which Serjeant Glanville was the chairman, have been vain efforts to undo the effect of these irregularities and encroachments. But the great objects of a national legislation and the spirit of freedom were of older date. Long before the actual existence of the commons as a third estate in parliament, the barons had extorted from their monarch, and had transcribed into the rude articles of Magna Charta, a principle and a feeling, before which the traditional longings after the laws of Edward the Confessor speedily expired. There was little left for the patriots of after times to add, but the necessary machinery of more adequate forms and institutions. Magna Charta seems to have been looked upon almost as a personal contract, which it was necessary to renew at the commencement of every reign, in order to make it binding upon successive sovereigns. The terms of its successive confirmations (Lord Coke reckons no less than thirty-two) fixed in the minds of men an inseparable connection between the grant of supplies and the redress of grievances. The House of Commons put forth at different periods the claim to its peculiar privileges and its general powers. As early as the reigns of Richard II. and Henry VI., we find it refusing to proceed in the public business without a sufficient answer. For a time the two houses voted separate and unequal aids. The first notice of the maxim that parliamentary aids must be granted by the commons and agreed to by the lords, appears in the 9th Henry IV. As the report expresses it, when both are of accord, the grant is to be signified to the king by the mouth of the speaker of the House of Commons. This is said to be "in manner and form accustomed, to the end that the lords and commons may have what they desire of the king." The strictness of this privilege can never have stood on any sufficient reason. It was unimportant whilst the two houses voted their subsidies singly, and bound each other to different amounts, which continued to be the course with the clergy in convocation to the last. It was still more indifferent which of the two began from the time that supplies were voted by them in concurrence, since either house, by the use of its negative, could protect itself. Restraints on the initiative are not worth contending for. The exclusive right of determining all questions connected with the elective franchise would have been a more equitable distinction. Upwards of a quarter of a century before the third estate was called to parliament, the barons had paid the subsidy demanded of them into the hands of four of their own order, with directions to expend it at their discretion for the benefit of the king and kingdom. It was not until after the Restoration that the House of Commons was provoked, by the scandals of the court of Charles II. to adopt the much more respectful form in use at present, for the control and appropria-

tion of the national expenditure, although Clarendon declaims against it as an unheard of innovation. Of all their civil rights, immunity from taxation, except through parliament, has been that of which the English people were most tender, and which they first succeeded in thoroughly and irrevocably establishing. After the reign of Edward III. a few attempts, ill concealed under the soft words of loans and benevolences, are slight exceptions to the universal current of precedents. On this, admitted by Clarendon to be the clearest of all points, the Stuarts dragged the judges with them into the abyss. The patience and perseverance of the English people are equally signalized in the steady parliamentary resistance by which the account of ages was closed with the act of the 16th Charles I. c. 8, against the imposition of tonnage and poundage, without consent of parliament. It is the last act in the statute-book against arbitrary exactions of revenue. The right to participate equally in general legislation was obtained early, but slowly enforced. The 15th Edward II. had recognised the necessity of the concurrence of the commons to all measures whatever in the most positive terms. It is probable, however, that for some time afterwards, its assent for all purposes except taxation was little more than constructive. The commons, it is true, after the next reign, figure, by name at least, almost always in the enacting clauses; the laws being generally said to be made by the king, with the assent of the lords, at their request. At this period, however, the king, by diminutions and additions to a petition, often so completely changed its nature, as to become himself the real legislator on its contents. They consequently insisted, in the 2d Henry V. "considering they had ever been as well assenters as petitioners," that without their assent it should be no statute. The abuse was only put an end to in the reign of Henry VI. by the slight variation of drawing up the bills in their present form. There is only one instance mentioned during the tyranny of Henry VIII. of the rejection of a bill supported by the crown. The commons found courage on several occasions to resist the measures of his children. The year 9 Henry IV. above referred to, is also remarkable for the first assertion in behalf of freedom of speech in parliament, by declaring that the king is to take no notice of what passes there. This impunity is confined, however, to the locality of the speech so spoken. A publication of it by the press or otherwise is responsible to the ordinary law. The earliest definition of privilege on arrest is in Larke's case, in 8 Henry VI. The case of Storie in the 4th Edward VI. is the first commitment which has been recorded of one of their own body for contempt. In proportion as the House of Commons became gradually more and more mixed up with the general affairs of state, the possession of these powers and privileges rose in importance, as being essential to its independence. Mere assurances of this or that immunity are of no avail, unless the means of realizing them also exist. The necessity to which Sir Thomas More was obliged to yield, of retiring into private life, in order to escape the displeasure of Henry VII., on account of a speech in the House of Commons, shows that the season for a valid parliamentary opposition had not yet arrived. In the attack upon the five members in the house itself, Charles I. outheroded himself. On other occasions, he had lain in wait for the dissolution of parliament, which was his usual signal for resuming more open hostilities against the liberties of his people. As soon as the speaker's mace had been disenchanted of its protecting power, the royal warrant was wont to go forth against the most popular of the late members by whom his illegal designs had been principally thwarted. The law and the fact, however, improved together. Both houses have long been in possession of whatever powers can be necessary for the performance of their public duties. Popular members are as safe after as during sessions. Nobody dreams of intimidation. Parliamentary corruption has not merely declined; it has almost disappeared. If a comparison between the pensioners and placemen of ancient parliaments, with the modest list of officers of the crown sitting there at present, be satisfactory, what ought to be felt at the contrast between the unblushing bribery of Walpole's administration and the purity of modern governments? The compulsory economy introduced into the treasury has co-operated, with other causes, of which the chief is public opinion raised under the sanction of the middle classes, to elevate the standard of public morals amongst public men. The boundary which separates legitimate and undue influence, is that at which practical politicians no less than theoretical reasoners have arrived at last. As corruption began at the top, it has first ceased there. Whatever remained to be done in improving the public spirit of the elected, as well as of the electors, it is the direct tendency of the reform bill to accomplish. The elective franchise is now thoroughly identified with the nation, and is made, in the eyes both of those who choose and those who are chosen, more visibly and entirely a public trust. The destruction of the nomination boroughs leaves no pretence for the open constituencies which persevere in converting the trust into a sordid personal advantage. The parts which unfortunately appear to continue tainted are as yet inconsiderable. Unless they yield to the alteratives by which the whole body politic has been renewed and strengthened, they must be cut out. History holds out no hope that the inconsistency of incorrupt representatives and of corrupt electors can continue long.

The supposition of a legislature consisting of three coordinate authorities, does not imply a defined line or logical division to which they must each conform, and which every body can distinguish; on one side of which, the concurrence of the several parts must degenerate into mere dependence; whilst, on the other, their separation must form into impracticable opposition. The experience, however, of all mixed governments, more especially a comparison of the case of England with that of countries subject to the simple forms, establishes the fact that it is not a mere fiction, concealing under nominal distinctions the real servility of the inferior in their subjection to the superior members of the supposed partnership. It is evident that a sort of adjustment does practically take place, sufficient to produce a palpable effect. The nature and temper of a particular society may easily make such a constitution impracticable. But, under fortunate circumstances, it in a great measure accomplishes the ends which it is its professed object to perform. The problem assumes the natural inclination of its respective parts to press unduly on each other. In tracing a constitution which has been formed by time, and has endured through ages, the tendency of the several biases must be expected to be more apparent, now one way, now another, than in a government of entirely new construction. Encroachments at different periods are more likely to take place, from a recurrence to former usages on one side, or from a spirit of re-action to them on the other, in constitutions which have grown up, like those of England and ancient Rome, by the amendments of centuries, than in mechanical contrivances, like the government of Lycurgus and that of America, modelled from the beginning and at once, on an express design. Accordingly, English history presents examples of each branch of the legislature in its turn assuming a legislative power. The king has issued his proclamations to create, not to promulgate law, under the pretence of state expediency. An irregular exercise of the equivalent power of suspending or dispensing with the law, in other words, a claim to

Government and Laws.

untie by himself the knot which the entire legislature had tied, had prevailed so long, that even at the Revolution it was only partially denounced. Ordinances authorized by both houses, whether for the militia or otherwise, are equally indefensible. The same is the case *a fortiori* with resolutions by either house singly against putting in execution such laws as happen to be unacceptable to it, but which the other branches of the legislature are not willing to repeal. Notwithstanding a most unguarded admission by Mr Justice Gould to the contrary, in the conflicting decisions which arose out of Wilkes's case, there can be no doubt but that the doctrine of Lord Mansfield is correct. Speaking of declarations of law made by either house of parliament, he observed, that he never thought himself bound in his judicial capacity to honour them with the least regard. The vote of the commons in 1648, that their single enactment was law, called forth on the Restoration the statute of 13 Charles II. It subjects to the penalties of *præmunire*, the advised affirmation that both or either of the houses of parliament have any legislative authority without the king. The unconstitutional attempts of both houses, especially of the lords, to extend their jurisdiction as courts of justice, brings us properly to the next consideration.

Judicial power.

The necessity of separating the judicial from both the legislative and the executive power, and of vesting it in independent tribunals, is now universally admitted. But it is a necessity which antiquity never perceived; and it was in direct opposition to the letter and the spirit of the feudal system. Therefore the successive generations which moulded the English constitution into shape, may be excused for having learned it but slowly and by experience. English history providentially is stained with fewer judicial iniquities, which are the greatest of all crimes, than that of almost any other country. But a failure of justice is the worst feature of the long period comprehended in the lines of Plantagenet and Tudor. Perhaps the greater part of the deficiency is to be attributed to the imperfect division of these powers, especially of the executive and judicial. Lord Clarendon has left a picture, sketched as late as the middle of the reign of Charles I., of what may be expected from a legislature, a court of justice, and a board of administration, all in one. Officers of the crown became "a court of law to determine civil right, and a court of revenue to enrich the treasury; the council table by proclamations enjoining to the people that which was not enjoined by the laws, and prohibiting that which was not prohibited; and the star-chamber, which consisted of the same persons in different rooms, censuring the breach and disobedience of those proclamations by very great fines, imprisonments, and corporal severities; so that any disrespect to any acts of state, or to the persons of statesmen, was in no time more penal, and the foundations of right never more in danger to be destroyed." The supreme courts at Westminster were originally derived out of the royal court or *aula regis*, which consisted of the great household or personal officers and the barons. They were intended to dispatch the ordinary judicial business, especially during the absence of the household and personal officers in attendance on the king, or when the barony might not be assembled. The authority of these derivative courts, whatever might be the case with the *aula regis* as far as concerned the barons, was not in the eye of the law inherent. It was supposed to be delegated to them by the king, as the fountain of justice to his subjects. The judicial power of parliament, however, was not displaced, nor meant to be so, by these auxiliary institutions. Fleta, writing in the reign of Edward I. treats it as still the high court of justice, "where doubtful cases of judgments are resolved." There can be no doubt but that annual parliaments were first demanded, and their intermission felt to be a much more serious grievance on account of their judicial than of their legislative capacity. It is evident, from the state of the early statute-book, that the meeting of many a parliament might have been saved had they met only for the purpose of legislation. There is a memorable order of 18 Edward I., by which petitioners to parliament are apportioned to the several subordinate courts of justice, both for their own dispatch, and to enable parliament to attend to public business. If the matter happened to be so great or of such grace that these courts could not end it, the chancellor and chief ministers were with their own hands to bring it before the king and his council. Coke observes, that wherever the king and council are mentioned judicially, it is to be interpreted to mean the House of Lords. The celebrated treason statute, 25 Edward III. closes its enumeration of the treasons specified therein with the express reservation of "other like cases of treason which may happen in time to come." In which case "the judge shall tarry without going to judgment of the treason till the cause be showed and declared before the king and his parliament, whether it ought to be judged treason or other felony." The reservation, however inconsistent with the right of a people that the law shall be defined beforehand, so that they may know what to avoid, and under what penalties, is plainly a reservation of judicial and not of legislative power. In fact, this parliamentary superintendence is recorded, on the authority of Chief Justice Thorpe, to have been at that time the common course in other cases as well as treason. He stated, in the 40th Edward III. "that he and Sir Hugh Green went together to the parliament, when there were present at least twenty-four bishops and earls, and asked the opinion of those who had been the makers of the late statute of jeofail, concerning the alteration of a record." "At another time," the same judge says, "we were commanded by the council, that when any case of doubt should happen, we should not go to judgment without good advice; therefore," adds he, in the case then before the court, "go to the parliament, and as they will have us do we will, otherwise not." The danger from this anomalous tribunal would have been increased a thousand fold, if the lords had succeeded in the unwarrantable claim which they set up in 11 Richard II. to a law of parliament differing from the civil and the common law. The extension of this irregular claim by Coke to the privileges of the lower house was more, certainly, than the imperious barons of Richard II. ever contemplated by their mutinous declaration. But it is still more unwarrantable, and more surprising, that Burke should have renewed the doctrine of a parliamentary supremacy, in judicial proceedings before parliament, over the rules of ordinary law. As the penalty of this grievous error, his admirable Report on the proceedings against Warren Hastings remains comparatively unknown.

The share which the House of Commons took in this judicial jurisdiction was, if any, very inconsiderable. Thorpe in the above passage uses the word parliament, but mentions only earls and barons. The ordinance 6 Henry IV., which has provoked so much legal spleen, from its directing that no apprentice or other man of the law should be elected a knight of the shire, took its hint from a previous one in the reign of Edward III. against lawyers practising in the king's court. They were accused of putting forward, as public petitions of the commons, matters which concerned only their own clients. Notwithstanding the expression client, the ground of disqualification here assigned relates probably to what was formally legislative, and not judicial business, something like the private bills of the present day From the course of the constitution,

as well as on their own disclaimer, Mr Hallam considers that the intermeddling at all in judicature by the commons upon the petitions addressed to them, was pure usurpation. He suggests that their intrusion may probably account for the disuse into which, from the time of Henry IV. the lords allowed their appellate authority to fall. It is very difficult to make out the steps by which they could have claimed the right in question. But there is some difficulty in conceiving that the influence of the House of Commons was so commanding at the period in question as the alternative supposition would imply. Could they be strong enough to make good a mere encroachment of this sort, and leave a competitor like the House of Lords no other method of resisting their invasion of its ancient right than by also abandoning it altogether? Writs of error were resumed by the lords about the accession of James I., renouncing all claim to any original jurisdiction in judicial causes. This is surely anomaly enough. All pretence for the other had disappeared in the equality of persons, in the uniform supremacy of the law, and in the acknowledged excellence of the ordinary tribunals. Notwithstanding this disclaimer, the extent to which the English legislature, under circumstances more or less excusable, perplexes itself with questions properly belonging to courts of justice, is subject to serious objections. It nowhere appears to such disadvantage as in bills of attainder, of pains and penalties, and divorce bills, which are all proceedings of a judicial nature applied to a case of *ex post facto* law. In judicial inquiries, carried on as such by either house, its numbers, partialities, habits, and the intrinsic difference between legislative and judicial considerations, make it impossible to convert a legislative assembly into a satisfactory court of justice. This truth has been frequently, and is still, occasionally verified. In its character of a court of ultimate appeal, the House of Lords escapes the disgrace which must otherwise have been heaped upon it long ago, by retaining the jurisdiction only in name, whilst the jurisdiction is in fact abandoned to its legal members. There is more to be said for so peculiar an exception as that of an impeachment. But later precedents, as in the instance of Warren Hastings and Lord Melville, do not warrant the expectation that an impeachment, even before such a body, can easily become an efficient instrument of justice. The only judicial matters which can be brought before the House of Commons are proceedings for contempts. Hurried on under great excitement before the whole house, they are exposed in an aggravated shape to whatever risk proverbially disqualifies an individual from being a judge in his own cause. It is only in comparison with what is recorded of the trial of disputed elections by the house itself, that election committees have acquired a conditional reputation. Committees on private bills are frequently legislative only in form, whilst they are in reality judicial inquests. They consider themselves above even the forms of justice. Nothing is more common than for members to oblige their friends, by stepping in to divide upon the merits of a case, where they have never heard a syllable of either the evidence or the discussion. It is a singular instance of the force of habit, and of the barrier raised by technical distinctions, that this is done by persons who would act nevertheless with perfect honour upon a jury.

In a simple state of society the judicial and executive authorities are always found united. Eastern kings administered justice at the gate; St Louis under the oak. A confusion between these authorities is therefore, under all governments, in the natural course of things a more probable event. The original theory of the English constitution, as far as theory can be predicated of its rude provisions, saw no incongruity between the duties. The traces of an entirely opposite presumption are still amongst the minor embarrassments of at least the language of the law. The administration of justice in the name of the king was formerly more than an honorary prerogative. It was a feudal truth and necessity. It is now a fiction which can only mislead both kings and people. Blackstone says, that when the law calls the king the fountain of justice, it does not mean that he is the author of it, but the distributor. Yet there are many things contrary to this distinction, and the contradictions show most strongly the mischief of these metaphorical compliments. The payment of fees on original writs, the unjust rules in the exchequer in behalf of the prerogative, the flagrant fines in the olden time as the only means of obtaining common justice, presuppose that the king was so far its author that he could only be asked to grant it upon his own terms. Judicial extortions became less frequent after Magna Charta; but they prove the grievous necessity which existed for its assurance that the subject should have remedial justice, "freely without sale, fully without any denial, and speedily without delay." A tax on justice is one of the worst sources of royal revenue, under whatever title it be imposed. At the present day the propriety of completely separating executive and judicial duties is the tritest truism. It is next to impossible that a sovereign should have the leisure, the attainment, or, in the most important cases, the impartiality, to administer justice in his own person. The guilt of tampering or of intimidation addressed to the judges, to whom the king has on the part of society committed his judicial trust, is a heinous offence in the meanest subject. When it proceeds from the king it is aggravated a thousand fold. But it is not enough that the hands of justice should be pure. Their purity should be beyond suspicion. For this purpose the independence of the bench ought to be maintained above all possibility of fear or favour. Perhaps there is no better evidence of what had long been only tradition concerning the personal attendance of the king in his courts of justice, and on the limits within which he was confined, than is contained in the case of jurisdiction of the House of Peers in the year 1666. It is there said, that "when the king attends in the House of Lords in his judicial capacity, he sits but as chief justice, doing nothing singly, but by plurality of opinions, as when the kings would in person sit in the king's bench, which they have in former time done, where all is said to be *coram rege*, though now he never come there; and in our memory King James hath sate in the star-chamber." It is natural that the king's presence should be last seen in the courts, which were not made unintelligible to common understandings by the forms of the common law, and which, by retaining the longest the name and the character of his council, seemed to keep the nearest to his person. Serjeant, when elected speaker in 1640, tells Charles I. "My disabilities are best known to myself; and to your majesty, I suppose, not altogether unknown; before whom, in the course of my practice and profession, it hath been your goodness towards the meanest of your subjects divers times to do me the honour and favour to appear and bear a part as an ordinary pleader." So little did the Plantagenet generation know what they ought to have prayed for on this subject, that in a list of very bold articles presented by parliament, to which Henry IV. consented in the eighth year of his reign, there is found the following request. It was prayed his majesty, that, "considering the wise government of other Christian princes, and conforming himself thereto, he would assign two days in the week for petitions, it being an honourable and necessary thing that his lieges who desired to petition him should be heard." James I. had a great longing to exhibit every phasis of his learning to his subjects. After having been told in Wraynham's case by

Government and Laws.

the judges, *cessat regnare qui cessat judicare*, it is not surprising that he should think the opinion of Lord Coke, that kings of England were incapacitated from the exercise of any judicial functions, little short of treason. Nothing, however, is more fully settled than that, as on one hand, the House of Lords, the Privy Council, and the ordinary tribunals of the common law, derive all their judicial authority in the first instance from the crown; so, on the other, whatever judicial authority the king originally possessed, it was possessed as in a reservoir, and has since all passed out of him into the appointed channels of his courts.

Direct interference on the part of the crown with the integrity of the judges was unfortunately not peculiar to the Stuarts; but it ended with them. It was carried by them also to such extravagant and unheard of lengths, as to throw all previous outrages of this description into the shade. The ignominy of the imputation has rested therefore principally on their name. Elizabeth had the sense to respect the honour of the interpreters of her laws; so that Coke felt what he called the taking of auricular confessions by James to be a novelty and a disgrace. The course, however, of the whole judicial history of England teaches a great lesson: the extreme difficulty of maintaining freedom with dependent judges. The struggle began at Nottingham, with the treasonable surrender of the infant constitution of their country by Tresilian and Belknap, in their discretionary expositions of law to Richard II. The impunity of intervening centuries tempted the colleagues of Finch and Crawley to believe that, supported by a sovereign at least as arbitrary, they might in their day set parliament at defiance. Although their virtue often failed, yet, in the main, the judges of the supreme courts of Westminster did their duty beyond what could have been expected. Fortunately for their characters, special commissions, composed chiefly of courtiers, were issued on most occasions of jealousy and alarm. In consequence, they seem to have kept their ground in the confidence of the public much better than the subordinate magistrates, who were subject, but in a less degree, to the same influence. These latter never gave much satisfaction. The ancient conservators of the peace, instead of continuing to be elected by the freeholders, were turned, in the first year of Edward III. into nominees of the crown. The necessity of suppressing the malefactors, who appear in those days to have been at times encouraged by member of the nobility, could not prevent the justices so appointed, on the extension of their jurisdiction, from becoming speedily unpopular. A petition from the House of Commons, in the 11th Richard II., declares that "every freeman in the land would be in bondage to these justices." Even in the retrograde years between Henry VI. and VIII., the difference between the independent tribunal of a jury, and that of perpetual officers connected with the executive, was well established. The right that criminal proceedings should follow the course of indictment and of the common law, is repeatedly and earnestly urged. Juries had so far begun to do their duty, that the fiscal purposes of Henry VII. could only be carried into effect by enabling these creatures of his power, removeable at his pleasure, to try all offences except treason and felony by themselves. The restoration of a jury to its pristine rights was one of the measures by which Henry VIII. won, on his accession, the popularity which he afterwards so cruelly abused. This affectation of a return to the old constitutional character of the English courts of justice, was soon overthrown by terrible innovations, like the creation of the president and council of the north, and of the Welsh marches. The worst part of these novelties consisted in their in reality placing the judicial and executive authority in the same hands. What could the subject expect from a tribunal of which Wentworth was the president? Mr Hallam says that these and other irregular tribunals, when abolished by 16th Charles I., had usurped so extensive a cognizance as to deprive one third of England of the privileges of the common law. It was nevertheless reserved for the high churchmen of Charles II. in the year 1664, to return to the charge. Legislating against what they unjustly called seditious conventicles, they ventured to arm a single justice (it is necessary to remember only what were the dependent justices of those days) with the power of inflicting seven years transportation on a third conviction of the offence of worshipping God contrary to act of parliament.

The objection applies still more strongly to the original authority of the sheriff. The shrievalty was generally sold by the Norman kings, and was an office of great emolument, and still greater influence. The coroner, with his limited inquest of criminal police, was left to popular election. But the sheriff, from the conquest downwards, except during the sixteen years which intervened from the 28th Edward I. to the 9th Edward II., was nothing but the annually nominated servant of the crown. Great judicial authority was intertwined with his civil superintendence over his county; the more so, because the law has never sufficiently distinguished between acts which are judicial, and acts which are ministerial only. Although in the hundred and the county, as well as in the baronial court (not being courts of record), the freeholders were the real judges, both of law and of fact, the sheriff's authority was the subject of great alarm. The principal sources of this jurisdiction were by degrees turned into other channels. Criminal pleas were taken from him entirely as far back as Magna Charta. The complaint upon which that clause was founded had only sought that he should be restrained from hearing them except when assisted by the coroner. The confidence felt in the popular presence of that officer for decompounding and breaking up this dangerous identity of powers, appears by several other writs in Rymer. The justices-in-eyre, not being the same always as the judges of Westminster, were probably often but partial improvements on the local administration of the sheriff. Their circuits, however, facilitated the transfer of most of the civil as well as the whole criminal business into a more strictly and purely judicial court. The civil cases which were formerly tried by the sheriff are now cognisable in the county courts, established under the 9th and 10th Vict., cap. 95, and of which there are sixty in number.

From this brief review, it appears that formerly the judicial power was often placed in the same hands with the legislative and the executive. This probably never took place without the people suffering severely from it. The small territorial jurisdictions, civil or criminal, must have been the worst of all. The existence of other checks at present, and the vigilant rapidity with which public opinion keeps hovering over and bearing down upon all official misconduct, may blind us as to the importance of the principle itself. A hazard, of which the only actual mischief is in the precedent, may seem not too much to incur for the convenience of this or that exception. At the same time, no nation is wise which in such a case presumes too far upon its security. A judge, when member of the legislature or of the cabinet, is in a position which ought to create, both with himself and with the people, a degree of watchfulness, not to say jealousy, far beyond the case of other men. It is to be remarked, that the greatest of all exceptions which occurs in this respect in English practice, that of the Lord Chancellor, occurs in the very instance where the existence of the judge depends on the casualties of the ministry of

Government and Laws.

which he is a leading member. An examination of the judicial removals during the Stuarts shows the extent to which the hopes and fears of the bench were constantly played with. It was a system, and not an accident. Nothing short of the 13th William III. could have put it down. That statute altered the patents of the common law judges, from patents during the king's pleasure, to patents during their own good behaviour. The little that was left to be done, was done at the accession of George III. This last amendment consisted in excepting their commissions from the fate of all other crown appointments, that of being vacated on its demise. It was a very prudent waiver of the little remnant of arbitrary power which, strange to say, had in the interval been misused. But the waiver could of necessity be made by any actual sovereign, solely at the expense of his successor. If a stop had been put to the analogous suspicions connected with the promotions of judges and the translations of bishops, it would have obviated an evil of more frequent recurrence. On considering the elements of the character and of the happiness of the nation, the English people are perhaps not more indebted to their participation in legislation by means of the House of Commons, than to their share in the administration of justice in the capacity of jurors. Not only has the executive been kept at bay by their interposition, for the legal verification of the fact at issue, but the legislature has received more than one useful warning from their collateral influence on the law itself. For both these purposes it was indispensable that intimidation should be removed from a juror as thoroughly as corruption; and that offences imputed to him in the discharge of his duty should be investigated and punished as cautiously, as reverently, and before as impartial, if not as solemn a tribunal, as similar offences imputed to a judge. The day when, in Bushell's case, the court relinquished the pretension of fining or imprisoning a jury for its verdict, ought to be as memorable as any in the annals of the victories of justice. It heralded in, and was in no degree less important than, the day which made it impossible that any successor of Pemberton (for even the chief-justice who tried Russell had paid too much respect to freedom) should be arbitrarily displaced. In this point of view the dissatisfaction expressed by Jefferson with the corresponding rule in the constitution of the United States, that the judges are irremoveable, except by a resolution of two thirds of congress, is very surprising. The exception would seem amply sufficient to secure the legislature the necessary discretionary control. Considering the position occupied by the ordinary courts of justice in the United States and in England, it is impossible that they can make any serious encroachment on the other departments of the state, without a degree of negligence or connivance on the part of the legislature utterly inconceivable. The cry against judge-made law, on the ground of its being an unwarranted encroachment, appears also, to the extent to which the common law courts have carried their incidental legislation, to be quite unfounded; and most of all in England, where the common-law judges are much more justly liable to the inconsistent accusation of standing too stoutly upon the letter and strictness of the law, and of having brought on the necessity of an equitable jurisdiction and of irregular tribunals, from their narrow adherence to precedents and forms. They are not answerable for the main defects of the English system, whether in the body of the law itself, in the centralization of the metropolitan courts, or in the inadequacy of the local jurisdictions.

Executive power.

A government, where in point of form the legislative and judicial authority appears to emanate from the crown, is certain to have placed its executive power solely in the king. Long after the two former authorities have succeeded in gradually emancipating themselves from every thing but the antiquarian recollection of their original subordination, the latter arrangement will in all probability retain its pristine vigour. This is the consequence of the substantial advantages which belong to a single and permanent executive. Such, at least, has been the course pursued in England. The founders of the republic of the United States, from their near observations upon the French Directory, and from their personal experience of the disunion of executive committees during the war of independence, admitted the propriety of placing the necessary powers of the general administration in the hands of a single individual. The name, whether king or president, is hardly worth discussing. The great questions are, the mode by which this supreme magistrate shall be appointed, and the powers with which he shall be invested. In comparing with this view the English and the American systems, the principal difference between them is in the mode by which the executive is appointed, and not in the amount or nature of its powers. In their jealousy of the concentrating effect of power, the Americans have subjected all the members of congress, the senate as well as the house of representatives, and the office of president equally with the senate, to the principle of rotation; only differing in the degree of rapidity with which the elective wheel in the several cases performs its circle. By this specific the evil tendencies of political power are supposed to be reduced within manageable limits. Impartial spectators, on comparing the risks of hereditary descent as experienced in England, with the risks already manifested in the quadriennial presidential elections of America, may perhaps be disposed to decide in favour of an hereditary parliamentary title, with reference to the actual passions and prospects of society. A four years' lease of the president's chair may be too exciting a prize to be safely left to popular competition. Besides, the very character and abilities most likely to be admired, are those on which the temptations of such an elevation must act with the greatest force. It is one of the advantages of the English system, that whilst the doctrine of descent greatly limits the probability of dangerous talents in a sovereign, the mechanism of the constitution is so well arranged and uuderstood as to do its work without them. The powers vested in the royal executive are not extreme; for they are nearly the same as those which it has been found necessary to maintain in the United States, notwithstanding all the advantages of a new country.

Under an ancient but progressive government, the executive authorities of the chief magistrate, like all the other authorities of the state, must be capable of being considered in three different points of view. These are, the historical, the actual, and the philosophical. Its constitutional history will vary, both in the facts which it exemplifies, and in the reasoning by which it is explained, at different periods. The correct legal description of it at any given moment, for instance the present, can represent at most only the law and practice of the age. The philosophical conclusion, how far it ought to extend in reason, may be, and probably will be, only obscurely signified in either of those inquiries. Mr Allen, in his inquiry into the rise and growth of the royal prerogative in England, and Mr Hallam, in different parts of his constitutional history, have left little to be added upon the first division. Mr Bentham, in his treatise upon legislation, has generalized upon the last. The legal exposition of the second is all that Blackstone properly undertook. Nothing certainly can be more absurd than the language which he has copied, in order to express the paradoxical fictions of the supposed attributes of sovereignty, perfection and perpe-

Government and Laws.

tuity. The parliament which consented to describe the forfeiture of the crown by James II., under the euphonism of an abdication, proceeded in the selection of the word on many precedents. Their ancestors, at every compromise with royalty, had demonstrated much indifference to words, provided that the end and consummation were substantially achieved. In English constitutional law, an unlimited and almost oriental deification of expression is found alongside of rights strictly limited and specifically defined. The Plantagenets, however, were much more cautious than the Tudors in bringing this inconsistency to the test of a collision. Unluckily for the Stuarts, they were mystified by the welcome homage of servile civilians and meddling churchmen. By forcing on the solution of the problem, they learned too late, that from the fact of the prerogative being incorporated with the law, whatever was not found there could not possibly be within it. Even Locke's definition of prerogative, which Blackstone has thought fit to praise, is too liberal, not only for the rights of reason, but for the rule of law. "The discretionary power of acting for the public good" does not extend to all cases "where the positive laws are silent;" but to such points only as the constitution has expressly reserved for this discretion. Otherwise we come to the intermediate inherent power on which James I., in his Flowers of Grace, claimed for royal proclamations the force of temporary laws. The proper course on such extraordinary occasions is for ministers to act on their responsibility, and trust to parliament for an indemnity. The Stuarts were doomed to make the additional discovery that, among prerogatives strictly legal, there were some, both prerogatives of authority and prerogatives of revenue, which, being false in principle and mischievous in effect, the public had become sufficiently intelligent and powerful to recall. Our early kings, in the insidious reservations (*salvo jure coronæ nostræ*) by which they narrowed many of their most popular concessions, had succeeded in a great measure in rendering that part of the constitution unimproveable and fixed. This was the course, before notions of an abstract *jus regium* by consent of nations, or the doctrine of a native immortality in the prerogative, which acts of parliament even could not reach, had been yet imported into courts of law. A struggle which could only be kept up by these new and desperate assertions, was evidently near its close. These novelties were in part the penalties of the Reformation, at least as applied to England. Henry VIII. obtained for the crown a new prerogative on that occasion. It was a more dangerous one than perhaps all before it, in consequence of the greatness of the subject which it concerned. The act of supremacy was the corner stone of the high commission court. Mr Hallam truly observes, that "the real aim of the clergy, in enormously enhancing the pretensions of the crown, was to gain its sanction for their own." They played into each other's hands. If, as Mr Hallam affirms, the nation might be considered, up to 1640, as having been, "in regard to spiritual dominion, a great loser by the Reformation," it would have lost every thing in regard to the crown, had civil liberty depended on the loyal sophistries of the church. The apparent strength of the executive on the breaking out of the civil wars, presented so formidable an aspect, as to deceive even Strafford not only into a desertion of the cause of the people, but into the adoption of the language and sentiments of Laud. From the example of former times, and from the external superiority which necessarily surrounds the throne, he egregiously miscalculated the means of the two parties who were then about to decide this battle by an appeal to arms. It is scarcely less surprising, after its result, to find political judges like Jefferies so intoxicated by the saturnalia of the Restoration, as to continue to hazard these and similar insane *dicta*, down to the very eve of the Revolution. On that event the nation carried the principle of the exclusion bill by acclamation. The exclusion bill was looked upon, from the time that it was first mooted, as the extreme case. It was among the principal argumentative advantages of the Revolution, that it put an end to all discussions founded upon the supposition of inviolable prerogatives, then and for ever.

It is perhaps not too much to say that the *direct* prerogatives, in respect of authority, which were objectionable, are all either abolished, or, in case the law of England allowed of desuetude, are obsolete. Some few *incidental* ones remain, which appear to be in the course of removal; since recent legislation has happily shown a desire to look towards a reformation of the law. It is unfortunate that the direct prerogative, which is on the face of it the most revolting, nevertheless, from its having so long principally supplied the king's service with seamen, demands, in the immediate modification of it, considerable caution. Marine impressment, it must be remembered, came in, however, upon no supposed necessity of this nature. It is the remnant only of a doctrine and a practice which at one time included soldiers, and many classes of civilians. Like most other prerogatives, it was abused under Charles I. for the purpose of extortion. Several of the common people who refused loans are said to have been pressed into the navy. There has fortunately been such little demand for prerogative learning since the great argument of ship-money, that the judgment of Sir M. Foster in Broadfoot's case, in the year 1743, in support of the legality of impressment, was wanted to recall the attention of English lawyers to the several conditions which the law requires as evidence of a subsisting prerogative. The debates on the alien act revived these discussions for a season. The lawyer and the statesman look at questions of this kind from different points of view. The first regards what is; the second, what ought to be. For whether the particular powers are wanted, and where they should be placed, are further questions. In case these questions are settled in the affirmative, it is unwise, by division, rotation, or a multiplicity of checks, to reduce their efficiency below a certain point. Society loses more than it gains by such expedients, as often as necessary powers are thus incapacitated for the due performance of their functions. This was frequently attempted in ancient times. On the other hand, governments cannot be too cautious against the abuses which constitute the provocations to such restraints. Unjust interpositions of the *nolle prosequi*, and of pardon by the crown, gave popularity to the appeal of murder. Lord Holt, looking back rather than around him, called the anomaly "a noble remedy." Several petitions were vehemently urged by the commons of former days against the generous prerogative of mercy. The degradation by James I. of the prerogative of honours, by bartering them, for the first time in English history, for money, and the subjecting the peerage by Queen Anne to the personal ambition of a minister, have the same tendency. They bring the prerogative itself, as well as the subjects of it, into disrepute. The prerogative of making peace and war was tarnished by the base negotiations of Charles II. It was damaged later still, when Chatham himself was not able to withstand the electoral prejudices of his sovereign in behalf of a campaign in Germany. The observation may be extended through every department of administration. It applies especially to the formation and the government of so jealous and delicate an engine as that of a standing army. The moderation which the executive had displayed in the exercise of more qualified powers, could alone have introduced into and kept in the mu-

Government and Laws.

tiny act the clause by which courts-martial are enabled to punish mutiny and desertion with death. It was inserted for the first time in 1718; and it was only carried at the time by small majorities. Of the impolicy of creating an atom of waste power there can be no dispute. But if the power is really wanted, they are sorry horsemen who are obliged to keep the strength and courage of their horse permanently below his work, as their only means of riding him. On the supposition that the powers are fitting powers for the executive magistrate to possess, the appropriate remedy is to apply ministerial responsibility to such cases, and to take care that the responsibility shall be a reality and not a name. The healthiness and *vis medicatrix* of the general system must do the rest.

The prerogatives of revenue depend on a different class of considerations. The financial purchase of tenure by chivalry from Charles II. and the subsequent arrangements entered into on granting successive civil lists, have not gone so far towards completely sweeping out the holes and corners of the exchequer as might have been wished. The last fibres of the barbarous fiscal pretensions which flourished there in former days have still to be rooted up. The national revenue, properly considered, consists of the portion of his property which each subject contributes to the state, in order to secure the remainder. That being the just principle, its demands should be limited in amount to what is necessary for the proposed object, instead of setting a fiscal net to catch an irregular and indefinite number of certain matters. Further, by an accurate calculation and repartition, the necessary taxation ought to be equally borne, in respect of their means, by all the king's subjects, instead of falling upon particular individuals on the happening of particular contingencies. In its original state most of the ordinary or prerogative revenue raised the least possible sum with the greatest possible inequality and inconvenience. The greater part of what remains is only remarkable for its picturesque absurdity. There is, however, one terrible exception, far too monstrous to be left for mitigation to the humanity of the treasury. Nothing can be worse than the wholesale forfeitures and confiscations which still sweep in the train of our criminal proceedings. In spite of the praises bestowed by Blackstone on Mr Yorke's essay in defence of the law of forfeiture, and although the people owe the 25th Edward III., which has been called the magna charta of treason, almost solely to a squabble between the king and his grantees the barons, for their several portions of the spoil, according as the late owner had been found guilty of treason or of felony, it is impossible that the reason and humanity of a great country can much longer permit cruel iniquity, abandoned by the most civilized part of Europe, to be justified upon antiquarian learning or by metaphysical refinements.

Blackstone's declaration at the commencement of his chapter on prerogative, that the powers which are vested in the crown by the laws, are necessary for the purpose of society, may be thought even now, if their whole detail is minutely examined into, to go something beyond the truth. The exceptions, however, can be in practice of no great consequence. The most obscure member of parliament would have nothing to do at the present day but to attack any indefensible exception, by a motion for its repeal. From the era that a general control over the government passed into the House of Commons, influence has so much superseded force, that questions of pure prerogative have lost much of their importance. According to present usage, any transaction arising out of its exercise, if it is at all interesting or doubtful, must be brought sooner or later before the House of Commons. The difference in the three modes of proceeding, between which alone a minister has to choose, comes to little more than the option at which of its stages the transaction shall be brought there. This will depend on circumstances. It may be a case in which there is no pretence of a prerogative, as on a suspension of the habeas corpus act. Or the principle of a prerogative may be pretended; but it may be suggested that the means for carrying it into effect are defective, as was suggested in the alien act. If there be time to apply to parliament to strengthen the executive, a prudent adviser would recommend, especially wherever a continuous measure is required, of necessity, on the first of these supposed occasions, but on both of them would he equally recommend, that the authority of parliament should be called in. In case a temporary emergency arises, more especially one which will not wait for parliament, as in the instance of the embargo laid by proclamation upon vessels laden with wheat in the scarcity of 1766, every administration is bound to take the responsibility of the measures demanded by the emergency; and parliament is bound to indemnify the authors of them for venturing upon a discretionary rigour beyond the letter of every day's law. The third supposition yet remains to be mentioned. When a minister is confident of the existence of the prerogative, and that the necessity for exercising it has arrived, there can be no occasion that the immediate representative of the executive should advertise for a parliamentary discussion. Let him use the instrument in the manner in which it was left by the constitution to be used. The opposition for the time being have it always in their power (and may be usually trusted for the inclination, as in the late Dutch embargo) to press the question to issue, and obtain the opinion of parliament upon both the point of right and the point of policy. For, on state-questions of this description, the members of a government are as answerable to the community which they serve, for mistakes in policy, as for mistakes in right. The distinctions were only of use before the House of Commons ventured upon the general superintendence which it exerts at present. Blackstone observes, that "the king, in the exertion of lawful prerogative, is and ought to be absolute," subject to the responsibility of ministers. Yet, from the nature of the case, as it is now understood, the king cannot be more or less absolute, nor his ministers more or less responsible, within than without these bounds. An unlawful prerogative may be assumed, a lawful one may be abused. As long as the constitution lasts, the king is in both cases alike personally secure. The unconstitutional adviser is in both cases equally answerable upon impeachment, and to the same degree. The decision against general warrants, when the official practice of three quarters of a century was at last brought into a court of justice, exemplifies the jealousy of the law in its own defence. The truth is, that the most satisfactory account of the mysterious maxim, that the king can do no wrong, since for every act done by him there must be responsibility somewhere, is an innovation which even the Revolution itself did not immediately introduce. The earliest strong assertion of it which Mr Hallam has perceived, is in a speech by the Duke of Argyll in the year 1739. Public opinion must have stopped short indeed, when a Whig, like Burnet, thought ministers were liable for advice given at the council, but not for the resolutions taken there; that is, they were to be liable for their own words, but not for the act, which might be the act of the sovereign himself. Whilst this distinction remained in force, it was possible that the whole question in these cases might turn on the limits of prerogative, and on the fact, whether the necessity of coming to parliament for fresh power could be evaded. This distinction, or something not distinguishable from it, was the shield behind which, strange as it now appears, both Whig and

Government and Laws.

Tory ministers, Somers as well as Harley, alike retreated, since the Revolution.

Prerogative, as above treated of, regards solely the remnant of those powers and privileges which had been vested in the crown from time immemorial by the common law. What is left is a small portion of a heterogeneous sovereignty, which had been originally wrested from a weak community by mere force, or which pertains to principles and circumstances long since decayed. From a sort of obscure traditional feeling, the word prerogative is more associated in men's minds with the personal will and pleasure of the sovereign, than with his political and strictly legal duties. The thing itself has, however, gradually fallen into the general mass of executive authority. Considered in this point of view, great additions have in later times been made to it. These additions consist of powers derived directly from parliament, and transferred to the supreme magistrate on the simple supposition that they are necessary for the public welfare. The preliminary question, Are they indeed necessary? occurs still more naturally on a demand that new powers should be granted, than on the suggestion that ancient powers might properly be retained. It is only when that point has been made out, that a prudent legislature will enter on the consideration of the precautions by which their abuse may be prevented, whilst their efficiency is maintained. To mention only one or two examples: The patronage of office has its risks in a free government. Yet it must be remembered that Polybius saw, in the influence which the contracts and public works gave to the Roman senate, the necessary link by which its connection with the Roman people was held together. At all events, the disadvantages of the actual extent of ministerial patronage belongs to the greatness of the British empire, and to the nature of its colonial possessions. The most rigid economy can alone reduce it within certain limits. An enormous national debt must still leave the public burdened with the additional evil of a proportionately enormous fiscal law; more equal in its assessment than, but perhaps almost as harassing as, the ruder aids and incidents of feudal jurisprudence. It is made both more costly and more pernicious, from the childish weakness of insisting that the bitter pill, if it must be taken, shall be concealed under the form of indirect taxation. The difference in the powers, as given by the common law and by the riot act, to public officers over unlawful assemblies, is scarcely so great as to be considered a dangerous augmentation to the force of any government. At the same time, whatever it may be, the same authority, or something very like it, may have become necessary for the preservation of the peace, when a vast manufacturing population is collected together on one spot; liable to be thrown out of employment at every moment by the oscillations of trade; accessible, besides, and accustomed almost daily to the most inflammatory appeals. This is the case also with regard to the extension of a regular police, and to the employment of the military in subordination to a civil magistrate. The change, however, which would most surprise Whitelocke and the patriotic parliament-men who argued the militia question under Charles I., would be the mutiny act and the army list of the present day. They would think that the king might well consent to the concession of coming to parliament for its sanction, as his portion of the compromise. The balance of power in Europe was the only cause at first assigned in justification of a standing army; and it is still the burden of the mutiny act preamble. Our immense provincial dependencies have also to answer for it in part. However, another and a domestic necessity must have been silently making prodigious way, when so cautious a statesman as the late Lord Liverpool defended in parliament the numerical increase of the army, not by a reference to the state of Europe or the colonies, but by a comparison between the amount of the population now and in former times. It would be impossible to govern with so slight a pressure as society is at present used to, without a strong executive. It is fortunate, therefore, that, from the systematic regularity which prosperous civilization has favoured, the actual powers of the executive government have become more consolidated, and their operation more uniform. The effect of the whole is, that in Mr Hallam's opinion at the time of writing his invaluable work on the constitutional history of England, the English executive, "though shorn of its lustre, has not lost so much of its real efficacy, by the consequences of theRevolution, as is often supposed; at least, that with a regular army to put down insurrection, and an influence sufficient to obtain fresh statutes of restriction, if such should ever be deemed necessary, it is not exposed, in the ordinary course of affairs, to any serious hazard."

On the supposition that this opinion was correct at the recent period when it was delivered, experience alone can determine how far the supposed influence alluded to in it has been affected by the subsequent change in the constituency of the House of Commons. The supposed euthanasia of the English constitution, namely, the establishment of that simple monarchy which Hume and other writers have predicted as its natural fate, has been thrown back to an indefinite distance by parliamentary reform. If any thing like the same good sense and good fortune which have hitherto prevailed in the history of the people and their government shall be continued, there seems little reason why they should be thought to be hurried, by a measure of that principle and extent, within the perils of the opposite extreme.

Neither the principle nor mechanism of the reform bill has so changed the nature of the account. The difference of opinion entertained by different persons on a general comparison of the forces at work in the English constitution, seems of itself positive proof that the variance, whether before or since, has been only in the inclination, but that the constitution is on its balance still. At the same time it must be admitted, that the interest which was strong enough to carry the reform bill, is tolerably secure. It is not difficult to prognosticate what would have been the issue of open resistance to the new political adjustment which has been settled upon its terms. It was impossible, also, from the causes which urged it forward, that the adjustment could have been much longer peaceably delayed. The impoverishment of the crown by the alienation of the royal demesnes; its abandonment of claims and maxims become odious or ridiculous; its political incapacity to act on the House of Commons by the disfranchisement of old or by the creation of new boroughs; the scandal of private nominations, the still greater scandal of corrupt corporators and bribed freemen; the doors of parliament thrown open to the people through the publication of the debates by means of a daily, almost an hourly press; the increase of dissenters, displacing the monopoly of the clergy; a liberty, nay license, of discussion, popularising crude analogies to a new and kindred democracy in the United States, and reaching over every question and up to every individual in the land; public opinion circulating from one end of the kingdom to the other, and brought concentrated with electrical rapidity at any moment to any point; the rights of conscience, of free opinion, and of political equality, so proudly recognised that they overcame at last even all the recollections arrayed against the Roman Catholic persecution of Protestant reformers; the universal responsibility of ministers

Government and Laws.

for every act of government now as universally acknowledged; the rise of immense towns, swarming with active artisans easily excited and easily combining; the constant accumulation of numbers, competence, and intelligence in the great and powerful body of the middling classes; the disappearance of the last relics of feudal castes and prejudices; the swamping of the ancient historical nobility by a modern aristocracy of wealth, favouritism, and corruption; the final breaking up even of the court and country party, whilst in their stead had risen up and found themselves face to face, those two parties which must always exist in open commonwealths—on one hand, the honest and also the servile partisans of power—on the other, the seditious and also the constitutional friends of the people;—these are but a part of the alterations which had changed not only the face but the core of England. A new soil, so to speak, had been turned up. A revolution in society had outstripped the Revolution of 1688. The rights of Englishmen, as Blackstone calls them (but what are in truth the rights of man, wherever man is civilized enough to understand and to preserve them) had grown into fuller consistency and bulk. The national system, now in its manhood, made, as it were, more blood, and required that the arteries should be enlarged which were to carry it to the heart.

A political student, after looking at the points to which all governments should strive, at the imaginary commonwealths of theory, and at the degree of approximation which, from amongst their thousand experiments, mankind appears to have ever realized, may think that there is good reason to be content both with the end and with the means which the English constitution recognises and secures. He will perceive that English liberty was long heavily mortgaged, but that the mortgage was never foreclosed. Its standard-bearers were sometimes down, but the pennon itself was always flying. Nations who regard England as a model, whether to be copied or to be surpassed, should remember that no nation can hope to buy a suitable constitution ready made. The end ought to be one all the world over, namely, the happiness of the people. But the condition of the people may be so different, as necessarily to demand the greatest difference in the means. The quantities with which moral and political problems have to deal, so far from being fixed, are in constant fluctuation; and the truths which they have to establish can never be tried by taking extreme cases. An assimilation and correspondence between that which acts and that which is acted upon, are conditions grounded on the nature of the human mind. In no case is strict attention to them more indispensable than in the relation between a people and its institutions. The best security for this is gradual adaptation. The Americans take English experience and English character into new circumstances, with the woods to back them. They may ride with a looser rein, and may try bolder tricks in legislation, than, in an old, densely-peopled, and overwrought community, any person, at least any reasonable person, acquainted with human nature and the difficulties of the case, could venture to recommend. They will not undervalue the necessity of such compromises with the nature of things and of events; since, in truth, no country ever made a greater sacrifice to the predominance of circumstances over principles than America has made, and is still making, over half her empire, in the most fatal of all exceptions. It is a worse one than the barbarism of the barbarous age of Magna Charta; an exception limited not even by the test of freedom, but that of the colour of the skin. It may be doubted whether the English experiment would not have failed, as the same experiment failed elsewhere, if its authors had rushed in the first instance to the point where their posterity at present stand. Light things may hurry forward, but the elephant must make sure of every step he takes.

A free government must be complicated in its parts. The checks introduced by circumstances, habits, and opinions, and which have been subjected to gradual amendments, remain a hundred times more effectual than any mere appeal to reason, which is all indeed that a totally new system has to make. The latter, however theoretically superior, must trust to its argumentative merits for its hold on the minds and affections of mankind. Montaigne expresses great contempt for long philosophical discussions concerning the comparative advantages of different forms of government. When he refers not only in opinion, but in reality, to usage as the sole criterion in every case, he is guilty of a gross exaggeration. This however ought not to prevent due respect being paid to the truth on which the very exaggeration is grounded. The whole history of England is the narrative of a long preparatory schooling to fit its people for their actual institutions. Institutions certainly are faulty which cannot stand the more summary test of Pope, when he disposes of these questions by a single line, " whate'er is best administered is best." For this in sensible prose must be understood to mean that the government is best which contains the best provisions for securing a good administration of all public affairs which depend on the relation of the governors and the governed. This security, it will appear by the description which has been given, it is the great object of the English constitution to establish by the proper formation and distribution of the legislative, judicial, and executive power.

II.—Laws.

The civil law approached to the character of a universal language. The breaking it into fragments on the fall of the Roman empire, and the substitution in its stead of the coarse and mixed materials of the barbarian and feudal codes, had the effect of the confusion of tongues. Each code was nothing more than a partial dialect. Whilst the rest of Europe fell back more or less under the legal dominion of its ancient master, England alone stood out. It was impossible, however, that it could altogether resist an influence so universal; and it is probable that a greater impression was incidentally received than contemporaries were aware of, or than antiquarians have since been at the trouble to retrace. Mr Hallam observes that a good work, pointing out the extent to which the Roman law affected Bracton and his successors, is a desideratum in our legal literature. Nobody has yet felt a sufficient interest in, or been sufficiently conversant with, both systems to supply it. The distance to which England was thrown from the common orbit of classical jurisprudence, appears to have been even something more than the difference which separated the northern and southern divisions of France, where the one was subject to a customary, and the other to the Roman law.

English civilians and foreign scholars always treated the vernacular common law with the greatest possible contempt. John of Salisbury, in the reign of Henry II. calls it *aucupatio verborum.* Whitgift derides the learning which is learning nowhere but in England. Erasmus must have seen it to great advantage in the person of Sir Thomas More; nevertheless he mentions its professors in terms scarcely more respectful than the scurrilities of the college-play of Ignoramus, got up in its ridicule for the entertainment of James I. Evelyn is content so that he escaped from it with no harder word than " that impolished study." The provocation given by Law-Latin and

Law-French has since been got rid of; that of tenures and their commentators still remains. Any insular jurisprudence, growing up during the middle ages, must have certainly suffered in its philosophy and its symmetry by excluding the written wisdom of the Pandects. By way of compensation, it is suggested that the alienation was of great advantage to English freedom. Whatever was gained in this direction is probably to be attributed more to the class to which the professors of the two systems respectively belonged, than to the supposed exemption of black-letter precedents from the arbitrary spirit of the imperial constitutions. The Inns of Court were long the principal seminaries in which the gentry of England completed their education; whilst, in the universities, the foundations for the study of civil law rivalled those for the study of divinity. The civilians and canonists, cousins-german by descent, thus became twin-brothers in feeling. In fact, civilians were formerly almost always churchmen. The difference of pedigree between them and the common lawyers was visible down to the time of Laud. The civil law, in any comprehensive sense of it, may be said to be extinct in England. To the degree, however, in which it exists, the English constitution is likely to find as warm supporters at present in Doctors Commons as in Westminster Hall.

The first point, on inquiring into the laws of a country, is to ascertain where the power of making them is lodged. It is very desirable that, as far as possible, the power should rest exclusively with the distinct and supreme authority of a recognised legislature. In this manner, laws adequately and publicly discussed will receive perhaps as general and as efficient a promulgation as the subject admits of. Certainly no better security can be devised against the possibility of constructive and *ex post facto* liabilities, than the practice of open debates, and the rule that legislative measures shall be strictly prospective. The connection between legislation and legislature is the doctrine of the English law. It can nowhere be expressed more strongly. But the history of what is called the common law shows the difficulty of acting upon it throughout. Popular customs will have already taken root before a steady government is formed, or, at least, before it is so far universally established, as to take under its cognizance the whole field of legislation. With regard, therefore, to this class of self-sown customs, the best thing probably that the legislature can do, when it becomes adult, is to acquiesce in them. Certain divisions of the law, and those not the least intricate and important, will from time to time be elaborately commented upon in text-books. Particular rules will also be adopted by the profession; and these soon become the grounds on which properties and expectations rest. For instance, "the practice of conveyancers" easily goes the length of making by necessity the law in that department. Much more is this the case with the opinions and the practice of the regular tribunals. For this purpose it is by no means necessary that the statute-book should contain an intimation corresponding to the threat of the *Code Napoleon.* "Le juge qui refusera de juger sous prétexte du silence, de l'obscurité, ou de l'insuffisance de la loi, pourra être poursuivi comme coupable de déni de justice." Direct legislation must be infinitely more active, and must complete its work in a far more workmanlike way, than the parliaments of the Plantagenets, and even than the parliaments of to-day, not to leave vast chasms for judicial construction to fill up. The English law at different periods has been indebted to all these collateral sources in different degrees for accessions to its wealth. Nobody can now determine how far Alfred and our other supposed lawgivers collected or composed the documents transmitted in their names. It is not the less unreasonable to assume on that account, with Chief-Justice Wilmot and others, that the "common law is nothing else but statutes worn out by time." Madox has observed that the laws of the Anglo-Saxon kings are as different from the writings of Glanville as the laws of two different nations. Some of the points are brought out in contrast in the second volume of Mr Hallam's *Middle Ages*, p. 466. Yet, if we are driven to any particular date for the origin of the present common law, it must be a moment not much anterior to the age of Glanville. He wrote as early as the year 1180; and the laws called by the name of Henry I., which are in their spirit thoroughly Anglo-Saxon, must, by their mention of Gratian's decree, be as late as the very end of the reign of Stephen. Mr Hallam makes a very judicious suggestion. He supposes that these laws, like the water ordeal for the common people, contain the ancient usages of inferior jurisdictions, whilst the treatise of Glanville, he conjectures, comprehends only the rules of the Norman lawyers, by which, through the influence of the circuits, and by other means, the former were gradually superseded. The unwritten usages were become completely fixed by the time of Bracton's compilation, towards the end of the reign of Henry III. There are no grounds whatever for conjecturing that these fluctuations were preceded or ratified by any direct legislative notice.

At a later period, namely, in the year 1322, it was explicitly enacted that all matters to be established for the estate and welfare of the realm should be treated in parliament. After so solemn and public a declaration, it might much more plausibly have been supposed that every subsequent alteration, whether in the civil or in the criminal law, would be accompanied by a parliamentary sanction in evidence of its title. What a change, however, took place both in one and the other; yet no "statutes worn out by time" can here be pretended. It is indeed remarkable that the statutory changes long bear but a small proportion to those which were obtained from other quarters. Although usage after this period can have crept in only now and then imperceptibly, undoubtedly the sages of the law kept insinuating their opinions, even extrajudicially, from time to time into the system. But by far the greater part of the innovations, real and apparent, were derived through the means of judicial decisions preserved in reported cases, and argued out by help of what has been quaintly called the "logical deduceableness" of the principles of the common law. The grounds of every judgment were set out on the record till the reign of Edward III.; afterwards they were taken down by certain grave and sad men in the year-books; and latterly, they have been left to reporters of a less accredited description. These precedents constitute an immense repertory of case law. If regard is paid to the smallness of the basis compared with the vastness of the superstructure, the ordinary course will appear to have been the synthetical formation of general rules out of the application and extension of individual instances. The portion, however, is far from being inconsiderable, in which the judicial classification of particular facts has proceeded according to the *allegata et probata*, under certain established principles. Looking at the history of the science, Burke was justified in saying, in the report of the committee upon the impeachment of Warren Hastings, that "to give judgment privately, is to put an end to reports; to put an end to reports, is to put an end to the law of England." Reports of the leading cases are especially valuable where society and the law are in a state of transition. Without them, the law in such periods soon becomes what Lord Bacon says the law of his time would have become without the reports of Lord Coke, a ship without bal-

last. The whole equitable law of the court of chancery, now tied up as strictly as the common law itself, has been spun, with but very slight exceptions, out of maxims of conscience and limits upon discretion, laid down judicially at as late a day as that of Lord Nottingham and the Restoration. That part of the English system where at present the lucubrations of twenty years are more wanted than in any other, was still in its infancy little more than a hundred years ago. Sir Mathew Hale said, in 1672, "a little law, a good tongue, and a good memory, would fit a man for the chancery." Evelyn, noticing the death of Chief-Justice Treby, in the year 1700, adds, "The chancery requires so little skill in deep law learning, if the practiser can talk eloquently in that court, that probably few care to study the law to any purpose." Lord Nottingham could not have desired a successor more admirably qualified than Lord Eldon, to remove from his court the last traces of this reproach. His ingenuity and erudition, however, only added still further to "the mass of learning which no industry can acquire, nor any intellect digest." Vesey junior, and his voluminous successors, have accelerated the predicted "crisis of a necessary reformation, when our laws, like those of Rome, must be cast into the crucible. It would be a disgrace to the nineteenth century, if England could not find her Tribonian." (Hallam.) Mr Bentham admits that this legislative crisis will find, in the store-books of our reports, materials of a higher and more authentic character than were ever in the possession of any other country. The amendments of the law in the session of parliament for 1852 were more extensive than those of any single reign since Edward I. They extend equally to common law and to equity, and remove many of the objections to the system of procedure, both in regard to expense and delay.

A wise legislature will establish municipal rights in all cases, when by so doing it increases the sum of human happiness. These rights must be derived from the several sources of human pleasure. They therefore necessarily regard property, person, station, character, or opinions. Rights are public or private. Out of the first arise questions between the governors and the governed; to the second belong the disputes of individuals. The classification of these two descriptions of rights, and the specification of the circumstances which are the occasions upon which they vest, constitute the constitutional and the civil code. But rights are delusive unless protected by adequate guarantees. It is the first object of the remedial law, therefore, to define the circumstances which amount to a legal violation of whatever rights the substantive law has conferred. If the injury is considered to affect the public, its recurrence is sought to be prevented by subjecting the wrong-doer to the penalties of the criminal code provided on behalf of society at large. If the injury is of a private nature, the party injured is entitled to recover damages in the civil court for his own personal satisfaction. The mode by which the appropriate legal remedies for an alleged injury are ascertained, is called the trial. Since every case may involve disputed points of law and fact, it is requisite to make complete arrangements for deciding both. The efficiency of a trial will depend upon the constitution of the several courts, and the rules for regulating their proceedings. The first part of this problem concerns the number and locality of the tribunals, the principle upon which each of them shall be formed (as whether of a single judge or more, and with or without a jury), and lastly, the scale of appellate jurisdictions. The chief considerations relating to the proceedings concern the rules of pleading and of evidence, or the method by which a party is required first to make his statement, and afterwards to prove it. When the trial has established the merits of the case, and fixed the nature of the remedy, nothing remains but that proper means should be provided for carrying the judgment of the court into effect. This can be only done by making the property, and, on just occasion, the person, of the defendant duly available to the requisition of the law.

1. *Constitutional Law.*—This has been treated of in the former section. The shape in which the Roman civil law has come down to us, as recast at Constantinople by the imperial jurists, contains not a syllable which can be referred to the supposed resemblance between the mixed forms of government of ancient Rome and modern England. Excepting a few slight privileges belonging to the peerage as members of a second legislative assembly, English equality recognises no distinction but that of aliens and natives. Our doctrine of the unalienability of birth-allegiance, and our restraints on naturalization, are pushed to an illiberal extreme. But it is a great blessing to have escaped the useless and onerous diversity of castes by which Roman policy was embarrassed and American freedom is disgraced. England is safe from the interminable questions of political rights and civil condition arising among the *ingenui, liberti, servi;* and under the discrepancies of the various kinds of citizenship and the *Jus Italicum* and *Jus Latinum.* Shades of colour have introduced the risk of even still more dangerous collisions into the United States.

2. *The Relations of Private Life.*—Under the English law these relations were for the most part either settled upon, or have been since gradually brought within, the true principle, namely, that of deriving from the connection the greatest advantage to both parties, which, on a comprehensive view of their interests, the particular relation seems qualified to produce. On legislating upon this subject, our law-makers have not overlooked the painful fact, that there is no occasion where it is more necessary to keep constantly present to the mind the line which separates morals from law. The poor-laws and the factory bill are doubtful exceptions, in which the feelings of society may be suspected of having got the better of its judgment. Otherwise, the law has generally forborne from becoming responsible for those private virtues which no law can possibly secure, and has shrunk from an interference far too powerful not to tend to defeat the end it is desirous of accomplishing. In the service of adults, the contract between master and servant is the only criterion both of their claims and of their liabilities. The maxim that slaves cannot breathe the air of England, has at length comprehended our distant colonies within its blessing. The extension of a haughty local privilege into a national truth is the proudest triumph of the humanity and justice of modern times. The relation of parent and child is placed upon proper grounds. Parental authority is reasonably limited to the degree of power necessary for the adequate performance of the duties which every parent is understood to undertake. The most faulty part of the legal distinction between legitimate and illegitimate children is not in the degree by which the parental obligation towards them is distinguished. The feelings of society must first alter, and the policy of our rules, and the most effectual method of attaining our object, must be carefully reviewed, or very little practical benefit will follow from a nominal amendment of the letter of the law.

The difference by nature and education between the sexes placed the female sex in the East, in Greece, and in Rome, in a permanent tutelary condition. Their disabilities were doubtless represented, as in the case of minors amongst ourselves, to be in reality privileges of protection. Modern civilization has transferred this state of imbecility from women generally, to women who consent to assume the character and *status* of wives. The marriage contract cannot be regarded as an ordinary partnership. Women are certainly the half of the species much the most interested

in the rule, that a contract, more or less resembling the marriage contract as it is actually established, should subsist. The only question which their advocates can raise must be upon its terms. It is admitted that the terms are partial. The question still remains, Can they be improved? Nothing is more imprudent than to volunteer speculative changes in an engagement of this domestic nature without infinite caution in examining into the capabilities of the case. It is impossible to equalize its effects and condition to the two parties. There is an extreme risk of injuring the female by the very precautions and facilities which it has been proposed to interpose in her favour. The interest which other parties (the children and society) have to keep families together, the first of those concentric circles by which a well-ordered community is formed, introduces a new and paramount consideration. The more the subject is reflected upon, the more will it appear that the English law of husband and wife requires only very incidental modifications. By the late amended marriage act (3d George IV.), the reluctant successors of Lord Hardwicke were compelled to retrace his steps, and to submit, on the marriage of minors, to the compromise of *factum valet, quod fieri non debet.* The debates on that occasion affirmed in the most striking manner the necessity of recognising the least of two evils in this delicate chapter of jurisprudence. No necessity, however, exists at all for making parliament the sole tribunal where a marriage can be dissolved. It is a singular anomaly, that this particular contract should become the subject of individual and *ex post facto* legislation in every case where parliamentary divorces for adultery are allowed to break in upon the ordinary law. Our practice does not leave a doubt that the contract should be legally voidable for adultery. But it is very questionable whether, on transferring this jurisdiction to a divorce court, as proposed by the recent commission of inquiry into the law of divorce, the interests of society in general, and of females in particular, would be promoted by the admission of any other grounds of divorce whatsoever. Nevertheless Cranmer, in the proposed reformation of the ecclesiastical law at the Reformation, was prepared to give to many of the causes on which a separation takes place at present, the effect of a complete dissolution of the marriage. The rule which, subject to a few exceptions, prevents a husband and wife from giving evidence either for or against each other, seems very unreasonable. The legal consequences of marriage do not depend, as Blackstone states, upon any canonical union of persons, which can be supposed to suspend or merge, during coverture, the legal existence of the wife. These consequences are much better accounted for by the rustic simplicity of ancient times, which regarded the wife as only a servant of a better fashion. It is evident that a family partnership, which, when it has once been formed, can be determined only by death or by criminal conduct of a serious nature, requires a conjugal superiority on one side or the other. In this view the law is censurable rather from the discourtesy of the occasional language of some of its authors, than the substance of its provisions. The superiority is certainly evident enough. There is the spiritual promise at the altar to obey, and the legal solemnity which makes it petty treason to kill her lord and husband. Marital restraint and correction carry the power of domestic discipline, in the case of a wife, a greater length than in that of any other servant except an apprentice. The principle of considering the wife incapable of committing certain crimes in the presence of her husband, owing to her supposed submission to his orders, is made additionally absurd by the inconsistency with which the supposition is applied. It is time that on one or two of these points the law should be put into harmony with the fact. There might also be a wholesome relaxation of the rule by which a married woman is prevented, under all circumstances except the civil death of her husband, from being sued as a single woman. The landed property of a wife could formerly be alienated only by a fine. It was imperfectly protected against the exercise of undue influence, on the part of a grasping husband, by her separate examination. Her real and also personal estate may be made safe enough at present. As far as property is concerned, the devices of a marriage settlement, and the interposition of trustees, seem to accomplish everything which can possibly be accomplished by law.

3. *Real Property.*—The lawyers of Greece and Rome had no idea of the necessity of two systems—one for land, and the other for goods. In England the systems are entirely distinct. The civil law of England during a very considerable period seems to have had little else but land to treat of. It characterized land by the expressive denomination of reality; and distinguished it still further by establishing its legal title and qualities on exclusively feudal principles. Hypothesis and research will be equally at a loss to make out any analogy between the Roman Institutes and Littleton's Tenures. The language of Craig would have been unintelligible to Papinian. Where the same word happens to be used, it only deepens the contradiction by the difference in its meaning. Dower, for example, by which the Romans described the property which a woman brought with her on her marriage, signifies, in our modern application of it, the life-interest which, on the death of her husband, the widow acquires to a third of his land. The changes in society gradually made it impossible to retain the strictness and also the peculiarities of feudal learning. The "old books" were already antiquated, and several of their cases seldom came into practice in the time of Sir Mathew Hale. The new reports, such as those of Coke, Plowden, and Dyer, the exact perusal of which he pressed upon his student, are now become "old books" themselves, and are approaching towards a similar fate, partly by statutory repeals, partly from desuetude or ignorance, under a still greater revolution in the law. The wave from the commonwealth which, during the reign of Charles the Second, carried off part of the rubbish of former times, did little in comparison with what was done in the first session of the reformed parliament. The abolition of fines and recoveries, the amendments in the law of inheritance and dower, and of wills, hold out substantial encouragement to expect that the labours of the different law-commissions will in course of time be brought to a satisfactory legislative conclusion. A code itself would be only a partial remedy, unless it superseded the necessity of looking back into the volumes which preceded it. Feudal doctrines are too completely woven into them ever to be worked out of their text. During centuries when the legislature either could not or would not act, judge-made law was by far the least of the two evils to which the country was reduced. The judges certainly did their best towards accommodating the law to the altered condition of society, by means of the only instrument in their power. But the course taken led naturally into a labyrinth of fictions and refinements, which it will now require pretty much the same astuteness to unmake as was originally employed in the making of them. The complaint is not that the law is difficult to be understood. That might be expected. What shocks a reasonable person at the present day, is the finding that so many of its rules, when they come to be understood, are irreconcilable with either common sense or with the usages of the community which they govern.

Thus, in descent, instead of regarding the just expectations of near relations, the law is occupied in tracing the blood of the first purchaser. In forfeiture, instead of balancing the claims of the family on one side, and the claims of injured society on the other, the law can see nobody but

the original feudal donor. In questions of the lawfulness of a distress, the difficulties do not turn on the point, whether the goods which have been seized represent under the circumstances the fair and natural security for the benefit which the owner of the goods has derived from the premises where they were found, but whether the landlord, on putting an occupier in possession of the premises, had taken care that the terms of the occupation were so expressed as to be sufficient technically to raise a tenure. Independently of judicial construction, successive legislative innovations have materially broken in upon the feudalism of the common law. This is the case particularly in regard to entails and remainders, and in the exercise of the testamentary power. The most important of all innovations is, however, the extent to which the doctrine of trusts and uses has brought the principal questions concerning land into a court, where forms and principles in many respects essentially differing from those of the old common law prevail. The intermediate legislation respecting uses, from 50th Edward III. cap. 6, to 27th Henry VIII. cap. 10, is a characteristic specimen of the English method of creeping on step by step, after the mischief has run, like the dry rot, into the frame of society, instead of taking a comprehensive view of the necessary consequences of the new system, and anticipating the confusion by such a conclusive statute as, after all its previous minute enactments, it was ultimately obliged to pass. It answers in civil to the cautious manner with which in criminal jurisprudence the law of *mayhem* advanced, taking successively the different parts of the human body under its protection, one after another, until at last came a general measure known by the name of Lord Ellenborough's act. Blackstone, writing in 1765, observes that the Chancellors, "by a long series of uniform determinations *for now near a century past, with some assistance from the legislature, have raised a new system of rational jurisprudence,* by which trusts are made to answer all the beneficial ends of uses, without their inconveniences or frauds." Considering the strictness of the doctrinal division between legislative and judicial authority, and the traditional attachment to juries, the national submission to this legal revolution, consummated by the great seal, is a remarkable proof of the impossibility of working the system of the common law in the present state of society. It may be questioned whether any country ever adopted, at so comparatively an advanced stage of civilization, so complete a change; with little notice beyond an occasional murmur in some quarters at what was going forward, and that general ratification on the part of the public in the consent that comes from silence. The nature of a jurisdiction like that of Chancery, must be to enlarge, and not contract, its circle. It is now some time since Mr Butler was of opinion that half the estates in the kingdom were held in trust. But there are further changes than those of form. The very substance of certain titles which make a great figure in the law-books is wearing out. Two species of incorporeal hereditaments, common and tithe, to which an extravagant and superstitious importance was formerly attached, seem shortly destined to disappear; and they will carry with them into oblivion a mass of favoured learning. Common of pasture and of estovers was supposed to be so necessary to the advancement of agriculture, and to the maintenance of tenantry and yeomen, that a case connected with it drew forth from Lord Coke the passionate exclamation, "God forbid that the law should not be so, for otherwise many commons in England would be avoided and lost." Long after the Reformation, a still deeper horror continued to be expressed by Spelman and the clergy, at the sacrilegious spectacle of tithe in lay hands, or of land discharged from the payment of tithe. When the necessity of statutes of limitation has been recognised in all other cases, and when even the crown has submitted to be barred by prescriptions of a reasonable extent, the ecclesiastical rule which sent back the proof of a *modus* to a time beyond legal memory (that is, previous to the reign of Richard I.) was no less impolitic than absurd. The tithe owner has to contend at present against passion and prejudice, as well as against reason. A violent re-action has taken place. The discouragement to agricultural improvements, from a surrender of a fixed portion of the gross produce, is a ground of objection in which the public at large are interested. The result is, a demand for a *general* commutation of tithe. Under the 6th and 7th Will. IV., cap. 71, and the various acts since passed for its amendment, a board of commissioners has been appointed to effect a commutation, either by a voluntary parochial agreement, or by the compulsory award of the commissioners, and the tithes are commuted into a rent-charge, the amount of which is adjusted annually, according to the average price of corn.

4. *Personality.*—It is agreed that Bracton borrowed the chief part of what he has said concerning personal property from the civilians. But the reader of the year-books finds himself at the reign of Henry VI. before goods and chattels have become of sufficient importance to make their way as the grounds of litigation into their records. The laws upon property of this description, and on personal contracts generally, are very much the same all the world over. This is probably to be accounted for, not by the supposition that similar laws must have had some common origin; but because these things are too perishable in their nature, and too much the subject of daily wants and traffic, to admit conveniently, under any circumstances, of any great deviation from a common line. The consequence is, that on this point, beyond some occasional quaint distinctions between what is realty and what is personalty, and a little absurdity concerning things which are merely the subject of base property and *nullius in bonis*, there is very little which can be noticed as peculiar in the English law. Where goods have been lost or stolen, the effect which, according to circumstances, prescription and sale ought to have in discussions between the original and the derivative owner, has been settled upon no discriminating principle. The rights belonging to an owner when he is out of possession have been slowly recognised in most countries. Blackstone hastily states, that unless a right of property were to be transferred by the sale even of stolen goods, in market overt, "all commerce between man and man must soon be at an end." He should have recollected that England offers the only exception in civilized Europe to the rule, "*nemo plus juris in alium transferre potest quam quod ipse habet.*" In the new questions which have arisen out of the extended intercourse and complicated interests of recent times, it is fortunate for the legal reputation of the country, that the demand for the development and application of the great principles of commercial and maritime law should have taken place at a time when Lord Mansfield and Lord Stowell presided in their respective courts.

5. *Private Wrongs.*—Every right must have its remedy, otherwise it is a right only in name. Verdicts with a farthing damages are sufficient evidence that the expressions *damnum absque injuriâ*, and *de minimis non curat lex*, are confined in practice within narrow bounds. The causes of actions are, in other words, a list of the cases which the law recognises as civil injuries, and which it accordingly promises to redress in that character. One of the great boasts of the English law is the means which it has taken to render illegal imprisonment almost impossible. This was at last obtained, but with infinite difficulty, under the final guarantee of the Habeas Corpus act. There is nothing otherwise remarkable in its estimate of the wrongs either to the persons or to the personal property of individuals, or in the general quality of the remedies provided by it. The injuries to real

property, and the peculiar remedies applicable in the several cases, partake strongly, at least in shape and in language, of the characteristic subtlety and jargon in which the law of real property itself is framed. There are instances, however, with respect to personal property as well as real, where the strictness of the rules at common law had the effect of a denial of right, and drove the parties into a court which undertook to adjust the remedy to the wants and feelings of society. Chancery would never have obtained a tenth part of its present jurisdiction, but that the common-law judges contented themselves with damages, instead of insisting that a contract should be specifically performed and goods specifically restored; but this is now altered by the 17th and 18th Vict., cap. 125; and unless they had obstinately refused, since the introduction of uses, to notice the existence of a trust. The bankrupt law is also about to undergo revision by the commission recently appointed, and it is to be hoped that this branch of our law will be put upon a footing likely to give, in its text and its administration, as much satisfaction as can be imparted to so untoward a subject. Nor does it follow that tradesmen who complain of the million that is discharged by a penny in the pound, are entitled to lay the blame upon either the policy or the execution of insolvent acts. The only effectual protection, that of more cautious credit, is in their own hands. The Roman system placed the debtor at the mercy of the creditor. The American system, according to Chancellor Kent, throws the creditor at the feet of the debtor. The experience of all countries seems to show, that in legislating upon insolvency it is impossible to reconcile the claims of humanity and of justice by the positive declarations of a universal rule.

6. *Criminal Law.*—Whenever the circumstances and motive under which a legal right is violated imply an injury to the public, it is reasonable that the remedy should cease to be solely of a private nature. The English law is defective in not endeavouring to combine reparation to the party directly injured, as a subordinate object. But it properly considers the mischief to the public, and the remedy for the public, as the paramount concern of criminal justice. The comparative alarm spread throughout society by different offences is the test of their several degrees of responsibility; nor is society entitled to take a criminal cognizance of them at all, save with the single aim of preventing their recurrence. The original point in this respect, from which the common law started, and the mode in which its circle widened, were too coarse and vague to admit of much discretion in the selection of the principle adopted, or of any very uniform correctness in its application. Civilization has tended gradually to exclude from the purview of human punishment the spiritual doctrine of expiation and the savage instinct of resentment. Proceedings *pro salute animæ* are left to the ecclesiastical courts; and the abolition, by 59th George III., cap. 46, of appeals at the suit of the party in all offences, has removed from criminal proceedings the last symptom of private vengeance. Up to a very recent period felony was heaped upon felony, as a matter of course, whenever a new or temporary provocation happened to arise. No wonder, where it was impossible that due attention could have been paid to the nature even of the specific evil and the proposed remedy, that the just proportion between the new offences and the great body of the criminal law should have also been neglected. In fact, they often seem to have taken their place by chance upon the penal scale. During the last few years the consolidation of great part of the criminal statute-law has been performed in a very workmanlike manner. The repeal of a multitude of obscure and almost conflicting enactments has been of great service to the public, and still more to practitioners. It has simplified the labours of future reformers. But a comprehensive view, a consistent direction, and a rational arrangement of the whole subject, is a task reserved for the commission now engaged upon it. The interests of society, as protected by the criminal law, are technically called the king's peace; and all offences against these interests are prosecuted in the king's name. But it is singular that, nevertheless, the burden and the management of criminal prosecutions, and, in popular language, the name even of prosecutor, should, contrary to the practice of many countries, be thrown upon the party injured. The principal legal consequence which has followed from taking the prosecution formally into the hands of the state is, that society obtains the evidence of the party injured, who would otherwise be excluded as being a party to the suit. The original object of using the king's name in this formal manner was probably to entitle the king, as a matter of course, to the penalties and compensations. A barbarous and fiscal rapacity was thus tempted to scatter wholesale forfeiture with indiscriminate profusion over the field of crime. The 25th Edward III., called the magna charta of treason, had no nobler origin than a contest between the king and the barons, which of the two should appropriate the confiscations upon conviction. They belonged to one or the other, according as the offence was treason or ordinary felony. It may easily be understood, therefore, what little principle exists in the rude classification of offences into felonies and misdemeanours, distinguished only by the nature of the punishment; the one being subjected to general forfeiture, and the other to special fine. Under these circumstances, a strict revision of the entire department of the criminal law, keeping steadily in view the one principle of the good of society, must bring to light anomalies and divergencies which it will be no less desirable than practicable to remove. This is likely to be the case much more in some questions than in others. For instance, the purely religious sentiment was formerly mixed up with the only consideration which can justify human laws in inquiring into offences against God; and it still partially remains so. Judicial perjury is punishable simply under the general description of being the violation of an oath. If the religious obligation is alone regarded, it may be contended with some plausibility that the breach and the offence must in all cases be the same. But if the danger to society be the point in question, it is clear that the danger must be materially affected by the nature of the case in which the perjury takes place. In some instances zeal without knowledge has been induced to pass the line by which morals ought to be always kept separate from law. The political economy of modern days has overturned many of the most sacred rules of policy and trade invented by the common-law wisdom of our ancestors. It is in vain that the corresponding statutes have been repealed, whilst narrow-minded judges feel a pride in proclaiming that unitarianism, forestalling, and engrossing, are still indictable misdemeanours. The same reasoning which annulled the statutory policy of the intermediate generations ought to avail for abrogating equivalent absurdities, supposed to have been embodied at an earlier period in the original structure of the common law. In many cases legal definitions, as formerly in larceny, or the specific enumerations contained in an act of parliament, or the purview of a preamble, or the recognised jurisdiction of our actual courts, may be found to fall short of their proper object. It is plain to the understanding of the present day, that the terms of the statutes of treason, which left even Strafford's case to forced constructions, were too monarchical. The decay of the ecclesiastical courts, of the court of honour, and the abolition of the star-chamber, threw loose many offences which have never been examined and arranged on system. It may be doubtful whether seduction and adultery are properly left to a civil remedy only. A doubt, however, can scarcely be entertained but that the indictable character of words spoken, as distinguished from

Government and Laws.

words written, ought not to be derived solely from their containing a consequent breach of the peace in their tendency to lead to a challenge. There is little foundation in reason for the general rule, which, in slander or libel, admits the truth to be pleaded as a justification always in an action, but never in a prosecution. A careful investigation of the true principles, which, in a compromise of difficulties, may be the best guides on many subjects, will lead to another very important consideration. A great deal of needless, and, what is worse, pernicious pains, appears to have been employed in turning into fixed rules of law what it would be much more satisfactory to the ends of justice to have left as questions of fact. This must happen in all subjects and occasions where the nature and tendency of the act depends on circumstances which it is almost impossible to define beforehand. Supposing what we see no reason to suppose that a common jury is incompetent to decide questions of fact of this description, it becomes the duty of society to create a competent tribunal. All offences of opinion are of this nature. But there are numerous others. Notwithstanding the complaint of Sir Thomas More against the judges of his day, that, in order to escape personal responsibility, they threw everything on the jury, it is evident that, honestly and dishonestly, English judges have brought many points, as legal conclusions of the science, under their own judicial authority, which, as questions of fact, would have fallen, and much more properly belonged, to the province of a jury. National character is involved in the history of the public institutions and policy of a country. England, both at home and abroad, labours under the imputation that the letter, and even the execution, of its criminal law, are severe beyond the example of other states scarcely its equals in general civilization. The difference would appear by comparing a scale of offences and punishments under the English law with a similar table drawn up according to the progressive mitigations which have been attempted by America and France. It need not be feared but that the experience of opposite systems, and a patient discussion of the peculiarities of England, of the nature and circumstances of its population, the distribution of its wealth, and the free character of its legislation, are sufficient securities against vague and theoretical innovation. The result would ascertain what degree of success has attended the humane endeavours of the enlightened statesmen of other countries towards the amendment of their penal codes, and whether any just cause can be assigned why England may not safely venture upon imitating their example. The comparison of the nature of comparative anatomy between the laws of different nations may be very useful. In this instance it would be most satisfactory, were it to terminate, as some confidently insist, in proving that England has already redeemed its right to the distinction which it lost in and after the reign of Henry VII.—*Nulli gentium mitiores placuisse pœnas.* The executions during the reign of Henry VIII. are reckoned by Hollinshed to have averaged two thousand a year. Towards the close of the reign of Elizabeth they averaged annually about four hundred. Notwithstanding the vast increase of our population, and the supposed increase of crime, the criminal return for 1830 gives, on 12,805 convictions, the sentences to death 1397, and actual executions only 46. In France the criminal return for the same year (1830) gives, on 4130 convictions, the sentences to death 92, and actual executions 38. By the parliamentary return for 1853, the convicted offenders in England and Wales were 20,756. Of these 55 were sentenced to death, but 8 only were executed.

7. *Courts of Justice.*—The occasions are few and strictly limited, in which the English law allows the party injured, or his immediate relations, to right themselves. A third person cannot justify interfering on behalf of the private interest of even his dearest friend. It is only as a member of society that he can step forward on the public grounds of preserving the public peace. The great singularity of the chapter on preventive justice in the English system, is not, as Blackstone states, that there should be one at all, but that it is so short. There is nothing, however, which a stranger is not privileged in doing, in order to prevent the commission of a felony. In other respects, every one is understood to have transferred the redress of whatever wrongs he may sustain, as well of a private as of a public nature, to the collective justice of the community. Under these circumstances, it is the duty of the community to establish tribunals for a prompt, cheap, and efficient adjudication of the differences which must necessarily occur. The necessity of reconsidering the constitution and distribution of courts, both of original and of appellate jurisdiction, has been at last forced upon the English legislature. Original tribunals may be separated or combined upon four principles: *First*, By the nature of the causes, whether civil, criminal, or ecclesiastical: *Secondly*, By the importance of the proceedings; that is, according to the value of the matter in dispute, or according to the amount of punishment to be inflicted: *Thirdly*, By territorial extent: *Lastly*, By the number and description of the judges, and by the different forms in which justice may be administered in each. The English system admits all these principles.

The supreme courts are classed on the first principle. They were originally founded upon a positive metaphysical division, which went so far as to parcel out particular classes of civil causes to particular courts. Thus all controversies between subject and subject were to be taken into the Common Pleas; all civil questions which might affect the revenue were to be decided in the Exchequer; whilst the King's Bench had the proper cognizance of all trespasses which savoured of a criminal nature, in right of its transcendent authority for the correction of crimes and misdemeanours. By means of rival measures of ludicrous trickery, hardly worthy to be called astuteness, these courts gradually obtained in most civil actions a concurrent jurisdiction. But this jurisdiction unfortunately remained stationary while society advanced. In course of time Chancery took under its charge the vast civil interests with which the common law refused to interfere. Common lawyers were for a time indignant; but they seem, after the first unsuccessful struggle, to have shrunk from entering into competition with the political ascendency of the Chancellors. Consequently, the greater part of this equitable jurisdiction is what no fiction or rule of court has since been ingenious or venturesome enough to reach. Soon after the Norman conquest, it was the policy, perhaps, of the government, but still more of the church, to separate judicially the civil from the ecclesiastical authority. The King's Bench has revenged itself on Doctors' Commons for the encroachments of Chancery, and has always taken jealous care, by its prohibitions, to keep the ecclesiastical courts within their peculiar province. The province is still, however, considerably larger than present opinion would have made it; for it would be difficult to make out how matrimonial and testamentary questions are properly matters of spiritual concern. The suspicion entertained by Mr Bentham, that the metaphysical classification of courts must have been the result of a scramble between competitors, is not confirmed by our legal history. The scramble began with and brought about the consolidation. Nevertheless, although at first a deliberate arrangement, it seems to have been an injudicious one; and as such, it has been in a great degree abandoned. Every classification of the kind multiplies the chances of clashing jurisdictions. It creates also an additional risk of a failure of justice; since there is a chance the more of a formal error, by mistaking the appro-

priate tribunal. Each court, having less to do as the business is more minutely subdivided, can supply the judicial demands of a wider area. Thus is superinduced the further disadvantage of extreme centralization. Circuits by the supreme judges at stated periods only partially mitigate a portion of these evils. They have been in use for many ages, and have the very desirable effect of bringing the metropolitan courts nearer to the great majority of the suitors of the kingdom; but it is difficult beforehand to make the calculation of the probable business at the several places of a circuit, with so much accuracy as not to become the occasion of one or other of opposite inconveniences. Causes are often hurried through with indecent haste, or are got rid of by an almost compulsory arbitration; or great vexation and expense are incurred in waiting for a trial, which, after all, is obliged to be put off until the next assizes. The Common-Law Procedure Acts of 1852 and 1854 conferred on the common-law courts a considerable extent of equitable jurisdiction in discovering evidence, examining the parties, issuing injunctions, pleading equitable defences, compelling the delivery of specific chattels, and the reference of disputed accounts.

The periodical visits of the supreme judges, and the presence and example of the powerful metropolitan bar, have doubtless a very wholesome influence in the provinces. They constitute moveable local courts for the time being. In the great majority of cases, trials at bar must have been always out of the question; and much more so, while the metropolis was a place talked of rather than known in remote counties, than at present. From the earliest times, therefore, the courts at Westminster could not dispense with justices in eyre travelling to the spot.

The inferior courts for the administration of justice were dispersed generally throughout the kingdom, but from one cause or other these petty tribunals have fallen into decay, although a new institution has recently been grafted on one species with an enlarged jurisdiction. These courts were— 1. *The Court Baron*, which yet obtains so far as relates to the surrender and admittance of copyholders to their estates, while its jurisdiction as a court of common law for the manor has fallen into almost entire disuse. 2. *The Hundred Court*, which was held for all the inhabitants of a particular hundred; but no resort to this court is at present ever made. 3. *The County Court.* Formerly this court had only jurisdiction to hold pleas of debt or damages under the value of 40s., but by the 9th and 10th Vict., cap. 95, the jurisdiction was extended to not more than L.20, whether in balance of account or otherwise, excluding actions of ejectment, or for libel, &c. This was raised by the 13th and 14th Vict., cap. 61, to L.50, or by agreement of both parties the court was empowered to try causes although the matters might be beyond its jurisdiction.

By an order in council, dated March 9, 1847, the whole of England and Wales was divided into sixty districts, and certain towns and places were specified where the court should be held at least once in every calendar month. The course of proceeding is regulated by statute, and the trial is by the judge alone, or with the assistance of a jury of five, whose verdict must be unanimous. There is a power of imprisonment for any period not exceeding forty days, and an appeal lies on any matter of law where the claim is above L.20, to the superior courts at Westminster.

The size of France more naturally led to great provincial institutions, like the old French parliaments, or the actual *Cours Royales*, with their divers subordinate jurisdictions. The different courts existing in England for different purposes vary considerably in the number of their judges, and in the forms by which justice is administered. Mr Bentham praises single-seated judicature. Aristotle, on the contrary, insists that one or more colleagues are wise precautions against the moral or intellectual obliquities of a single individual. The practice of England offers a choice of every kind. The varieties are varieties of accident apparently, not of principle. Courts of equity, and most of the courts which do not proceed according to the common law, have always afforded, and still afford, only a single judge. But the number in the supreme common-law courts fluctuated considerably in former times. That of the Common Pleas, for instance, has been nine, seven, six, four, and five; of which latter number the three principal courts of common law consist at present. On the circuit the number drops down to one, both in civil and criminal cases. The trial of a peer for felony takes place before the whole body of the nobility. The inferior courts vary equally. There are the mayor and aldermen of corporations, assisted, or not, by their recorder; magistrates with summary jurisdiction, one or two in certain cases, up to the indefinite scramble of the bench at quarter-sessions. When members of a corporate body, and justices of the peace, render their judicial services gratuitously, the financial objection of a numerous judicature is removed. But it is only the financial objection; and a remuneration, more than adequate to the services performed, is likely to be often got in local influence, or some more objectionable shape. When the aggregate numbers stop short of letting in the passions which seize upon all large assemblies, even the majority may be yet likely enough to want the requisite character and knowledge. It is absolutely necessary to keep down this risk within certain limits. But the importance of interesting the higher and middling classes in the administration of justice may counterbalance in this instance, as in that of a jury, a small percentage of errors.

If no very good cause can be assigned for the numerical varieties which appear upon the English bench on different occasions, it is perhaps still more difficult to give a rational account and justification of the distinctions by which the presence or absence of a jury is determined. The precise history of the institution, of its original object, and of the transitions through which it has passed to its present state, appears to be irrecoverably lost. But enough is left to show that it was a trial by neighbours, acting in the mixed capacity of witnesses, sometimes to facts, sometimes to character, as well as in that of judges ultimately determining the truth of the fact upon the result of the evidence. They were always the *patria*, but only in certain cases the *pares*, of the parties. As the law advanced to the dignity of a cultivated science, the line of demarcation between the facts which were to be proved, and the law which was to be applied to them, became strongly (occasionally too strongly) marked. If the temporary and casual inquest returned by the sheriff was recognised as the proper judicature for solving the question of fact, the permanent professional representative of the sovereign was alone competent to answer the question of law. The jury, growing up with, and itself a part of, the common law, was thus made the constant adjunct to its courts. It insured at all events publicity, without which every other excellence can give little security for real, and none for apparent, justice. Yet apparent justice is the source of the general confidence and satisfaction which forms one of the principal objects of government in all its branches. In their own limited departments, courts of equity, admiralty, and chivalry, arose under the civil law, and ecclesiastical courts under the canon law. Knowing nothing of a jury, they knew nothing of the above distinction; and the professional judge was of course entrusted with the decision both of fact and law. Before the passing of the 15th and 16th Vict., cap. 86, sect. 15, cases in Chancery, where an issue was directed, were the mere exceptions of practice. There is nothing in the great ma-

jority of the questions which come before any of these courts, as compared with the civil questions which are tried at the assizes, to warrant a difference of this description. The interposition of a jury is matter of command in the one case, and of prohibition in the other; yet the rule rests only upon prescriptive usage, and not on reason. The legislature has often dispensed with juries, for obvious reasons. It is easy to understand how a jury is too popular an institution to be trusted with the administration of unpopular laws; such as laws enforcing rates, excise, and customs, must unfortunately always be. A more agreeable reason will justify the absence of a jury in some, but in some only, of the questions left to justices of the peace. Many causes are too free from difficulties, and at the same time too frequently recurring, to render it necessary or prudent to fill a jury box by means of a legal conscription on their account. Twelve citizens need not be summoned from the farm-yard or the counter to superintend the prosecution of all minor offences, and on every affair of correctional police. Whilst accidental circumstances have had the greatest share in establishing the distinctions by which in the higher courts juries are admitted or excluded, it would be as well to see in what cases some better criterion can be found. This would be wiser than the opposite courses which have been recommended by the extreme advocates of reform; an indiscriminate reception, or an almost indiscriminate refusal. A jury is an excellent tribunal for solving and appreciating ninety-nine out of one hundred of the combination of facts with which criminal justice has to deal. It is thoroughly qualified to determine all cases of intention, and assess almost all questions of uncertain damage, as in actions of libel and of trespass. Whatever abuses may stain certain periods of our history, the institution has well earned the traditional reverence with which it is regarded. It is entitled, on collateral accounts, to the respect of the lawyer and to the gratitude of the people. The distinction by which a question belonged to the judge or to the jury, according as it was a question of law or of fact, impressed a peculiar character upon our legal proceedings. It was the occasion of the remarkable simplicity and precision with which these separate questions were early discriminated in the English law. The national character of Englishmen has become remarkable for its almost judicial sobriety, and for the degree in which a deep sense of justice and an invincible respect for property are singularly combined with popular public spirit. How much of these, one or all, may be owing to the immemorial co-operation of the people in the administration of the law, is more than any one can presume to say. The impression left by English history on Jefferson is recorded in his declaration, that he would rather live without parliaments than without juries.

It is for the interest of the parties as well as of the public that a suit should be brought to a final termination as soon as a reasonable certainty for a correct decision has been secured. A government is bound to make its courts of original jurisdiction as good as, with reference to the circumstances of the case, it has the means of making them. That is the first and indispensable security. Supposing, nevertheless, that there are grounds for suspecting a failure of justice in any instance, on account of misdecision either upon the fact or the law, the course to be pursued depends on the stage which the proceedings have reached. There can be no reason for withholding from the original court, if it has still charge of the proceedings, the power of doing justice. This is done in civil cases, in a court of common law, by means of a new trial. On the return of the record by the judges who were commissioned to take the trial at Nisi Prius, the court from which the record was sent can revise the law laid down at the trial by the presiding judge, and can also exercise a discretionary criticism on the verdict of the jury. In the event of the question being transmitted to a second jury, the judge commissioned to superintend, and the jurors summoned to rehear the facts, may be different individuals from those concerned in the former investigation; but the class which the inquest represents continues the same. It is not a superior court, but only another edition of the former. The judges on this occasion have frequently an opportunity of putting the parties to such terms as may appear to be advantageous to the ends of justice, especially with regard to the new evidence to be produced. It was, before the 15th and 16th Vict., cap. 76, a peculiarity belonging to the form of the action of ejectment, that a party might give himself the benefit of a new trial without the assistance of the court. In Lord Bath's case there had been five successive verdicts for Lord Bath before the House of Lords decreed a perpetual injunction. Justice Powell, in the year 1712 (1. Peere Williams, p. 212), observes that new trials from Nisi Prius are things of which he did not well know the foundation, but of which he had found the courts in possession. Judges of equity, possessing the whole case in their own hands, have allowed themselves a somewhat greater latitude of reconsidering and recalling their decrees, under the analogous forms of a rehearing and a bill of review. When an original court has once pronounced its final judgment, such a judgment is rightly made conclusive ever after, unless reversed by a higher court. There is sometimes the reality, and always the appearance of hardship in binding the losing party to the possibly hasty or prejudiced opinion of a single tribunal. He will often be desirous of appealing elsewhere for the chance of its reversal. One chance of this kind, if the superior tribunal to which it is carried up is at all properly constituted, will be enough. This part of any possible judicial arrangement contains a choice of evils. Unless a power of removal or of appeal be given, one act of ignorance or of injustice will be fatal to the unlucky suitor. The other side of the risk was exemplified in the skeletons presented by the inferior courts for counties, hundreds, and baronies. If the power is given, either both courts are really kept alive, in which case the temptation to run the gauntlet of both will often take a party through two proceedings, where he had much better have rested satisfied with one; or society and the law-books will be taxed with keeping up the cumbersome representation of a first court long after it has fallen into disuse. The differences between a writ of error from a court of common law and an appeal from the Court of Chancery are unimportant. They are the respective names by which the two systems mean the same thing. The supreme court of appeal from other courts of justice is the House of Lords. This high judicial office has been retained by them as the ancient *consilium regis*, which, during the early periods of English law administered justice with the assent of the king and the assistance of the judges; and it received statutory confirmation in the year 1340 from the 14th Edw. III., cap. 5. Their claim to an appellant jurisdiction over causes in equity on petition without reference from the crown, has been exercised since the reign of Charles I.; and their jurisdiction over causes brought on writs of error from the courts of law, although that power was originally derived from the crown, it was confirmed by the 27th Eliz. cap. 8. The opinion of the judges is taken on points of law on which the Lords wish to be informed.

Appeals in ecclesiastical, maritime, or prize causes, and colonial appeals, both at law and in equity, are determined by the judicial committee of the Privy Council.

Criminal proceedings are carried on with or without a jury. The latter are called summary convictions. They were unknown to the common law. At present they take

place in frauds on the revenue, and in many minor offences, before the particular persons appointed by the several statutes which have created these extraordinary jurisdictions. When the commissioner or magistrate has once pronounced his decision on the case as brought before him, he is *functus officio*. The privilege of appeal from his decision, in order to obtain a second inquiry into the merits, is not of common right; it only lies where it has been expressly given by act of parliament. The word is connected with the comparative novelty of the proceeding. For the word appeals had not passed beyond the spiritual courts until the time of James I. The earliest mention of appeals to the quarter-sessions is in the beginning of the reign of Charles II.; and towards the latter part of his reign they had come into general use. On the other hand, the writ of *certiorari*, by which the Queen's Bench removes before itself the proceedings of all inferior criminal jurisdictions, existed at common law. A certiorari has the object and effect of a writ of error, in an instance where, from want of learning, error was most likely to occur. For this purpose, whenever it is granted, the determination of the justices, like that of a jury in the case of jury trial, is final as to the matter of fact; and the superior court, in reviewing their judgment, notices nothing but what appears upon the face of the conviction. The power of granting certioraris has been taken away by express statutory prohibition upon many occasions since the Revolution. Nevertheless the power is considered by the Queen's Bench as so beneficial to the subject, that the extent of these prohibitions is as much as possible restrained by the utmost jealousy of construction. A knowledge of law travels down to the quarter sessions in the shape of opinions obtained from the metropolis, and in the persons of an attendant bar. If one or other must be dispensed with, it may perhaps therefore be fairly questioned whether the limited argument on a certiorari is not both more expensive, and at the same time less beneficial to the subject, than the more comprehensive re-investigation admitted upon an appeal. The conclusive nature of criminal proceedings before a jury depends on an absolute rule which the common law introduced, and which it has been able to preserve up to the present day in its own favourite tribunal. No man can be put in jeopardy twice for the same offence. As long as appeals for felony were in practice, this maxim might have been easily evaded. One precedent in direct contradiction to it is reported by Foster in the trials of the Jacobites. But when the jury has once been sworn on a charge within its jurisdiction, and upon a sufficient indictment, it is undisputed law that the prosecutor cannot elect to be non-suited, and that there can be no second trial. The points on which a criminal judgment may be falsified or reversed by the Queen's Bench, or by the House of Lords, either with or without a writ of error, are all independent of the merits. Wherever the proceedings below are annulled on the supposition that the party prosecuted has never been tried at all, of course he still continues liable to prosecution in the same manner as if the former nominal trial had never taken place. The doctrine of attaints in criminal cases was at no time held in terror over a jury. At moments of violence, arbitrary judges, dissatisfied with a criminal verdict, formerly imposed fine and imprisonment instead. This was equally unjust, and was illegal into the bargain. In the nature of things, however, there can be no reason why the presumption in favour of the correctness of a verdict should be placed higher in criminal cases than in civil. Yet the one is left carefully open to revision, while the other is as carefully closed. The distinction is partly the result of accident, partly of indifference. But it is probably in some degree to be attributed to the fact that it was an object to bring litigation sooner to a close, where, owing to the poverty of the parties, and to the rules concerning the costs of an indictment, the litigation would be prolonged at the expense of the public. The present popularity of the distinction is undoubtedly for the most part matter of tradition. The cause of it is to be found in the despotic practices of former times. The people gladly acquiesced in any rule which lessened the number of criminal prosecutions, and secured to a defendant the whole advantage which had been hardly earned for him by the rare contingency of a courageous jury. It is impossible that even the violent condition of unanimity can make the first impression of any court, especially of a court constituted like a jury, so completely satisfactory that the conclusiveness of a single verdict can be consistent in all criminal trials with the ends of justice. The rule in the present state of society operates entirely in favour of the prisoner. It must do so as soon as the crown has learned to exercise the prerogative of pardon on purely public considerations. Amongst these, and in the first rank, stands the necessity of protecting the conscience of mankind against the possible suspicion of punishing the innocent. If there has been any mistake in fact or in law, or if any fresh evidence has come to light, the prisoner is certain of receiving from the executive the full benefit of the discovery, in mitigation or pardon. On the other hand, unfounded acquittals are very injurious to the best interests of a community. They turn back on society offenders whom impunity has hardened. They embolden all who are tempted by vicious propensities to prey upon the public. They bear down the innocent man's appeal to a verdict in vindication of his character, by the cry of acquitted felons. They destroy the confidence of the people in the truth and efficiency of the law. The ancient scruples, by which the statutes of *jeofails* were not allowed to amend errors in indictments, had no connection with truth, justice, or sound humanity. As little can be said in behalf of any scruple which refuses society, for the punishment of a wrong-doer, the same assistance as it affords a private individual in satisfaction of his private injury. It will not be to the credit of the reason and the temper of the English public of the present day, if they are not able to remove this inconsistency between the two systems, by the interposition of checks and precautions, which, whilst they give a proper chance of justice to the public, shall secure a prisoner against any further hardship than that of having his case properly decided.

8. *Judicial Proceedings.*—On these points the English practice bears a remarkable resemblance to the Roman in some particulars, which have been comparatively abandoned in countries where otherwise the civil law is the principal authority. It is the more curious to find these coincidences between two systems, which are otherwise so different, that Selden observes they have not a term in common. The original writs of the common law, by being the tests whether a party has or has not a right, are rude approximations to a code. Their analogy to the set forms for actions adopted by the Romans is so striking, that Duck and Noy agreed that the writs in the *registrum brevium* must have been settled by great civil lawyers. Blackstone (vol. iii. p. 117) speaks as if some similar standard was in itself undoubtedly necessary to fix the true state of a question of right; and he even subjoins, that an equivalent method is recognised by all the modern legislatures of Europe. This is surely a proposition very difficult to be maintained in the presence of the contrary experience, both of Scotland, and of the English courts of equity and of Doctors' Commons. In the subsequent proceedings, most judicatures leave the parties to tell their story in their own fashion. But Mr Stephen, in his excellent work on pleading, shows, by reference to Quinctilian's account of the method of oratorical analysis, which he himself used in forensic controversies (B. vii. c. 1), how artificially the

logic of a Roman advocate was directed to the object of bringing out the point in issue. Looking at the different ways in which the testimony of witnesses may be extracted, Mr Bentham says that cross-examination is, both in the thing and in the name, peculiarly English; for every thing of the sort is excluded by the interchange of written interrogatories from the present usage and vocabulary of the civil law. However, in the seventh chapter of the fifth book of his Institutes, Quinctilian has again sketched as accurate a picture of examination and cross-examination as a Nisi Prius leader could desire. Every rule of positive law is necessarily founded on a balance of advantages and disadvantages. In many cases the line of prudent compromise between opposite mischiefs is extremely difficult to draw and to preserve. Wherever the line is taken, nothing is so easy or so unreasonable as to caricature it, by representing only the inconveniencies which every compromise assumes. This is particularly true with regard to judicial pleadings. They are merely the statement made by both sides of their case; nevertheless they are a subject which, on account of the opposite mischiefs of the Scottish and English systems, has lately been the occasion in both countries of elaborate debate and judicious propositions for their reform. The nature of the mischiefs in these two instances is just the reverse of what might have been expected. Scotch pleadings, which were carried on under the superintendence of the judge, erred by extreme looseness; whilst English pleadings, which, except in extreme cases, had been for ages left to the discretion of counsel, became celebrated for the characteristic error of an extreme strictness and technicality. The intermediate course taken by the Court of Chancery appeared upon the whole to be the most rational. As the new rules relating to pleadings (of Hilary Term, 1853) have come into practice, it may be confidently trusted that the common law will no longer labour under the evil of voluminousness, or of technicality. Originally, parties made their statements to the judge by word of mouth, with as little form as a complainant tells his story to a magistrate, or as counsel at present open the case orally at the bar. During this period a great deal would depend on the talents of the judge for abridging irrelevant details, and clearing up ambiguous expressions. Afterwards, towards the middle of the reign of Edward III. when writing became common, the substance of the altercation, to which the evidence and the argument were to be applied, was required (and very properly) to be put down in writing in the first instance. The moment of this transition was the golden age of English pleadings. Serjeants drew them, and judges settled them. The judges ceased by degrees to interpose at this early stage of the suit. But, according to the scholastic subtilties of that age, the science of special pleading was encouraged to become more minute and complicated. A proportionate degree of technical knowledge was rendered necessary for the judge, since he had ultimately to award the prize to the professional combatant who had manœuvred on behalf of his client with most success on this preliminary arena. Fitzherbert, Littleton, and Coke expatiate on the learning, the lucrativeness, the honour, and delights of pleading. The reports of Chief-Justice Saunders are the glory of this art; and his mind is a model of the sort of astuteness which it cultivates. The department calls for but a small, and that far from the highest, portion of real judicial ability. It becomes only prejudicial craftiness the moment that it passes the boundaries within which a strong and logical understanding would confine the speeches of advocates at the bar. The degree at which an intimate acquaintance with special pleading still ranks in the list of qualifications for the bench, is a proof how much that boundary has been overpassed.

Besides mastering the merits of his case, formal difficulties of great magnitude were, in this early stage of the inquiry, thrown upon an English lawyer (before the passing of the acts 15th and 16th Vict., cap. 76). In the first place, he had to select the appropriate form of action; and having done that, he must comply with the established principles on which the forensic argument was to be conducted, and which, *mutatis mutandis*, were equally applicable to all forms. Our historical sketch of the transitions of English pleadings shows what alone they ought to be when they are properly considered. If they are nothing but the statement made by the parties, of their respective cases, What is the only object of an intelligent and honest statement? It can be nothing else than to keep clear of extraneous topics, and to get to the point in dispute as soon as possible. As every legal question consists of the application of a supposed principle of law to some one or other supposed fact, the first thing to ascertain is, About what are the parties quarrelling? Do they differ in their view of the law or of the facts, or both? The alternative cases present no difficulty. When there is no dispute about the facts, there is a simple point of law for the opinion of the judges. It is at once raised upon what is called a demurrer. On the other hand, when the dispute turns entirely on the facts, what is wanted is, that they be brought out to the jury in so precise and definite a shape that it is impossible to mistake the point or points in issue. If the party is prepared to dispute the correctness of the law as applied to the supposed facts, and further also, the correctness of the facts as stated, questions of considerable difficulty and difference of opinion open on him. Must he enter upon both issues simultaneously? or may he take first one, and then the other? and, in the latter case, with which of the two issues, that of fact or that of law, ought he to begin? The English common law disposes of these considerations by summarily making an admission of the facts a condition of a demurrer. A legal proposition can seldom be put forward so manifestly erroneous that a defendant will not think it advisable to retain both chances in his hands. It is on the facts—namely, what he should prove, concede, deny—that he must be careful to watch over his own interests. Points of law will comparatively take care of themselves, and the benefit of these is also secured at all stages. Demurrers are freed in courts of equity from the above condition. The experience in equity by no means justifies the apprehension entertained by the common-law pleaders, that on the removal of the condition every cause at common law would be forthwith burdened with a tentative demurrer. The discretionary application of costs might easily be made a most effectual instrument for the suppression of such unwarrantable speculations as might at first arise upon a relaxation of the former rule. The abuses of special pleading have on many occasions induced the legislature to interpose; and now special demurrers are abolished by the 15th and 16th Vict., cap. 76, sec. 51. Particular defendants, as magistrates, for instance, have been favoured, by way of exception, with the privilege of pleading the general issue; that is, they are allowed to deny generally the wrongful act imputed to them, without being called upon to state whether they mean to deny the law or the fact, or to mention a single item of the hundred possible special grounds of their defence. The English system prides itself on its peculiar mechanism, every movement of which necessarily tends to a clear and single point. The plea of the general issue does much more than lose the advantage for which so much is sacrificed. It covers everything with a cloud. It gives the defendant the privilege of evading the duty of speaking out, by adopting a common form, which tells the opposite party absolutely nothing. The regulation which refuses a prisoner a copy of his indictment till he holds up his hand to take his trial, is scarcely in principle more unjust. Fraud lies in generalities. On the one hand,

a defendant or a prisoner has a right to know the particulars of the demand or of the accusation brought against him; something more than the mere assertion that he is liable to a demand or charge of some sort; what it is being left to appear on the day of trial. On the other hand, plaintiffs and prosecutors are equally entitled to know beforehand the particulars of the defence on which their claim is to be resisted; something beyond a direct negation. At all events, when the power of pleading the general issue is thrown over a party as a shield, the exception should rest on the nature of the case, and not on the authority of the person. A better distinction might be found than that of official station. Pleadings drawn up and communicated by the professional representative of the parties ought to contain a correct narrative of the transaction in writing. Thus prepared, they might be expected to be more complete, and at the same time more relevant and more concise, than any judge could have obtained from their own mouths if present. Yet what would be thought of parties in open court who were to ramble into the jargon and exaggeration of a declaration; or who should indulge themselves *viva voce* in the fiction of alleging the utmost preciseness of time and place, whilst every syllable of the allegations was perhaps notoriously and ridiculously untrue. It is difficult to account for the origin of such extravagant falsehoods. They are as indefensible in point of reason, coming from the pen of a pleader, as if they came from the principal himself, preferring his claim and conducting his cause in person.

9. *Evidence.*—What the pleadings have stated, it is the object of evidence to establish. One of the most difficult things to account for is the absurdity of the rules of judicial evidence, which have prevailed in all ages and over all countries. Sir William Jones observes, in his preface to Isæus, that "we may triumph in our elegant and philosophical theory of evidence, which Aristotle and Plato must have admired, and by the strict rules of which all trials in the world ought to be directed." No panegyric was ever less deserved. It is perhaps true that the English theory on this subject is less objectionable than the theory of almost any other country, inasmuch as its exclusions appear upon the whole to be fewer and more strictly limited. But it is faulty enough even in this respect; whilst whatever other defects may be found incorporated in its principles, they are likely to be felt more severely in practice, in consequence of the unbending rigidity with which every rule is enforced by English lawyers. Our judicial system is too careless in requiring or preserving preconstituted written evidence, even in the case of recurring events and deliberate transactions. The registries of baptisms, deaths, and marriages, are still left as a part rather of ecclesiastical discipline than of civil obligation. They are exposed to great irregularities and losses, whilst a general registry of deeds remains yet to be established. In criminal proceedings the attendance of witnesses on both sides is secured by summary methods. The duty of appearing for a prisoner as well as against him is equally a debt due to society by its members; although it is one which the law was disgracefully slow in recognising. In civil cases witnesses are obliged also to attend; nor can they insist upon more favourable terms than the tender of their expenses. The English law formerly admitted of four heads of personal incompetency in a witness: one intellectual, as want of sufficient reason; and three moral. Of these, the first was a want of religious belief, extending as far as to disbelieve the existence of a God and of a future state of rewards and punishments; but by the 1st and 2d Vict., cap. 105, such person may give evidence under the form of oath, which he may declare to be binding. The second was infamy of character, evidenced by a judgment of felony, or for some offence considered by the law as infamous. This has been done away with by the 6th and 7th Vict., cap. 85; and the last, or where the party has a direct legal interest in the cause at issue, or in the question asked, has been removed by the same statute, as amended by the 14th and 15th Vict., cap. 99. The only head of incompetency from family relationship, is the case of husband and wife. It applies to both, and to evidence offered either for or against each other. The only instance of incompetency from professional relationship, is the rule by which a lawyer is prohibited from giving evidence against his client concerning any facts with which he has become acquainted under the sanction of that relation.

The objections are equally fatal, whether the acts to which the testimony applies are sudden or deliberate. It would be as difficult to justify the want of distinguishing between these two classes, as to prove the propriety of the distinctions which, in some instances, prevail between the admissibility of the same evidence in criminal as in civil proceedings. The rejection of hearsay is also too extensive. It may be doubted whether the rejection should ever be carried further than to declarations made by a person whom it was possible to have produced as a witness, and who might have been compelled in the character of a witness to repeat his supposed statement under the sanction of an oath or other solemnity, and subject to cross-examination. It does not apply to declarations, themselves a part of the transaction. The tendency of the judges of latter days has strongly run in the direction of letting in evidence. A witness is not bound to answer any question tending to expose him to punishment as a criminal, or to any penalty or forfeiture. There can be no doubt but that the examination of a prisoner, humanely conducted, would be very favourable to truth. But there is much doubt whether even an open court could be trusted with the authority, and still more whether the public would be satisfied with the change. All the objections above enumerated go to the competency of a witness, and, where they apply, are fatal. All other objections are of minor consequence. They go only to the credit, and as such, they are questions, not of total exclusion, to be determined by the judge; but matter for observation, turning on degrees of credit, more or less, to be weighed by the jury. Two witnesses, or an equivalent, are universally required by the civil law. With us, one witness, if believed, was sufficient for all purposes, until parliament made two necessary in treason, and until a rough sort of comparative arithmetic established the demand for something more than a single witness upon a charge of perjury. Previous to January 1, 1838, it was necessary to have three witnesses to a will devising an acre of land, though a million in the three per cents. might be bequeathed by an unwitnessed testamentary paper; but now, by the 7th Will. IV., and 1st Vict., cap. 26, two witnesses are sufficient in either case. Courts of equity have imposed a limit on their encroaching jurisdiction, by allowing the positive oath of a defendant to be conclusive against the unsupported testimony of a single witness. The limit has probably a reference to the double origin of Chancery; first as a court of conscience, and next as more closely connected with the civil law. There are but few instances, and those introduced by act of parliament, where written evidence is of absolute necessity. The policy of the celebrated statute of frauds, 29th Car. II., cap. 3, was adopted from the French ordonnance of Moulins; and it admits of no exceptions where it applies. But writing is often used by the parties in transactions which are without the statute. The common law is equally strict in both cases, in preventing written instruments from being varied, added to, or explained by *parole.* The rule has been broken in upon to a certain extent, by a distinction between *ambiguitas patens et latens*, of which Lord Bacon has the credit. The best justification to be made for the exception which allows an ambiguity raised by

Government and Laws.

external evidence, to be also removed by external evidence, appears to stand on the following considerations. It restrains the fear of perjury within a much narrower circle. In the next place, the author of the writing had not equal means of protecting his intentions against an ambiguity of this description. The admissibility of copics is tried by the paramount rule, that the best evidence in existence must be produced. Mere declarations acquire no further validity by being committed to writing. They thus become only written hearsay. The mode of extracting oral testimony varies according to the courts in which it takes place. Very little can be added to the excellence of the system in the courts of common law. A witness there delivers his evidence *viva voce*, in the presence of the public, of the parties, and of the deciding judge. There is scarcely a limit to the range of examination and cross-examination, but the discretion of the court. The practice in courts of equity was before 1852 much more imperfect. The examination being conducted on written interrogatories, and by examiners out of court, lost all the advantages of *viva voce* suggestions on the spot, of cross-examination, and of publicity. The very demeanour of the witnesses was removed from the observation of the judge who had finally to determine on their credit. This defect has been removed by the 15th and 16th Vict., cap. 86. Either party may require the evidence to be oral. The proof of writings depends on the nature of the instrument, or on the mode of its execution. The English law does not affect to create a scale by which the value of particular evidence may be determined. With the same forbearance, it has refrained from establishing any judicial standard concerning the amount of evidence which is or is not adequate grounds for a judicial determination in any cause. These are questions of fact, on which (beyond a few hints, more valuable to a committing magistrate than to the deciding judge) the less that is said in law-books the better. The only security for correct decisions is the founding competent tribunals, and binding them to no other criterion than that of their own personal conviction. Mr Bentham's work on evidence, and his criticism on this branch of the English law, are perhaps the most original, and at the same time most useful, of all his writings.

10. *Judgment and Execution.*—The object of a civil action is either the recovery of a right certain, for instance, particular lands, specific goods,. a fixed sum as settled by the agreement of the parties; or the recovery of uncertain damages, more or less, according to the extent of the injury which the plaintiff shall be able to prove that he has sustained. The first class of cases, by the nature of the demand comprehended in it, relieves the tribunal from the vague and discretionary inquiries arising under the second. The amount of damage is a fact which a few impartial individuals taken from the body of society are in the great majority of cases peculiarly qualified to assess. This in civil actions is accordingly the province of the jury. They are likely to be far better acquainted than learned judges with the real elements on which the calculation ought to proceed. Damages evidently so excessive as to be explained only by the imputation of gross ignorance or corruption, are, however, one of the admitted grounds for sending back the case to a second inquest. The judgment against Titus Oates, for *scandalum magnatum*, at the suit of the Duke of York, where one of the juries of those days had assessed the damages at L.100,000, was reversed after the Revolution. The costs of a trial were never given at common law. In most cases, however, they have for a long time followed as the ordinary incident to judgment. Since the preliminary oaths and pledges of former days have fallen into oblivion, they constitute the only security of the defendant against frivolous and vexatious actions. Costs are too material an item in litigation to be properly bound in any court by one uniform rule. We are not disposed to recommend, for the sake of consistency, that courts of equity should be brought under the strictness. It would be a better approximation that the discretion of the courts of common law should be assimilated to the latitude which courts of equity have assumed. It is easy to enlarge the statutory power given in some instances to judges' certificates, or to grant an analogous authority to the jury. Certificates for costs might be made a sufficient restraint on fraudulent attempts against the credit of the law and the interests of society. There are occasions when personal vindictiveness combines unnecessarily an indictment and an action in misdemeanours, or when base practitioners multiply actions for the sake of costs against several parties who happen to be all legally liable. In ejectments, trespasses, libels, joint-stock companies, and all cases where many rights depend upon a single title, or the ends of justice may be satisfied by a single verdict, the law in its present state may be far too easily and too profitably abused.

In consequence of the feudal restraints on the alienation of land during a great period of English history, it continued to be only partially liable for its owner's debts of any description, and was not liable at all for ordinary debts by simple contract. The restraint went far beyond the policy of entails. To the extent that entails were permitted, a tenant for life might, as far as the principle was concerned, have bound the life estate, but nothing more; since that only is his own. This invidious protection of land, even when owned in fee against simple contract creditors, has been completely removed by the 3d and 4th Will. IV., cap. 104. Ever since the 29th Charles II., whenever land was at all liable, it was equally so although held in trust for the debtor, as when it was held in his own name. No feudal principle interfered to protect personalty from a creditor. Nevertheless, the absurd expression, that money could not be sold, and the maxim, so inconsistently evaded in many cases, that a debt or a right to sue another was not transferable, had an equally mischievous effect. No sensible reason could be assigned why the principle of foreign attachment should exist for the benefit of the citizens of London only, and not for the benefit of every creditor in England. There was even still less reason why funded property should be placed beyond the reach of the law, on the technical distinction arising from its subsisting in the form of an annuity payable by the nation to the holder of the stock. And, accordingly, the legislature has provided first by the 1st and 2d Vict., cap. 110, that a distringas may be obtained on stock by judge's order, and secondly, by the 17th and 18th Vict., cap. 125, that a judge may order the attachment of debts due from a third person to the debtor. And the judgment of a court of law, duly certified on a recovery against a stockholder, ought to have the same effect as the signature of the accountant-general of the Court of Chancery for authorizing a transfer of the stock. There is a dangerous tendency in facilities for credit to run to too unlimited an extent. The power of imprisoning the person encourages this tendency; and, what is worse, it is frequently resorted to in the hopes of laying the innocent relations of a spendthrift under contribution. The humanity of modern times has thrown open the doors of the debtors' gaol, by discharges under the insolvent act, and by abolishing arrest on mesne process under L.20. The security contingent on the person of a debtor was never good for much. In its actual state, it is of far too little value to be worth contending for.

For the prevention of crimes, the law seeks to obtain a counteracting influence in all directions; in its command over property, character, liberty, and life. The jury find merely the fact of guilt. The legislature has to most offences affixed a *maximum* of punishment, according to a

rude calculation of the nature of the offence and the interests of society. In a very few a *minimum* also is enacted. The power of arbitrating between these extreme limits, and of mitigating the penalties where no limit has been prescribed at the bottom of the scale, rests entirely with the judge. The gradation of punishments seems to call for further revision, with the object of proportion, mitigation, and precision. The calculation of public damage proceeds on the principle of prevention, and is set apart for the judge; that of private damage looks only to the satisfaction of the party, and belongs to the jury. The distinction arose probably on totally different grounds. It may be justified, however, by the observation, that the calculation in the instance of crimes does not depend on the individual case, but on a more comprehensive and general view of the bearings of the whole criminal law than a jury can well be qualified to take; and that a greater chance is thus afforded of an approach to that uniformity or average which it is so desirable to obtain. Pardon is a prerogative properly left with the executive. This is so in America, notwithstanding the foolish denial of the possibility by theoretical writers against republics, equally as in England. The exercise of the prerogative is of course greatly influenced by the recommendation of either the judge or jury. The abuse of it in favour of particular criminals was one of the scandals of many reigns. This had reached so extravagant a pitch, that Sir Thomas More praises Henry VIII. on the ground that never king granted so few. Nevertheless, such was the complication and severity of the law, that to execute it according to its letter would have been not only unpopular, but impossible. At the very period when particular pardons were a national grievance, general pardons were looked forward to as public blessings. It is observed by Sir Bartholomew Shower, that there were never five years without a parliament pardon, and that eleven were published by Elizabeth. "These," he says, "it was which made parliaments and crowns the darlings and the desire of the people." The dispute whether the crown can pardon on impeachments, was one of the remains of the jealousies of former days. It was raging, as a great political question, as late as the Revolution; and it is still open to argument as a point of law. The dissolving parliaments to save his favourites from impeachment, is charged even by Clarendon upon Charles I. as a denial of justice to the nation. There is a vast variety of writs of execution in civil suits of the most trifling moment. By way of contrast, Blackstone notices the slightness of the form by which a marginal note put by the judge upon the calendar, is the sole authority for the sheriff, even in a capital conviction. It is one only of many instances of the comparative value set by our ancestors on the formal administration of civil and criminal jurisprudence. The execution of the law in all cases, of whatever description, is intrusted to the official representatives of the executive. Special jurisdictions have their special officers; but, by the common law, the sheriff is in all judicial matters the proper minister of the crown.

Further information regarding the constitution will be found under Parliament.

ENGLAND, Church of. See England; Bishop; Benefice; Episcopacy; Reformation, &c.

ENGLISH CHANNEL, the *Oceanus Britannicus* of the Romans, and *La Manche* of the French, is that narrow sea or channel which separates the southern shores of England from the northern shores of France. It communicates on the west with the Atlantic Ocean, and on the east with the North Sea. It is narrowest at its eastern extremity where it forms the Strait of Dover, being only 18 miles across between Dover and Cape Gris-Nez. West of this strait it rapidlv increases in width; and between Brighton and Havre it is more than 90 miles across. Farther west, however, the peninsula of Cotentin projects from the French coast into the Channel; and between Cape Barfleur, its eastern extremity, and Catherine's Point on the Isle of Wight, the distance is scarcely 60 miles. Between Sidmouth and St Malo it attains its greatest width, being about 130 miles. At its western mouth, between Land's End in Cornwall and the island of Ushant on the French coast, the width is about 100 miles. The general average breadth is about 70 miles; east of Beachy Head it is 38, thence to Portland 67, and west of Portland 83 miles. It is estimated to have an area of 23,900 square miles; and includes the Channel Islands, the Isle of Wight, and the Scilly Islands. The ports on the French coast are shallow, none of them having naturally sufficient depth of water to admit men-of-war, while England, on the contrary, has some of its finest harbours on this part of its coast. To remedy this, the French have, at great expense, constructed at Cherbourg two harbours, a naval and a commercial, the former excavated out of the solid rock, and having a depth of 50 feet at high water. (See Cherbourg.) The English coast is 390, and the French 570 miles in length. A chalk ridge at the depth generally of from 12 to 30 fathoms crosses the channel at Dover, along which the submarine telegraph is laid. Hence the depth gradually increases, but it is at no part considerable. Westerly winds are prevalent, and render the navigation of the channel at times difficult. In stormy weather the surface is raised two feet or more above that of the North Sea, and the ports have several feet more of water in strong westerly winds than on ordinary occasions. The current, though not perceptible in any part, is generally, if not constantly, running from west to east, as is evident from the eastern tides being stronger than the western or ebb tides, and their running longer in stormy weather from the west. The channel abounds in fish, and the fisheries give employment to a considerable number of men on both coasts, the most important branch being the pilchard fishery along the coasts of Cornwall and Devonshire, and the oyster fisheries in the bay of Cancale.

ENGLISH LANGUAGE. When the Romans invaded the south of Britain, they found the country possessed by a people of Celtic origin, and speaking a dialect of the Celtic tongue. This invasion took place about fifty-five years before the birth of Christ, and the invaders retained their ascendancy till the commencement of the fifth century. During this interval, the Romans imparted to the rude natives some tincture of their own intellectual refinement, but must have left the British language as they found it: the foreign settlers were not sufficiently numerous to produce any change in the speech of the original inhabitants. When the huge fabric of the Roman empire began to decay, the Britons, who had the advantage of a remote and insular situation, found means to assert their independence. They however divided themselves into many petty states, and exercised many petty animosities, which impaired the national strength, and rendered them an easy prey to foreign invaders. The pirates of Saxony had long been accustomed to make occasional depredations on their coasts. The Picts and Scots, that is, the Goths and Celts of North Britain, infested them on the frontier; and at length the sense of common danger produced some degree of union in their councils and exertions. In this condition of their affairs, the Saxons obtained a permanent footing in the country. In the year 449, Vortigern, king of the Britons, had recourse to the aid of Hengest and Horsa, who first appeared as allies, but were soon converted into the most formidable enemies.[1]

The Saxons, like other Gothic tribes, derive their origin from a mighty horde which wandered from the east, and gradually overran the best portions of Europe. So early as the time of Ptolemy the geographer, this particular tribe had proceeded as far to the westward as the banks of the Elbe, and their primitive seat was between that river and the Eyder. Although at first they were not very formidable for their numbers, they gradually obtained a powerful ascendancy in Germany. Towards the middle of the third century, they entered into a league with the Franks for the purpose of opposing the Roman arms; and they afterwards enlarged their connexions and increased their influence till it predominated in a territory of great extent, reaching from the Eyder to the Rhine. This wide tract of country was not entirely peopled by Saxons: it included various nations, united by the ties of a kindred origin, and actuated by a sense of common interest or danger; but such was the ascendancy of the Saxons that they communicated their name to the entire confederacy, which, among other nations, comprehended the Jutes, who inhabited the south of Jutland, and the Angles, who inhabited the adjacent district of Anglen. Hengest and Horsa, the leaders whom we have already mentioned, were not Saxons, but Jutes. The subsequent emigrants were for the most part Angles, and their descendants were long distinguished by the name of Anglo-Saxons. The first part of the name denotes the predominant tribe, the second denotes the original relation of that tribe to the Saxon confederacy. The new country which they acquired was denominated Engla-land, or the land of the Angles. These German invaders established themselves in the most fertile districts, and gradually displaced the Celtic inhabitants, till at length they were chiefly confined to the fastnesses of Wales, where the prevalence of the ancient language still indicates the continuance of their race. Eight new states were formed by the Anglo-Saxons, who maintained their independence till the year 1016, when they were subjected to the yoke of a Danish conqueror. Canute, and his two sons, Harold and Hardicanute, reigned in England for the space of twenty-six years. A Danish court, and a Danish army, with other settlers, must have had some influence on the common speech, especially as the language of the conquerors was not very dissimilar to that of the conquered. But the laws and other public documents continued to be written in the Saxon tongue, and this new dynasty soon finished its course. The Saxon line of kings, which was restored in 1042, terminated in 1066, when Harold the Second was slain at the battle of Hastings, and William duke of Normandy ascended the throne of England. The Saxon dominion had thus continued for the best part of three centuries; and as the great body of the people was still of this race, it is obvious that their national language must have survived their political power. A writ in the Anglo-Saxon tongue was issued by Henry the Third, who began his reign in the year 1216.

In the language spoken by this ancient people, a great variety of literary reliques has been preserved. "The Anglo-Saxon literature," says Professor Rask, "possesses in many respects, even for its own sake, no small degree of interest. The numerous ancient laws throw considerable light upon the laws of the old Germans and Scandinavians, as well as upon their customs and civil institutions. The old chronicles and genealogies are important sources for the ancient history of the Low German and the Scandinavian nations. The various documents illustrate much in English history. Even the theological remains, shewing the constitution and doctrine of the ancient church, are not devoid of value for ecclesiastical history, especially to the modern English and Scottish churches. The translation of several parts of Scripture may likewise be advantageously employed in biblical researches. But of all, the poetical pieces are the most interesting, especially the great Anglo-Saxon poem in forty-three cantos, published at Copenhagen in 1815, by the Royal Archivarius G. J. Thorkelin,[2] which, from its commencement, he has aptly entitled *Scyldingis*. This is perhaps the only Anglo-Saxon piece possessing value on account both of its matter and style, particularly for the nations of the north; the principal hero being Swedish or Gothic, though the action lies in Denmark."[3] This ancient poem, more generally known by the name of *Beowulf*, has been translated into Danish verse by Dr Grundtvig, and ably illustrated by Mr Conybeare.[4]

The language of the conquerors became the language of the king's court and of all the courts of law. The pleadings of counsel and the decisions of judges were couched in a dialect which is commonly described as Norman French, but which in the mouths of English lawyers became utterly barbarous; and more curious specimens of composition are scarcely to be found than those which occur in the reports of cases written in a jargon half-French half-English. Lawyers have in all ages been conspicuous for their stiff adherence, with or without reason, to those forms and maxims in which they themselves have

[1] Saxon Chronicle, p. 14. Ingram's edit. Lond. 1823, 4to.

[2] A more recent edition may be found in an elegant little volume bearing the following title: "The Anglo-Saxon Poems of Beowulf, the Traveller's Song, and the Battle of Finnes-burh: edited, together with a glossary to the more difficult words, and an historical preface, by John M. Kemble, Esq. M. A. of Trinity College, Cambridge." Lond. 1833, 8vo.

[3] Rask's Grammar of the Anglo-Saxon Tongue, translated from the Danish by B. Thorpe, p. vii. Copenhagen, 1830, 8vo.

[4] Conybeare's Illustrations of Anglo-Saxon Poetry, p. 30. Lond. 1826, 8vo.

English Language.

been duly trained. Long after French had ceased to be the language of legal proceedings, they adhered to the practice of reporting cases in the motley dialect used by their predecessors; for, as Blackstone remarks, "the practisers being used to the Norman language, and therefore imagining that they could express their thoughts more aptly and more concisely in that than in any other, still continued to take their notes in law French; and of course, when those notes came to be published, under the denomination of reports, they were printed in that barbarous dialect; which, joined to the additional terrors of a Gothic black letter, has occasioned many a student to throw away his Plowden and Littleton, without venturing to attack a page of them."[1] By the 36 Edw. III. c. 15. it was enacted that for the future all pleas should be pleaded, shewn, defended, answered, debated, and judged in the English tongue, but should be entered and enrolled in Latin. The statutes of the realm long continued to be promulgated in French; and it was only from the accession of Richard the Third that Englishmen were governed by laws written in their native tongue.

The Norman conquest proved fatal to the entire race of Anglo-Saxon nobility, many of whom lost their lives, and almost all of them their property. Not a few of the number sought refuge in different monasteries. Some of them became abbots, and others closed their career as monks. The lands of the Saxon earls were occupied by the Norman barons, who found it necessary to consult their personal safety by inhabiting fortified towns and castles. They must have had but little intercourse with their vassals, whom they probably did not respect, and whom they had much reason to fear. They retained their native tongue, and seldom acquired any other. For a long period of time, the peasantry continued unmixed with foreign settlers: they continued to cultivate the same soil; and when the written language of the kingdom had received many foreign accessions, the rustic dialect preserved its primitive elements with very few material changes. Much of the patois of different countries consists, not in adulterations of the modern, but in remnants of the ancient language. Many Anglo-Saxon words and idioms, unintelligible to persons of a refined education, are still current among the rural population of particular districts of England.

The English monarchs of the Norman race were liberal patrons of such literature as they themselves understood. French poetry seems to have been much relished at the court of England; and, according to a very competent judge, M. de la Rue, it was from England and Normandy that the French received the first works which deserve to be cited in their language. The works of many Anglo-Norman poets have been preserved, and they certainly form a curious subject of literary research. In this department, a learned lady, Marie de France, makes a prominent figure. Her poems have been recently edited by M. de Roquefort; and one of the historical poems of Wace still more recently by M. Pluquet. A history of the Anglo-Norman poets and poetry is speedily expected from M. de la Rue, who has already exhibited sufficient evidence of his being well qualified for such an undertaking.

Of the language spoken by the great body of the people about a century after the conquest, the reader may in some degree be enabled to judge from the following specimen of Lyamon's translation of Wace's *Brut d'Angleterre*. The translator describes himself as a priest of Ernlye upon Severn, and he is supposed to have completed his task about the year 1180.

English Language.

Tha the masse wes isungen,
Of chircken heo thrungen.
The king mid his folke
To his mete verde,
And mucle his duȝethe:
Drem wes on hirede.
Tha quene, an other halve,
Hire hereberwe isohte:
Heo hafde of wif-monne
Wunder ane moni en.[2]

"When the mass was sung, out of the church they thronged. The king amid his folk to his meat fared, and many of his nobility: joy was in the household. The queen, on the other side, sought her harbour (or lodging): she had wonderfully many women." Here, and in a much more ample specimen of the same work, we perceive no mixture of French words. The idiom is essentially Anglo-Saxon, but with some indications of its being already in a state of transition: the vestiges of the language, in its more modern form of English, may be distinctly traced. Of the language in a state more considerably advanced, we find a specimen in a facetious poem published by Dr Hickes.

Far in sea, by West Spain,
Is a land ihote Cokaygne,
There n'is land under heaven-rich
Of wel of goodness it y-like.
Though Paradise be merry and bright,
Cockaygne is of fairer sight.
What is there in Paradise
But grass, and flower, and green rise?
Though there be joy and great dute,
There n'is meat but fruit;
There n'is hall, bure, no bench,
But water mannis thirst to quench.[3]

In this poem, which apparently belongs to the thirteenth century, we perceive a further deviation from the Anglo-Saxon idiom. In the preceding extract, the obsolete spelling is not retained, and the language is thus rendered more intelligible. The subsequent quotation is from a metrical history of England, written by Robert, a monk of Gloucester, who appears to have lived about the year 1278. This rhyming chronicle, as Mr Warton has remarked, is totally destitute of art or imagination. The author thus describes the island of Ireland, nor does he fail to mention its exemption from venomous reptiles.

Yrlond ys aler yle best with oute Engelonde.
The sea goth al abouten hym eke as ich vnderstonde.
More he ys than Engolond, and in tho south half he ys
Bradder and more of ynow than in the north ende y wys.
Aȝeyn the lond of Spayne he stond in the north syde ryȝt.
Selde snowe ther inne lith, and nameliche thre nyȝt.
So euene hot that lond ys, that men durre selde
Here orf in howse awynter brynge out of the felde.
Lese lasteth ther al the wynter: bute hyt tho more wonder be,
Selde me schal in the lond eny foule wormes se:
For nedres ny other wormes ne mow ther be noȝt;
And ȝef he beth thider bi cas from other landes y broȝt,
Heo dyeth thorȝ smel of the lond, other thorȝ towchyng y wys:
Eche gras that ther inne wexeth a ȝeyn venym yt ys.
For men that ben venymed, thorȝ grases of Yrlond
Y dronke he beth y clansed sone, thoru Godes sonde.
Hony and mylk ther ys muche, mony folk and bolde.
This ys the stat of Yrlond, as iche habbe y tolde[4]

Another chronicler, who however belongs to a period

[1] Blackstone's Commentaries on the Laws of England, vol. iii. p. 318.
[2] Ellis's Specimens of the Early English Poets, vol. i. p. 61.
[3] Hickesii Linguarum Vett. Septentrionalium Thesaurus, tom. i. p. 231.
[4] Robert of Gloucester's Chronicle, vol. i. p. 43.

English Language.

somewhat more recent, was Robert Manning, more commonly called Robert of Brunne. H has himself stated that he had resided fifteen years at Brunne, or Bourne, in the priory of black canons, when, in the year 1303, he began his translation of Grosteste's *Manuel des Pechés*. This version still continues in manuscript; but one portion of his historical work, his translation from Langtoft, has been edited by the indefatigable Hearne, who rendered a similar service to Robert of Gloucester. The inedited portion consists of a translation from Wace's Brut. Peter Langtoft was an Augustine canon of Bridlington in Yorkshire, and is supposed to have died in the reign of Edward the Second. The subsequent passage relates to Sir William Wallace.

Whan Sir Jon of Warene the soth vnderstode,
That the Waleis gane brenne, an oste he gadred gode,
And went to Struelyne agayne Waleis William,
Bot the erle with mykelle pyne disconfite away nam;
And that was his folie, so long in his bed gan ligge,
Untille the Waleis partie had vmbilaid the brigge:
With gauelokes and dartes suilk ore was non sene,
Myght no man tham departe, ne ride ne go bituene.
Thore first tham tauht how thei did Fawe kirke:
Alle gate the brigge he rauht, of nouht our men were irke.
Whan the erle herd say, the brigge how William toke,
He douted to die that day, that bataile he forsoke.
The Inglis were alle slayn, the Scottis bare tham wele,
The Waleis had the wayn, als maistre of that eschele.
At that ilk stoure was slayn on our side
God men of honour, that wald to the bataile bide.[1]

A more curious specimen of composition is to be found in the Vision of Piers Plowman, which appears to have been written about the year 1362, and which is commonly ascribed to Robert Langland, a secular priest. The work, which comprehends a series of visions, is replete with satire on the different orders of men, especially on the clergy, both regular and secular; but it is likewise diversified by a succession of incidents, and furnishes abundant evidence of the author's talents for description. His mode of versification is not unworthy of particular notice. Alliteration supplies the place of rhyme: the corresponding sounds are at the commencement, not at the termination of words. Our extract from this remarkable work must necessarily be very brief.

And to the church gan ich go, God to honourie,
By for the crois on my knees knocked ich my brest,
Sykinge for my sennes, segginge my pater noster,
Wepyng and wailinge tyl ich was a slepe;
Thenne mete me moche more than ich by for tolde
Of the mater that ich mete fyrst on Malverne hulles.
Ich sawe the feld ful of folk fram ende to the other,
And Reson revested ryght as a pope,
And Conscience his cocer by fore the kynge stande.
Reson reverentliche by for al the reame,
Prechede and provede that thuse pestilences
Was for pure synne to punyshe the puple,
And the south west wynd on Saturday at eve
Was pertliche for prude, and for no poynt elles.
Piries and plomtrees were poffed to the erthe,
In ensample to syggen ous we sholde do the betere:
Beches and brode okes weren blowe to the grounde,
And turned upward here tayl, in tokenynge of drede
That dedlych synne er domys day shal for do us alle.[2]

After these specimens of verse, we shall exhibit a specimen of prose, selected from the seventh chapter of the Acts of the Apostles, as translated by John Wycliffe. The translator, who was born about the year 1324, and died in the year 1384, may be regarded as the father of English prose. He was the author of various works in Latin as well as English; but the most important of his literary labours was a complete version of the Scriptures. He was the great precursor of Luther, who appeared after an interval of one hundred and fifty years; and it may perhaps be safely affirmed, that to him the cause of reformation was more deeply indebted than to Luther himself.

"This Moises ledde hem out, and dide woundris and signes in the lond of Egipte and in the Reed See, and in desert fourti gheeris. This is Moises that seide to the sones of Israel, God schal reise to ghou a prophete of ghoure britheren; as me ghe schulen heere him. This it is that was in the chirche in wildirnesse with the aungel that spak to him in the mount Syna and with oure fadris, which took wordis of lyf to ghyue to us: to whom oure fadris wolden not obeie, but puttiden him awei, and weren turned awei in hertis into Egipte, seiynge to Aaron, Make thou to us goddis that schulen go bifore us; for to this Moises that ledde us out of the lond of Egipte, we wite not what is don to hym. And thei maden a calf in tho daies, and offriden a sacrifice to the mawmet, and thei weren glad in the werkis of her hondis; and God turnyde and bitook hem to serue to the knyghthood of heuene; as it is writen in the book of prophetis, Whether ghe hous of Israel offriden to me slayn sacrifices, either sacrifices of oostis fourti gheer in desert? And ghe han take the tabernacle of Moloch, and the sterre of ghoure god Renfam, figuris that ghe han maad to worschipe hem: and I schal translate ghou into Babiloyne. The tabernacle of witnessyng was with our fadris in desert, as God disposide to hem, and spak to Moises, that he schulde make it aftir the fourme that he saigh: which also oure fadris tooken with Ihesu, and broughten into the possessioun of hethene men, which God puttide awei fro the face of our fadris til into the daies of Dauid, that foond grace anentis God, and axide that he schulde fynde a tabernacle to God of Iacob. But Salamon bildide the hous to him.' But the high God dwellith not in thingis maad bi hond, as he seith bi the propnete, Heuene is a seete to me, and the erthe is the stool of my feet; what hous schulen ghe bilde to me? seith the Lord; either what place is of my restyng? whethir myn hond made not alle these thingis?"[3]

Contemporary with Wycliffe was Geoffrey Chaucer, who is commonly regarded as the father of English poetry, and who closed his life in the year 1400. Dr Johnson has remarked that "he may, perhaps, with justice, be styled the first of our versifiers who wrote poetically."[4] He was a man of original genius, improved by a familiar acquaintance with writers in several languages. For the native poets who preceded him, he appears to have entertained but little respect: he sought for better models among the Latin, Italian, and French writers, and in all these languages he found works which he either translated or imitated. He possessed a lively fancy, and was a shrewd observer of life and manners. He improved the language, and refined the taste of his contemporaries. He taught them to write, if not with new harmony, at least with new terseness. The work by which he is best known are his Canterbury Tales; and in these he not only exhibits many characteristic delineations of manners, but likewise evinces a rich vein of native humour. They commence with the following verses, which we have selected on account of the elaborate analysis to which they have been subjected by Mr Tyrwhit.[5]

[1] Peter Langtoft's Chronicle, as illustrated and improved by Robert of Brunne, vol. ii. p. 297.
[2] Vision of Peirs Plouhman, p. 80. Whitaker's edit. Lond. 1813, 4to.
[3] New Testament, translated by Wiclif, p. 196. Baber's edit. Lond. 1810, 4to.
[4] Johnson's Hist. of the English Language, prefixed to his Dictionary.
[5] Canterbury Tales of Chaucer, vol. iv. p. 106. Lond. 1775, 5 vols. 8vo.

Whanne that April with his shoures sote
The droughte of March hath pierced to the rote,
And bathed every veine in swiche licour,
Of whiche vertue engendred is the flour;
Whan Zephirus eke with his sote brethe
Enspired hath in every holt and hethe
The tendre croppes, and the yonge sonne
Hath in the Ram his halfe cours yronne,
And smale foules maken melodie,
That slepen alle night with open eye,
So priketh hem nature in hir corages;
Than longen folk to gon on pilgrimages,
And palmeres for to seken strange strondes,
To serve halwes couthe in sondry londes;
And specially, from every shires ende
Of Englelond, to Canterbury they wende,
The holy blisful martyr for to seke,
That hem hath holpen whan that they were seke.

In the English language, as it thus appeared in the fourteenth century, the Anglo-Saxon vocabulary was still predominant, but the words had been greatly curtailed in their inflexions. This plan of simplifying the structure of speech is to be traced in other instances, where a rude or a strange race is mingled with a people who have cultivated a more complex language, bearing little or no resemblance to their own. The most essential part of the vocabulary may be acquired without difficulty; but it is not so easy to become acquainted with the inflexions of nouns and verbs, or with some other niceties which belong to language in its more complicated form. Many French words had now been incorporated with the English language; but the compositions of this period began to be marked by an affectation of words derived immediately from the Latin. If Chaucer did not set the example, he at least followed it; and when he aims at a more ornamented style, his use of such phraseology is sufficiently copious. In this respect, he was however exceeded by some of his successors, particularly Hoccleve, Lydgate, and Hawes, who inherited no portion of his strength and originality. Being deficient in taste as well as genius, they devised a verbose and languid style, interspersed with many sonorous and polysyllabic terms, with terms "aureate and mellifluate," which did not assimilate with their native tongue. The same false taste was at length communicated to the Scotish poets. Dr Nott has remarked that Barbour had given his countrymen a fine example of the simple energetic style, which resembled Chaucer's best manner, and wanted little to make it the genuine language of poetry; and that other poets of the same nation, particularly James the First and Henryson, adhered to this model of a simple diction, and affected no other ornament than what the proper use of their language supplied.[1] But ultimately the false taste, which had infected the English poets, was communicated to their brethren of the north.

Gower and Lydgate, whose names are very frequently mentioned with that of Chaucer, are well known to the readers of early English poetry. Thomas Hoccleve, whom his editor supposes to have been born about the year 1370, makes a more inconsiderable figure in the literary annals of that age, but seems nevertheless to claim a passing notice. He was deficient in the essential qualifications of a poet; and, in the opinion of Mr Warton, "his chief merit seems to be, that his writings contributed to propagate and establish those improvements in our language which were now beginning to take place."

The greater part of the fifteenth century was highly unfavourable to the progress of literature in England. The repeated contests for the crown, and the civil wars which they occasioned, were attended with a great waste of human blood, and with that incertainty of possession, and those reverses of fortune, which leave the mind but little relish for such pursuits as are chiefly calculated to gratify the taste. Some individuals, Sir John Fortescue, and a few other writers, have left favourable specimens of prose composition; and they were succeeded by others, who made further improvements in style. Among these we must include Sir Thomas More, Archbishop Cranmer, Sir Thomas Elyot, and Roger Ascham. But from the death of Chaucer, more than a century elapsed before another writer, deserving the name of a poet, appeared in England. This writer was Henry Howard, earl of Surrey, son and heir apparent to the duke of Norfolk, whom however he did not survive. He was beheaded in 1547, in the thirtieth year of his age. Although thus cut off before the full maturity of intellectual vigour, he lived long enough to effect some very material improvements in English poetry. The versification of preceding poets was more properly rhythmical than metrical. Although some improvements had been introduced by Chaucer, he left the number of syllables too indefinite, and did not reach the harmony and compression, of which this noble poet afterwards exhibited an example. One of the changes which he introduced was the use of the heroic blank verse. Langland and other poets had indeed dispensed with rhyme; but their alliterative lines were constructed in a very different manner. In the following sonnet, he bewails the death of another eminent poet, Sir Thomas Wyatt.

Divers thy death do diversely bemoan:
Some, that in presence of thy livelihed
Lurked, whose breasts envy with hate had swoln,
Yield Cæsar's tears upon Pompeius' head.
Some that watched with the murd'rer's knife,
With eager thirst to drink thy guiltless blood,
Whose practice brake by happy end of life,
Weep envious tears to hear thy fame so good.
But I, that knew what harboured in that head,
What virtues rare were tempered in that breast,
Honour the place that such a jewel bred,
And kiss the ground whereas thy corpse doth rest,
With vapoured eyes, from whence such streams avail
As Pyramus did on Thisbe's breast bewail.

Before the close of the sixteenth century, the English language had in a great measure attained that form and structure which it continues to exhibit. A great improvement of taste had been introduced by a more critical and more general study of the ancient classics. William Lilly, the famous grammarian, who had learned Greek at Rhodes, and who had afterwards acquired a polished Latinity at Rome, became the first teacher of Greek at any public school in England. This was at St Paul's school in London, of which he was appointed the first master about the year 1500.[2] The language soon began to be more regularly taught in the universities. At Cambridge the study of it was zealously and successfully recommended by Smith, Cheke, and Ascham, who were themselves distinguished by their proficiency. The elegancies of Latin style began to be better understood, and monkish barbarism was gradually banished. Ascham and Haddon acquired distinction by the style of their Latin prose; and some of the verses of Leland discover a classical vein previously unknown to his countrymen. Before the close of the century, many of the Greek and Latin writers appeared in an English dress, and classical story, with classical

[1] Nott's Dissertation on the State of English Poetry before the Sixteenth Century (p. cxc.), prefixed to the Works of Surrey and Wyatt. Lond. 1815, 2 vols. 4to.

[2] Warton's Hist. of English Poetry, vol. iii. p. 258.

mythology, was rendered familiar to the common reader. In addition to the French, the Italian and Spanish languages attracted a great degree of attention; and from all these languages, especially the two former, many works were likewise translated. New sources of knowledge, as well as of fancy, were thus opened, and the English tongue was enriched with a more copious and variegated phraseology. Surrey and Wyatt were succeeded by poets of great genius, by Shakspeare and Spenser, as well as by many others who, though of inferior powers, were yet possessed of a vigorous and brilliant imagination. The prose compositions of Bacon and Raleigh, partaking of the native energy of their authors, exhibited specimens of a condensed and forcible style, to which the preceding age had never attained. During the earlier part of the seventeenth century, ancient learning was assiduously cultivated; and men of great erudition, Selden, Gataker, and others, adorned the literary annals of their country. The prevailing taste of scholars had however a strong tendency to what was scholastic, if not pedantic; and even the poets, such as Donne and Cowley, substituted the subtilties of metaphysical conceits for flights of poetic fancy. Many words, derived immediately from the Latin, were introduced by the learned writers of the period to which we now refer. A considerable number of these has been subsequently rejected, while others are incorporated in the vocabulary. In the mean time, English poetry had nearly reached its highest limits. Milton's Paradise Lost, so eminently distinguished as a work of creative genius, affords the most remarkable illustration of the compass, power, and harmony of the language. Nor is Dryden unworthy of being mentioned with this mighty master of the English lyre. His powers of mind were no doubt different in kind and degree, but he was possessed of a genius truly poetical; and his prose, as well as his verse, exhibits a rich and copious vein of English phraseology.

The subsequent progress of the language our narrow limits will not permit us to trace. The history of the Scottish language is involved in more obscurity. The Celtic tongue is supposed to have been originally spoken in every district of this kingdom; nor has it been found an easy task to account for the introduction of a Gothic dialect, bearing a very close affinity to English. That the Scottish language is merely a dialect of the English, seems indeed to be the more prevalent opinion; and this foreign speech is supposed to have been gradually adopted by the Picts, who are at the same time described as a people of Celtic origin. The ancient history of every race of men which is possessed of no ancient records, and which has not attracted much attention from more enlightened nations, must ever be involved in doubt and incertainty. In the present instance, we have little to guide our enquiries, besides a few scattered and contradictory notices, added to the ordinary and well-ascertained progress of human speech. When other records fail, the history of a nation may sometimes be traced in the history of its language; and a very moderate degree of reflection will enable us to determine the probability of a Celtic people thus unlearning their native tongue, and from deliberate choice adopting another speech completely and radically different.

Dr Geddes, in a Dissertation on the Scoto-Saxon Dialect, has strenuously maintained this extraordinary opinion, which has likewise been adopted by a more recent writer, possessing no portion of his acuteness or learning. " The names," it is stated, " of all the rivers, mountains, towns, villages, and castles, of any note or antiquity, from Berwick-law to Buchanness, and from Buchanness to Arder-Sier, are all evidently Celtic. We must then either suppose that the language of the Picts was a dialect of the Celtic; or that they were not the original inhabitants of the country; or, in fine, that, after the extinction of the Pictish empire, or rather its union with the Irish-Scots, the language of these latter universally prevailed, and effaced the very remembrance of its Gothic predecessor. The second of these suppositions is contrary to history; the third is belied by experience; the first then is the only one that is founded in probability."[1] This observation with respect to the prevalence of Celtic names, though too strongly stated, is not without foundation. We may therefore admit that the south of Scotland was at some remote period inhabited by a Celtic people; but it is not a necessary inference that this people must be identified with the Picts. Whatever hypothesis may be adopted, it is not denied that many Celtic names of places have been retained where the inhabitants have long ceased to speak any dialect of the Celtic language. It may very easily be conjectured that this primitive race of Celts was finally supplanted by new settlers; and that those settlers, whether Scandinavians or some other Gothic tribe, adopted many of the names which the original inhabitants had applied to mountains, rivers, and other conspicuous objects. That a similar process has been followed in innumerable instances, must be obvious to every person acquainted with the history of European settlements in other quarters of the globe: the native appellations are almost always retained to a certain extent, and are mingled with other names, borrowed from the language of the colonists.

If we should suppose the Picts to have been a Celtic people, a very hard problem will remain to be solved:—by what extraordinary means could a distinct race of men, placed in such circumstances, be induced to reject one language, and to adopt another? This radical and unprecedented change Dr Geddes is disposed to ascribe to the operation of such causes as the following; to the temporary subjection of the southern provinces of Scotland by the Northumbrians; to the immense number of captives seized during the ancient wars with the English; to the planting of English garrisons in several of the Scottish towns; to the amicable intercourse of the Picts with the English; and, finally, to the influence of Malcolm Canmore's courtiers, whom he supposes to have learned the English language from Queen Margaret and her retinue. But it may without temerity be affirmed that, in the entire annals of the human race, such an effect was never produced by such causes. In a more refined state of society, the love of knowledge, the hope of gain, or the influence of fashion, may induce many individuals to betake themselves to the acquisition of foreign languages; but the great body of the people will ever be disposed to rest perfectly satisfied with the speech, whether rude or cultivated, which they have derived from their parents. It is only by some great revolution, by a total conquest, or by an overwhelming extent of colonization, that the current language of a country can be materially changed. After the Norman conquest, when French became the language of the court and of the law, and when Norman barons were planted in almost every corner of England, did the combined operation of such causes eradicate the old, and establish a new language in its place? Many new words were unquestionably introduced, but these were merely engrafted on the old stock of the Anglo-Saxon. " Had the Saxon," as Dr Jamieson well observes, " found

[1] Transactions of the Society of the Antiquaries of Scotland, vol. i. p. 408.

English Language.

its way into Scotland in the manner supposed, it would necessarily have been superinduced on the Gaelic. This has always been the case, where one language prevailed over another; unless the people who spoke the original language were either completely or nearly exterminated. Thus was the Norman gradually incorporated with the Saxon, as the Frankish had been with the Latinized Celtic of France. But the number of Gaelic words to be found in what is called Broad Scots bears a very small proportion to the body of the language."[1] And this solitary fact is indeed sufficient to evince that the inhabitants of the south of Scotland cannot be sprung from Celtic ancestors. Dr Geddes has ventured to specify the reign of Malcolm the Third, which commenced in the year 1057, as the period of a general denization of the Saxon tongue in Scotland. "That monarch," he remarks, "had been bred in England, and married an English princess. Her retinue were all English. English, in consequence, would become the language of the court. The courtiers would carry it to their respective homes; their domestics would be ambitious to speak the language of their masters; and thus it would be gradually introduced into every fashionable circle."[2] But to introduce a language into every fashionable circle, is somewhat different from rendering it the current speech of the people: French has long been the court language, and the language of fashionable circles in England, and yet the great body of the people still persist in speaking English.

The insuperable difficulty of accounting for such a transition as has thus been supposed, a transition from a Celtic to a Gothic dialect, renders the conclusion obvious and unavoidable, that the Gothic speech of Scotland was derived from a Gothic race of ancestors. Nor is this conclusion altogether free from difficulties, though they are of very inferior weight to those which are to be deposited in the opposite scale. It is the opinion of a late writer, who has investigated the subject with much ability, that the Picts emigrated from Scandinavia;[3] and, according to this opinion, the Picts and Saxons must have spoken two dialects of the same original tongue. The history of these kindred dialects may be illustrated from that of some others, derived from the same Gothic origin. The Islandic, Swedish, and Danish languages are all descended from the ancient Scandinavian. Island, which, as the learned Bishop Müller has remarked, is entitled to particular attention as the foster-mother of northern history,[4] was peopled by a colony of Norwegians in the year 874. This race of men, confined to a remote island, and maintaining but little intercourse, either of peace or war, with other nations, has preserved its ancient language with singular purity.[5] The Swedes and Danes, more extensively engaged in the pursuits of commerce, and more closely connected with the rest of mankind, have exhibited a different progress: but while both languages have receded very widely from the Islandic, they have not receded very widely from each other; a similar state of society, similar relations with other countries, and the study of the same foreign authors, have produced corresponding changes in both. In the history of these two languages, we do not find a complete parallel with that of the Scotish and English. the Swedish and Danish are both dialects of the ancient Scandinavian, while the Scotish is derived from the Scandinavian, and the English from the ancient German. But the Scandinavian and the German proceeded from the same common stock; and when we ascend to a period sufficiently remote, they are only to be regarded as dialects of the same language.

It is not to be concealed that Barbour, Winton, Henry the Minstrel, and other early poets of Scotland, have described their native language as English.[6] This application of the name has been explained, with at least some degree of plausibility, by referring to the circumstance of the Gaelic being then denominated the Scotish language.[7] A Celtic and a Gothic dialect could not well be described by the same term; and "when, by a necessary contingency, the Gothic language had in the same space, though in different nations, retained much the same hues, the name of that dialect, which was spoken by the greater and politer people, was imparted to the other, inhabiting a contiguous part of the very same island."[8] Mr Pinkerton is less fortunate in another suggestion; namely, that it is not more strange to perceive that the Italian, French, and Spanish languages were originally termed Romance. They were all described by this common name, because they were all derived from the language of the Romans; but we are not inclined to believe that the Scotish and the English tongues stand in precisely the same relation to each other. (D. I.)

Engrailed.

ENGRAFTING, in *Gardening*, the insertion of a scion of one tree or plant into another for propagation. See the article HORTICULTURE.

ENGRAILED (Fr. *gresle*, *grêle*, hail), in *Heraldry*, indented or made rugged at the edges, as if broken with hail; indented in curve lines or semicircles.

---

[1] Jamieson's Dissertation on the Origin of the Scottish Language (p. 21), prefixed to his Dictionary.

[2] Verstegan reasons in nearly the same manner. (Restitvtion of decayed Intelligence, p. 180. Antwerp, 1605, 4to.) See likewise the preface to Dr Wallis's Grammatica Linguæ Anglicanæ, p. xxii. and Mr Boucher's Introduction to his Glossary of Obsolete and Provincial Words, p. li.

[3] Pinkerton's Enquiry into the History of Scotland, vol. i. p. 168. Lond. 1789, 2 vols. 8vo.—Mr Roberts inclines to the same opinion: "The Picts, or more properly Phichts, probably a colony of Scandinavians, originally from Scythia, as they are said to have come over the northern sea. Triad 7." (Sketch of the Early History of the Cymry, or Ancient Britons, p. 125. Lond. 1803, 8vo.) Professor Magnusen, who has more recently investigated the origin of the Picts, bestows sufficient commendation on Mr Pinkerton's learning and research, and to a certain extent is disposed to adopt his leading opinion; but at the same time he declares himself unable to approve of all the arguments by which it is supported, especially of those which rest upon erroneous interpretations of Scandinavian words and antiquities; nor does he fail to express his disapprobation of this writer's unseasonable invectives against the Celts. (Om Picternes og deres Navns Oprindelse, S. 56. Kiöbenhavn, 1817, 8vo.)

[4] Müller's Sagabibliothek, Bind i. S. 4. Kiöbenhavn, 1817–20, 3 Bind. 8vo.

[5] Dr Sharpe has well stated that "war, invasion, conquest, treaties, intercourse with different nations, commerce, colonies, rise of arts, logical refinements, controversies, time or age, and the humours of a people, are all causes of alteration in language." (Two Dissertations, upon the Origin of Languages, and upon the original Powers of Letters, p. 35. edit. Lond. 1751, 8vo.)

[6] Barbour's Bruce, p. 82. Winton's Cronykil, vol. i. p. 4. Henry's Wallace, p. 231.

[7] "Duobus enim utuntur linguis, Scotica videlicet, et Teutonica, cujus linguæ gens maritimas possidet et planas regiones: linguæ vero gens Scoticæ montanas inhabitat, et insulas ulteriores." (Forduni Scotichronicon, vol. i. p. 44. edit. Goodall.)

[8] Pinkerton's Essay on the Origin of Scotish Poetry (p. lxxi.), prefixed to Ancient Scotish Poems. Lond. 1786, 2 vols. 8vo.

ENGRAVING.

ENGRAVING is the art of cutting metals, wood, and precious stones, and representing thereon figures, letters, or whatever device or design the artist chooses.

Engraving, being properly a branch of sculpture, is divided into several other branches, according to the matter on which it is employed, and the manner in which it is performed. This art is practised most commonly either on copper or steel, or on wood.

ENGRAVING *on Copper* is the making, conformably to some delineated figure or design, such indented lines on a smooth surface of copper, either by cutting or corrosion, as render it capable, when charged properly with any coloured fluid, of imparting by compression, to paper or any similar substance, an exact representation of the figure or design.

Whether we consider the art of engraving with regard to the utility and pleasure it affords, or the difficulty which attends its execution, we cannot but confess that on every account it deserves a distinguished rank amongst the polite arts. By means of this art the cabinets of the curious have been adorned with the portraits of the greatest men of all ages and nations; and it is by this art also that the paintings of the greatest masters have been multiplied, and the lovers of the polite arts enabled to enjoy those beauties from which their distant situations seemed to have for ever debarred them; while persons of moderate fortune have been enabled to become possessed of all the spirit and all the poetry contained in those miracles of art which seemed to have been reserved for the temples of Italy or the cabinets of princes. When we reflect, moreover, that the engraver, besides the beauties of poetical composition, and the artful ordinance of design, has to express, merely by the means of light and shade, all the various tints of colour and clear-obscure—to give a relief to each figure, and a truth to each object; that he has now to represent a sky serene and bright, and then one loaded with dark clouds—now the pure tranquil stream, and then the foaming sea tempest-driven; that here he has to express the character of the man, strongly marked in his countenance, and there the minutest ornament of his dress; in a word, that he has to represent all, even the most difficult objects in nature;—we cannot sufficiently admire the vast improvements in this art, and that degree of perfection to which it has at this day arrived.

Engraving is an art which for the most part is of modern invention, having taken its rise no earlier than the middle of the fourteenth or fifteenth century. The ancients, it is true, practised engraving on precious stones and crystals with very good success; and there are still many of their works remaining equal to any production of later times. But the art of engraving on plates and blocks of wood, in order to afford prints or impressions, was not known till after the invention of painting in oil.

The different modes of engraving are the following:—

1. In strokes cut through a thin wax, called etching ground, laid upon the copper, with a point, and these strokes bitten or corroded into the copper with aquafortis. This is called *etching*.

2. In strokes with the graver alone, unassisted by aquafortis. In this instance the design is traced with a sharp tool, called a *dry point*, upon the plate; and the strokes are cut or ploughed upon the copper with an instrument of an angular form, distinguished by the name of a *graver*.

3. In strokes first etched and afterwards finished with the graver. By this expedient the two former methods are united.

4. In dots without strokes, which are executed with the point upon the wax or etching ground, bitten in with the aquafortis, and afterwards harmonized with the graver, by means of which instrument small dots are made, or with the graver alone, as in the flesh and finer parts, unassisted with the point.

5. In dots first etched and afterwards harmonized with the dry point, performed by a little hammer—called *opus mallei*, or *the work of the hammer*, as practised by Lutma and others.

6. In mezzotinto, which is performed by a dark barb or ground being raised uniformly upon the plate by means of a toothed tool. The design being traced upon the plate, the light parts are scraped off by instruments for that purpose, in proportion as the effect requires.

7. In aquatinta, a later invented method of engraving, in which the outline is first etched, and afterwards a sort of wash laid by the aquafortis upon the plate, resembling drawings in Indian ink, bistre, &c. See AQUATINTA.

8. On wood, consisting of a single block, on which the design is traced with a pen, and those parts which should be white carefully hollowed out. This block is afterwards printed by the letterpress printers in the same manner as a book is printed.

9. On wood, consisting of two, three, or more blocks, the first having the outlines cut upon it, the second being reserved for the darker shadows, and the third for the shadows which terminate upon the lights; and these are substituted in their turn, each print receiving an impression from every block. This mode of engraving is called *chiaro-scuro*, and was designed to represent the drawings of the old masters.

10. On wood and on copper. In these the outline is engraved in a bold dark style upon the copper; and two or more blocks of wood are substituted to produce the darker and lighter shadows as before.

Of all these modes of engraving, the most ancient is that on *wood;* or, to speak more properly, the first impressions on paper were taken from carved wooden blocks. For this invention it appears that we are indebted to the brief-malers, or makers of playing-cards, who practised the art in Germany about the beginning of the fifteenth century.[1] From the same source may perhaps be traced the first idea of moveable types, which appeared not many years afterwards; for these brief-malers did not entirely confine themselves to the printing and painting of cards, but produced also subjects of a more devout nature, many of which, taken from holy writ, are still preserved in different libraries in Germany, with the explanatory text facing the figures, and the whole engraved in wood. In this manner they even formed a species of books; such as *Historia sancti Johannis, ejusque Visionis Apocalypticæ*, and *Historia Veteris et Novi Testamenti*, known by the name of *Poor Man's Bible.* These short mementos were printed only on one side; and two of them being pasted together, had the appearance of a single leaf. The earliest date on any of these wooden cuts is 1423, and the subject is *St Christopher carrying the Infant Jesus over the Sea*, preserved in a convent at Buxheim near Menningen. It is of a folio size, illuminated in the same manner as the playing-cards; and at the bottom is the inscription, *Christoferi faciem die quacunque tueris. Illa nempe die morte mala non morieris. Millesimo CCCC° XX° tertio.*

[1] Such playing cards, however, were in use in Germany as early as the year 1275. See CARD.—*Ed.*

Upon the invention of moveable types, that branch of the brief-maler's business, as far as it regarded the making of books, was gradually discontinued; but the art itself of engraving on wood continued in an improving state; and towards the end of the fifteenth and the beginning of the sixteenth century, it became customary for almost every one of the German engravers on copper to engrave on wood also, as may be seen from the first printed books, in which the initial letters were for the most part highly ornamented with various appropriate devices. The works of Albert Durer in this style of engraving are justly held in the highest esteem. Italy, France, and Holland have produced many capital artists of this description; but, for boldness and spirit, the palm must be given to the prints of Christopher Jegher, who worked under the direction of Rubens, and was without doubt assisted by that great master.

The invention of that species of engraving which is distinguished by the appellation of *chiaro-scuro* is also claimed by the Germans, and seems to have been first practised by Mair, one of whose prints of this kind is dated 1499. Many excellent works in chiaro-scuro have also been produced in France; and in Italy it was honoured with the performances of Titian and Parmegiano; but the attempts of Jackson, Kirkall, and others in England, have not been equally successful. Since these times, which may be called the infancy of wood engraving, the art has been carried to very great perfection in Britain; and the present day may boast of higher attainments in this branch than were reached at any former period.

In Germany, about the year 1450, prints from engraved *copper* first made their appearance. The earliest date of a copperplate print indeed is only the year 1461; but however faulty this print may be with respect to the drawing, and however defective in point of taste, the mechanical part of the execution has by no means the appearance of being one of the first productions of the graver. We have also several other engravings, evidently the work of the same master, in which the impressions are so neatly taken from the plates, and the engravings so clearly printed in every part, that according to all appearance they could not be executed in a much better manner at the present day, with all the conveniences which the copperplate printers now possess, and the additional knowledge they must necessarily have acquired in the course of more than three centuries. Hence we may fairly conclude, that if these were not the first specimens of the engraver's workmanship, much less were they the first efforts of the copperplate printer's ability. It is likewise to be observed, that Martin Schoen, who is said, with great appearance of truth, to have worked from 1460 to 1486, was apparently the scholar of Stoltzhirs; for he followed the style of the latter in engraving, and copied from him a set of prints representing the passion of our Saviour. Now, allowing Stoltzhirs to have preceded his disciple only ten years, this carries the era of the art back to 1450, as was stated above. But there is no ground to suppose that it was known to the Italians till at least ten years afterwards. The earliest prints which are known to be theirs are a set of the seven planets, and an almanack by way of frontispiece, on which are directions for finding Easter from the year 1465 to 1517 inclusive; and we may be well assured that the engravings were not antedated, for the almanack of course became less and less valuable every year. In all probability, therefore, these prints must have been executed in the year 1464, which is only four years later than the Italians themselves lay any claim to. The three earliest Italian engravers are, Finiguerra, Boticelli, and Baldini. But if we were to refer these prints to any of the three, we should naturally conclude them to be the work of Finiguerra or Baldini; for they are not equal either in drawing or composition to those ascribed to Boticelli, which we know at least were designed by that artist; and as Baldini is expressly said to have worked from the designs of Boticelli, it appears most probable that they belong to Finiguerra.

With respect to the invention of *etching*, it is not well known to whom it ought to be ascribed. One of the earliest specimens is the print by Albert Durer, known by the name of the *Canon*, dated 1518, and thought by some, with little foundation, to have been worked on a plate of iron. Another etching by the same artist is Moses receiving the Tables of the Law, dated 1524. Etching was also practised in Italy soon after this by Parmegiano, in whose productions we discover the hand of the artist working out a system as it were from his own imagination, and striving to produce the forms which he wanted to express. We see the difficulty he laboured under; and, from the examination of the mechanical part of the execution of his works, we cannot doubt that he had no instruction, and that it was something entirely new to him. If the story be true that he kept an engraver by profession in his house, the novelty of the art is rendered so much the more probable. He died in 1540.

The art of engraving by corrosion, or what is called etching, with aquafortis, must have very early suggested itself to the discoverers of copperplate printing; for it seems to have been the method used by the manufacturers of warlike implements in their decorations of sword-blades and the like: and thus the same artists would soon perceive the facilities afforded by a mode at once easy and expeditious when applied to higher branches, such as the copies of pictures and works of art in general.

As to that species of engraving in which the modes of *etching* and *cutting* with the graver are united, it must have been found necessary immediately upon the invention of etching: it was, however, first carried to perfection by Audran, and is now almost universally practised, whether the work is in strokes or in dots.

Engraving in *dots* is a very old invention, and attributable to the Italians. Agostin de Musis, commonly called *Augustin of Venice*, a pupil of Marco Antonio, used it in several of his earliest works, but confined it to the flesh, as in the undated print of An Old Man seated upon a Bank, with a cottage in the background. He flourished from 1509 to 1536. We also find an example of this method in a print of "A single figure standing, holding a cup and looking upwards," by Giulio Campagnola, who engraved about the year 1516. The background is executed with round dots, made apparently with a dry point; the figure is outlined with a stroke deeply engraved, and finished with dots, in a manner greatly resembling those prints which Demarteau engraved at Paris in imitation of red chalk; and the hair and beard are expressed by strokes. Stephen de Laulne, a native of Germany, followed the steps of Campagnola; and many of his slight works are executed in dots only. Jean Boulanger, a French artist, who flourished in the middle of the last century, and his contemporary Nicholas van Plattenberg, improved greatly on this method, and practised it with much success. It is only, however, of late that it has been considered as an object worthy of general imitation. John Lutma executed this kind of work with a hammer and a small punch or chisel.

The method of engraving in *mezzotinto* was invented about the middle of the seventeenth century; and the invention has generally been attributed to Prince Rupert. See MEZZOTINTO.

Of the method of engraving in aquatinta an account has already been given under that word. (See AQUATINTA.)

But it appears to us not out of place to give the following general directions; and for more particular information the article already mentioned may be consulted.

Engraving in aquatinta was originally invented by Le Prince, a French artist. For a long time, however, his process was kept secret; and his prints, it is said, were at first sold for drawings. As a proof that the art rose at once to perfection, as has already been mentioned, the prints which were executed by him are still admitted to be the finest and best specimens of the art. It appears, however, that he was only acquainted with the powdered grain, and the common method of stopping out. The first who practised this art in England was Mr Paul Sandby. By him, we are informed, it was communicated to Mr Jukes, whose works afford excellent examples of the perfection to which the art has been carried; and although it is now generally practised all over Europe, yet in no country is this done with greater success than in Britain.

The principle of this process consists in corroding the copper in such a manner that an impression from it exhibits the appearance of a tint laid on paper, or a drawing in Indian ink. This is accomplished by covering the copper with some substance which assumes a granulated form, and prevents the acid from acting where the particles adhere; and thus the copper is only partially corroded. The more minute the particles are, it is obvious the impression from the plate will more nearly resemble a wash of Indian ink, or a drawing; but the larger the particles are, the granulation becomes more distinct. The powder or granulation is called the *aquatinta grain*, and is produced in two ways.

The process for using the powdered grain, which was first employed, is the following. The outline being etched on a copper-plate, some substance, which easily melts with heat, adheres to the plate when cold, and resists the action of the aquafortis, is to be finely powdered and sifted. Besides asphaltum, resin, and gum sandaric, the substances which have been mentioned in the article already referred to, Burgundy pitch, gum copal, gum mastic, as well as some other resins and gum resins, may be employed. Gum copal, it is observed, produces a grain which resists the aquafortis extremely well. Whatever the substance be which is to be employed, the great object of the artist in its application is, to have it equally distributed over the plate. This is an essential part of the operation, and requires considerable attention. The usual method is to tie up a quantity of the powder in a piece of muslin, and to strike it against a stick held at a considerable height above the plate. Thus managed, the powder settles equally over it. The plate being thus covered equally with the dust or powder, the latter is to be fixed upon it by the application of a gentle heat, to melt the particles. This is usually done by holding lighted pieces of paper rolled up, and moving them about till the whole of the powder is melted, which is known by its changing to a brown colour. It is now allowed to cool, and after being examined with a magnifying glass, if the particles appear to be uniformly distributed, the artist proceeds to the next part of the process.

Those parts of the design or drawing to be engraved, which are perfectly white, are to be observed and marked, and the corresponding parts of the plate must be covered or stopped out. This is best done by means of mastic varnish, diluted to such a consistence with turpentine as to work freely with the hair pencil. To give it colour, lampblack should be mixed with it, in order that the touches of the pencil may be distinctly seen. When those parts of the plate which are stopped out are sufficiently dry, a border of wax is raised round the plate, in the same manner as in etching, and the aquafortis, diluted with water, is poured on. This, being the most precarious part of the process, requires the greatest experience. When it is supposed that the aquafortis has remained on the plate for such a length of time that when the impression is taken it will produce the lightest shade in the drawing, it is poured off, and the plate is washed with water and dried. The lightest tints are then stopped out, and the aquafortis is again poured on; and this process is repeated as often as there are tints or shades to be produced in the plate.

Many plates are entirely etched in this way, by alternately stopping out and biting in. It is, however, found to be extremely difficult, and indeed impossible, to produce impressions of minute and complicated objects with the requisite degree of delicacy and freedom. To obviate this difficulty another process has been proposed, by which the touches are laid on the plate with equal ease and expedition as on drawings made with Indian ink. Fine washed whitening is mixed with treacle or sugar, and diluted with water in the pencil, that it may work freely. This is laid on the plate covered with the aquatint ground, in the same way as ink upon the drawing. When this is dry, the whole of the plate is varnished over with a thin turpentine or mastic varnish, and when this is dry the aquafortis is poured on. The varnish immediately breaks up in those parts of the plate where the treacle mixture was laid, and thus they are exposed to the action of the acid, whilst the other parts of the plate remain untouched. Thus the touches or places of the plate where the treacle has been applied are bit in deeper than the rest, and have the precision of touches done with Indian ink. The plate being thus completely bit in, the bordering wax is removed, by gently heating it with a piece of lighted paper. It is then cleared from the ground and varnish by means of oil of turpentine; and being wiped clean with a rag, it is ready for the printer.

But in this method of aquatinting it is found difficult to produce the necessary degree of coarseness or fineness in the grain; and plates which are engraved in this manner afford but a small number of impressions before they are worn out. On this account it is now more rarely followed.

The other method of producing the aquatint ground, which is most generally adopted, is the following. A resinous substance, as common resin, Burgundy pitch, or mastic, is dissolved in spirits of wine. This solution is poured all over the plate, which is inclined, till the whole of the superfluous fluid is drained off, and what adheres to the plate becomes quite dry in a few minutes. The plate being then examined with a magnifying glass, it will appear that the whole of the spirit having evaporated, the resinous matter is left in a granulated state, or is cracked in every direction, and adheres strongly to the copper. In this way a regular and beautiful grain is easily produced, which will be found preferable, at least for most purposes, to that which is produced by the former method. The grain being thus formed, the other parts of the process are conducted in the same manner as before described.

Such are the usual methods of conducting this process. We shall add a few hints which may be found useful respecting the different parts of it. With regard to the materials which are employed, it is to be observed that the spirits of wine should be rectified, and of the very best quality. Resinous matters, as common resin, Burgundy pitch, and gum mastic, yield grains of a different appearance and form; so that advantage may be taken of this circumstance by using them sometimes separately, and sometimes mixed in different proportions, according to the views and taste of the artist. Different proportions of resin may be employed to produce grains of different kinds. When a coarse grain is intended, a greater propor-

tion is to be employed; and when a fine grain is wanted, a smaller proportion of resin only is required. The proper proportions may be ascertained by providing a number of spare pieces of copper; on these the liquid may be poured, and the grain examined, before it is applied to the plate which is to be engraved. After the solution is made, it should remain undisturbed for a day or two, till the impurities of the resin have subsided, and the liquid becomes quite limpid. This is the best method of freeing it from impurities; for if it be strained through linen or muslin, it is mixed with hairs, which are extremely injurious to the grain. It may be added, that the apartment in which the fluid is poured on the plate should be perfectly still, and entirely free from dust; for if any fall on the plate while it is wet, the grain forms a white spot, which cannot be removed. Great care should be observed in cleaning the plate before the ground is laid on. This is done with a bit of rag and whitening. The smallest stain or particle of grease produces a streak or blemish in the grain. Still, however, with all the attention which can be employed, and with the utmost delicacy in the management, it is necessary to observe that the process is extremely precarious and uncertain; and even the most experienced artists find themselves frequently subject to very unaccountable accidents.

Artists have frequently complained of the inconvenience arising from the fumes which proceed from the action of the acid upon the copper when the plate is large. To remedy this inconvenience, the following arrangement, which seems well calculated to answer the purpose, was suggested by Mr Cornelius Varley, an artist who distinguished himself no less by his mechanical abilities than by the exquisite productions of his pencil in water colours: "Get a frame made of common deal, or any kind of wood, three or four inches deep, covered with a plate of glass, and open at one side; and let the side opposite to this have a round opening, communicating by means of a common iron pipe with the ash-pit of any little stove or other fire-place, shut up from all other access of air but what must pass through the pipe. It is obvious that any fumes rising from a copper-plate laid under such a frame will be carried backward into the iron pipe by the current of air required to maintain combustion in the stove, and will by this means be carried up the chimney, in place of being allowed to fly about in the apartment. The pipe may be very conveniently used by carrying it down through the table to the floor, and so along to the place where the chimney may chance to stand; and when the frame is not wanted, the pipe at one of the joinings may be made to answer the purpose of a hinge, by which to turn up the frame against the wall, where it may be secured, while out of use, by a button or any other contrivance."[1]

This method of engraving in aquatinta seems to be chiefly adapted for slight subjects in general, and for imitations of sketches and washed drawings. But for the production of prints from finished pictures it is by no means calculated, because it is not susceptible of that accuracy in the nice management of the tints which is necessary for this purpose. It is equally unsuitable for book plates, because, without retouching the plates, the number of impressions which can be thrown off is very small. On these accounts, therefore, it is to be considered as greatly inferior to the other modes of engraving. But as it is more expeditious, and may be attained with greater facility, it is undoubtedly useful when it is confined to those subjects for which it is peculiarly calculated. This rapidity of execution, however, and facility in acquiring the practice of the art, are followed with the unfortunate circumstance, that they favour the production of an indiscriminate multitude of prints, which, it is to be feared, may rather tend to vitiate than improve the public taste.

Engraving with the tool was the kind originally practised, and it is yet retained for many purposes. For though the manœuvre of etching be more easy, and other advantages attend it, yet where great regularity and exactness of the stroke or lines are required, the working with the graver is much more effectual; on which account it is more suitable to the precision necessary in the execution of portraits, as there every thing the most minute must be made out and expressed, according to the original subject, without any license to the fancy of the designer in deviating from it, or varying the effect either by that masterly negligence and simplicity in some parts, or those bold sallies of the imagination and hand in others, which give spirit and force to history painting.

The principal instruments used in engraving with the tool are, gravers, scrapers, a burnisher, an oil-stone, and a cushion for bearing the plates.

Gravers are made in several forms with respect to the points, some being square, others lozenge; the square graver being designed for cutting broad and deep, and the lozenge for more delicate and fine strokes and hatches. The most generally useful are those of a form between the square and lozenge; and they should be of a good length, small towards the point, but stronger upwards, that they may have strength enough to bear any stress which there may be occasion to lay upon them; for if they be too small and mounted high, they will bend, which frequently causes their breaking, especially if they be not employed for very small subjects.

The burnisher is used to assist in the engraving on some occasions, as well as to polish the plates. It is made of fine steel well polished. The burnisher is sometimes formed at one end, and a scraper on the other, each about an inch and a half long from the point; between them about four inches of the instrument is made round, and serves as a handle, and is thicker in the middle than at the necks, where the burnisher and scraper begin, which necks are only a quarter of an inch in diameter. The principal application of the burnisher in engraving, besides its use in polishing the plates, is to tone and harmonise the work, and to take out any scratches or accidental defacings that may happen to the plates during the engraving; or to lessen the effect of any parts that may be too strongly marked in the work, and require to be taken down.

A cushion, as it is called, is likewise sometimes used for supporting the plate in such a manner that it may be turned every way with ease. It is a bag of leather filled with sand, and should be of the size which will best suit the plates it is intended to bear. Cushions are round, and about nine inches over, and three inches in thickness.

The cushion, made as above directed, being laid on the table, the plate must be put upon it; and the graver being held in the hand in a proper manner, the point must be applied to the plate, and moved in the proper direction for producing the figures of the lines intended; observing, in forming lines, to hold the plate steady on the cushion, and where they are to be finer, to press more lightly, using greater force where they are to be broader and deeper. In making circular or other curve lines, hold your hand and graver steadily; and as you work, turn your plate upon the cushion against your graver, otherwise it will be impossible for you to make any circu-

[1] *Philosophical Magazine*, vol. xxiii. p. 137.

lar or curved line with that neatness and command of hand which by this means may be acquired. After part of the work is engraved, it is necessary to scrape it with the scraper or graver, passed in the most level direction over the plate, to take off the barb or roughness formed by the cutting of the graver; but great care must be taken not to incline the edge of the scraper or tool in such a manner that it may take the least hold of the copper, as it would otherwise produce scratches in the engraving; and, that the engraved work may be rendered more visible, it may afterwards be rubbed over with a roll of felt dipped in oil. In using the graver it is necessary to carry it as level as possible with the surface of the plate; for otherwise, if the fingers slip betwixt them, the line that will be produced, whether curved or straight, will become deeper and deeper in the progress of its formation, which entirely prevents strokes being made at one cut that will be fine at their extremities and larger in the middle, and occasions the necessity of retouching, to bring them to that state. For this reason it is very necessary for those who would learn to engrave in perfection, to endeavour, by frequent trials, to acquire the habit of making such strokes, both straight and curved, by lightening or sinking the graver with the hand, according to the particular occasion. If, after finishing the design, any scratches appear or any part of the engraving be falsely executed, such scratches or faulty parts must be taken out by the burnisher, and further polished, if necessary, by the above-mentioned roll.

The dry point, or needle, which has been of late much used in engraving, is a tool like an etching point, which being drawn hard on the copper, cuts a stroke and raises a burr; the burr is scraped off, and there remains a stroke more soft and delicate than can be produced in any other way.

Although the instruments for the use of the engraver above enumerated and described are very simple, yet we have thought it advisable to subjoin the following figures illustrative of their forms, and about half the dimensions of those employed.

Fig. 1.
Graver.

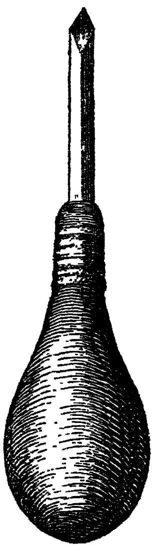


Fig. 2.
Dry Point, or Etching Needle.

Fig. 3.
Scraper.

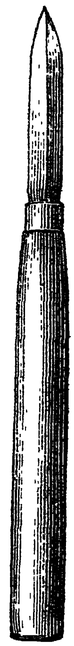
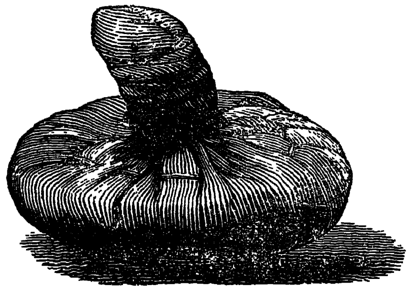


Fig. 4.
Burnisher.

Fig. 5.
Ball of Etching Ground, covered with silk.

Fig. 6.
Dauber, covered with silk, and stuffed with cotton or wool.



The plate is covered with etching ground in the following manner: Heat it upon a stove or otherwise till it melt the ground in the silk bag, fig. 5, which must be spread equally over the surface of the copper by means of the dauber, fig. 6. The ground is then to be moderately smoked all over with a candle, and when the plate is cold it is ready for use.

Etching ground is composed of virgin wax and asphaltum each two ounces, and of black and Burgundy pitch each half an ounce. Melt the wax and pitch in a new-glazed earthen pot, and add to them by degrees the asphaltum finely powdered; boil the whole until such time as, by taking a drop upon a plate, it will break when it is cold, on bending it double three or four times between the fingers. The ground, being sufficiently boiled, must be taken off the fire, and, being allowed to cool a little, must be poured into warm water if the weather be cold, or cold water if the contrary, in order that it may be the more easily worked with the hands; for it should be pulled a long time, to mix the ingredients more completely, when it may be divided into small balls for use. The fire must be moderate, for fear of burning the ground; and the ingredients must be stirred during the whole time of preparation, particularly when the asphaltum is being put in.

Wax for surrounding the plate in the process of biting in with aquafortis is made of one pound of Burgundy pitch or black pitch, and of bees' wax half a pound, melted over a slow fire. When melted, add about a gill of sweet oil, and when moderately hot, pour the whole into water, pull it well, and fashion it into balls for use.

In the conduct of the graver and dry point consists the whole art, for which there are no rules to be given, all depending on the habitude, disposition, and genius of the artist. However, besides the explanations already given, some general observations and directions may not be improper. As the principles of engraving are the same with those of painting, a person cannot expect to attain any considerable degree of perfection in this art who is

not a good master of design; and therefore he ought to be well acquainted with both perspective and drawing in general; for, by the proper degradations of strong and faint colours, he will be enabled to throw backwards the figures and other objects of the picture or design which he proposes to imitate, and which the painter often intrusts to the discretion of the engraver. In working, the strokes of the graver should never be crossed too much in a lozenge manner, particularly in the representation of flesh, because sharp angles produce the unpleasing effect of lattice-work, and take from the eye the repose which is agreeable to it in all kinds of picturesque designs; we should except the case of clouds, tempests, waves of the sea, the skins of hairy animals, or the leaves of trees, where this method of crossing may be admitted. But in avoiding the lozenge, it is not proper to get entirely into the square, which would give the work too much of the hardness of stone. In conducting the strokes, the action of the figures and of all their parts should be considered; it should be observed how they advance towards or recede from the eye; and the graver should be guided according to the risings or cavities of the muscles or folds, making the strokes wider and fainter in the light, and closer and firmer in the shades. Thus the figures will not appear jagged; and the hand should be lightened in such a manner that the outlines may be formed and terminated without being cut too hard. However, though the strokes break off where the muscle begins, yet they ought always to have a certain connection with each other, so that the first stroke may often serve by its return to make the second, which will show the freedom of the engraver.

In engraving the flesh, the effect may be produced in the lighter parts and middle tints by long pecks of the graver rather than by light lines, or by round dots, or by dots a little lengthened by the graver, or, best of all, by a judicious mixture of these together.

In engraving the hair and the beard, the engraver should begin his work by laying the principal lines, and sketching the chief shades, in a careless manner, or with a few strokes; after which he may finish it at leisure with finer and thinner strokes to the extremities. When architecture or sculpture is to be represented, except it be old and ruinous buildings, the work ought not to be made very black; because, as edifices are commonly constructed either of stone or white marble, the colour, being reflected on all sides, does not produce dark or brown shades, as in other substances.

In engraving cloths of different kinds, linen should be done with finer and closer lines than any other sorts, and be executed with single strokes. Woollen cloth should be engraved wide, in proportion to the coarseness or fineness of the stuff, and with only two strokes; and when the strokes are crossed, the second should be lighter than the first, and the third than the second. Shining stuffs, which are generally of silk or satin, and which produce flat or broken folds, should be engraved more clear and more straight than others, with one or two strokes, as their colours are bright or brown; and between the first strokes other smaller ones may be interlined. Velvet and plush are expressed in the same manner, and should always be interlined. Metals, as armour, &c. are also represented by interlining, or by clear single strokes. In architecture the strokes which form the rounding object should tend to the point of sight; and when whole columns occur, it is proper to produce the effect as much as possible by perpendicular strokes. If a cross stroke is put, it should be at right angles, and wider and thinner than the first stroke. In engraving mountains, the strokes ought to be frequently discontinued and broken for sharp and craggy objects; they should be straight, in the lozenge manner, and accompanied with long points or dots; and rocks should be represented by cross strokes more square and even. Objects which are distant towards the horizon should be kept very tender. Waters that are calm and still are best represented by strokes which are straight and parallel to the horizon, interlined with those that are finer, omitting such places as, in consequence of gleams of light, exhibit the shining appearance of water; and the form of objects reflected from the water at a small distance upon it, or upon the banks of the water, are expressed by the same strokes, retouched more strongly or faintly as occasion may require, and even by some that are perpendicular. For agitated waters, as the waves of the sea, the first strokes should follow the figure of the waves, and may be interlined, and the cross strokes, if any, ought to be very lozenge. In cascades the strokes should follow the fall, and may be interlined. In engraving clouds, the lines should sport, when they appear thick and agitated, in turning every way, according to their form and agitation. If the clouds are dark, so that two strokes are necessary, they should be crossed more lozenge than the figures, and the second strokes should be rather wider than the first. The flat clouds which are lost insensibly in the clear sky should be made by strokes parallel to the horizon, and a little waving; if second strokes are required, they should be more or less lozenge; and when they are brought to the extremity, the hand should be so lightened that they may form no outline. The flat and clear sky is represented by parallel and straight strokes, without the least turning. In landscapes, the trees, rocks, earth, and herbage, should be etched as much as possible; nothing should be left for the graver but perfecting, softening, and strengthening. The dry point produces an effect more delicate than the graver can, and may be used to very great advantage in linen, skies, distances, ice, and often in water, especially in small engravings. In most things it is proper to etch the shadows, only leaving the lighter tints for the dry point, graver, and other instruments.

Much excellence may be attained, and a great deal of time saved, by the process of rebiting, particularly in landscape. This process is effected in the following manner: When all the strokes have been laid in upon the portion of any subject to be rebit, the lines upon the plate should be very carefully cleaned out with turpentine and a piece of stale bread. It is then to be heated, and the dabber, with a moderate portion of etching ground, applied dexterously to the surface, care being taken, however, not to permit the ground to sink into the lines, but only to cover the intermediate surface effectually. The aquafortis is now to be applied, and the lines bit down or corroded to the depth required. This process is, comparatively speaking, of recent invention, and was wont to be esteemed precarious and difficult in the management; but a little experience, and the great demand for illustrated works of late years, have been the means of rendering this, as well as other matters of detail in the engraver's art, much more certain.

To imitate *chalk drawings*, a mixture of varied and irregular dots are used, made more or less soft, so as to resemble the grain produced by the chalks on paper. Every stroke of the chalks on paper may be considered as an infinite number of adjoining points, which are the small eminences of the grain of the paper touched by the chalk in passing over it. When the copper-plate has been properly prepared with etching ground, as in the common method of engraving, the drawing to be imitated may be counterproved on the ground of the plate. If this cannot be conveniently done, black-lead pencil or red chalk must be applied to varnished or oiled paper, and this chalk or pencil transmitted to the ground. The outlines of the

object must be formed in the etching by points, whose magnitude and distance must be determined by the quality of the strokes in the original drawing. The artist may be provided with pointed instruments or needles of various sizes, with single or double points. In forming the light and shade, he should distinguish between those hatches which serve to express the perspective of the object, and those which form the ground of it. The principal hatches should be more strongly marked; the middle tints, if etched, should be marked lightly, or they may be left till the varnish is taken off, and be perfected with a greater degree of softness by needles, or the point of the graver, as the original may require. There is nothing peculiar in the method of applying the aquafortis in this kind of engraving; but it may be observed that it should not be left so long as to corrode too much the lighter parts. If the light parts are sufficiently corroded, they may be stopped up with turpentine varnish and lampblack mixed together, and the aquafortis may be applied again to the stronger parts; for it will be no detriment to them, if the points which compose the shade burst into one another, provided the extreme be avoided. When the work of the aquafortis is finished, and the varnish taken off the copper, it will be necessary in the softest parts, such as the flesh, to interstipple with proper points, as an effect will be thus produced more delicate than it is possible to attain with the aquafortis only; and the strongest shades will require additional strength to be given them with small strokes of the graver. Drawings made with chalks of different colours may be imitated in this manner, if a plate be provided for every colour. This method of engraving is intended to form a kind of deception, so that the connoisseur may not be able, on the first inspection, to distinguish between the original drawing and the engraving made in imitation of it; and it is extremely useful, as it serves to multiply copies of drawings left by those masters who excelled in the use of chalks, and thus to form and improve young artists, who could not have access to the originals in the practice of drawing.

To this account of the history and practice of the art of engraving we shall annex the following ingenious observations by an eminent artist.[1] We present them to our readers without alteration or abridgment.

On the linear art in general.

"When compared with painting, the art of engraving is but a recent invention, being coeval only with that of printing; and, like that noble art, it possesses not only a similar, but a greater power of multiplying and extending the productions of genius over the world, for its language is universally understood.

"It would have been well for the art if it could boast of a more remote date, as we might then have had many more of the finest designs of the first painters of antiquity, now doomed to oblivion, saved from the rude ravages of time.

"But this invention seemed to be reserved for the fourteenth century, and its improvements for the age of Louis XIV.; an age in which a number of artists, who may be said to have invigorated the art and invested it with beauty, arose both in France and Italy.

"Lines, in the first state of the art, like every other pursuit whose excellence is progressive, were comparatively rude and unmeaning, and had nothing more to recommend them than merely representing a particular sort of markings, or slight hatchings with the pen, without any other apparent degree of execution or expression; although it is our pride to acknowledge that it has been not a little beholden to the elegant etchings of the great masters in painting, as well as to their drawings in pen and ink in its early stages, by which means an eminent degree of taste was introduced into the art, particularly in the department of linear disposition; amongst those, the drawing of a Raffaelle, Michel Angelo, and the learned Da Vinci, some of which we have occasionally seen and admired. Some by Da Vinci were hatched in a square but delicate manner, with a white fluid, on dark-coloured paper. Those of Michel Angelo and Raffaelle inclined more to the lozenge, in black or brown ink. They even carried this style of hatching with the pencil into their pictures, some of which adorn the Vatican; and in the famous cartoons in the Royal collection by Raffaelle. Baccio Bandinelli generally hatched his lines in one direction, particularly a Taking down from the Cross, which was sold in London at the sale of the late Sir Joshua Reynolds' drawings. Vicenzio Dante hatched in a similar way about the year 1550. Julio Romano used also to draw in this style with the pen, several of which are still to be found in the most select cabinets of men of taste; and for near a century and a half after the invention of etching, it is rare to mention a painter of eminence who was distinguished in drawings, who did not annex this art to that of painting. But with the application of the burin the art has been gradually improving till the present period. Linear[2] engraving is nothing more than drawing elegantly on copper. It became more studied as it was found capable of representing the various appearances of nature. The texture or surface of objects became proportionally discriminated by such peculiar modifications of the line as seemed most suitable to the subject represented, although, at the same time, it rendered it much more arduous in the execution. Hence arose that diversity of style, and that scope for succeeding excellence, which, by combining elegance with simplicity and beauty, distinguished those artists who have been most conspicuous in its improvement.

"It has been said that we are indebted for the origin of this art to an ingenious Florentine, Masso Finiguerra the sculptor. He was succeeded by a number of other ingenious men, among whom we rank Botticelli, Andrea Mantigna, and other able designers; and in Germany, Albert Durer, Aldgrave, and Lucas van Leyden, who severally contributed their labours. But in the fifteenth century the works of the divine Raffaelle began to be multiplied by the correct graver of Marco Antonio, an artist whose prints were the delight of that great painter. Antonio had many imitators, but none who equalled him for justness of contour, for which his works will be ever highly appreciated among the early productions of the art. Having had occasion to mention a few of the principal artists who reared the scaffolding of this elegant art, we shall proceed to those who have so much distinguished themselves in finishing the superstructure. Among those, Augustino of Venice began to introduce a better disposition of line in his shades, as well as the ingenious Bolognese, Augustino Caracci; whilst Egedius Sadelaer displayed no less zeal in Germany. In the sixteenth century the art displayed still more vigour and taste, and seemed to have but little more wanting; for all that meagre dryness of line began to disappear, which so manifestly marks the early works of Il Tedesco, Aldegraff, and other artists of a former period. Their works became consequent-

[1] Francis Legat, Esq. historical engraver to George IV. when Prince of Wales, and F. A. S. E.

[2] The author has taken the liberty of adopting here the word *linear*, from its strict analogy to this mode of engraving, and with the approbation of some of the first professors, both in painting and engraving.

ly more rich in style, by embracing the best productions of the pencil; and as they were applied to a greater number of ideas, they became still more interesting and successful.

"Patrons were numerous and liberal; and it is but proper to remark, that the various artists, on their part actuated by a becoming zeal which was highly creditable to themselves, were indefatigable. This is a circumstance not less worthy of imitation than the many admirable monuments of the art which they produced. Few but admired the works of Masson, Poilly, Nantueil, and Rousselet; and some time after the death of the ingenious Cornelius Bloemart, who had given a grace to his lines hitherto unknown at Rome, the matchless Audran and Edelinck displayed their excellent productions at Paris. But arts are liable to fluctuate; and when the art of engraving began to decline abroad, it gradually displayed a high degree of lustre in our own country; and the variety of styles which has since sprung from the original manner of engraving, shall be the subject of the following sketch.

"We shall, therefore, treat more particularly of the disposition of the lines, and their consequent effects, distinguished by the terms *linear expression, imitation, disposition,* and *harmony;* with a strict investigation of the first and most approved subjects, either in etching or engraving, and of their essential beauties, as far as they may tend to illustrate the subject.

"As the great object of this mode of engraving is to adopt those lines the most expressive of the form and character of whatever happens to be represented, it is necessary to begin by maturely investigating not only the action, but the cause and correspondent effects, of the original picture, in order that the artist may avail himself of all that is most beautiful in his translation, and efficient in the aggregate, either with respect to the expression, spirit, or sentiment.

On linear expression and disposition.

"When historical subjects consist of several figures where there is generally a variety of draperies, some of them appearing thick and cumbersome, others more thin and flexible, sitting close and elegant on the limbs, being composed of a finer texture or thread; the coarser stuffs are consequently more effectually represented by a bolder line, as the thinner sort, by the application of a fine line, gives a more lively representation; a discrimination which has been observed of late by the most approved modern artists in linear engraving. Observations of this description, when treated in a liberal manner, not only superadd a degree of truth, but even render the subjects sweeter to the eye of fancy. In the early stages of the art some excellent artists have been led into particular and limited systems. In the works of such as have affected to describe every subject in the same line indiscriminately, even the arms of the most delicate women are often engraven as if perfectly polished, by approaching to a metallic appearance, a mode not uncommon among the second or third class of artists about the beginning of the last century; by which manner all that softness and delicacy was neglected which is so happily effected in the linear productions of Strange, Bartolozzi, Morgan, Sharp, Heath, and others. Those who are acquainted with the works of the ingenious Chaffard, must with pleasure have perceived in his foliage how even the texture of flowers is imitated from the delicate line-like fibres of which they are composed, issuing from the stem and spreading their silken beauties to the sun; and in this class of imitation, the clear transparency of glass, the rough texture of woollen, the thinness of lawn, the flickerings of satin, or the lightnings of steel, as well as the rude rock, the lucid lake, or the flashing of the torrent, are all admirably adapted to linear effect by the almost infinite diversity in their construction and general constituent principles, strictly observing on what laws the beauty of lines consists, by ever keeping in view the due balance of taste, and a noble simplicity of style throughout. It is the business of the skilful artist to overpower and subdue the difficulties in his profession; for no excellence in art is of cheap or vulgar acquisition. Let it be remembered, that with forming steel even the enchanting graces of the Venus de' Medicis were hewn from a rock, and the almost breathing Apollo from a block of Parian stone.

"An elegant English poet, in a critical essay on poetry, observes that the sound should seem an echo to the sense; so should the lines in a fine print seem to harmonize with the subject, by flowing with the external cast of the features, and the predominant passion expressed in the original picture; for the same character and disposition of the lines that suit the action of the muscles in one passion, will be found to appear more vacant and less expressive when applied to others, however graceful they may appear.

"As this is a point of view to which the art has never yet been fully extended, perhaps it may meet with some degree of attention, as it will be found of utility in forming a principle respecting disposition, more particularly in historical subjects, where the passions are required to be nicely expressed; and although it may admit of some slight exceptions, it is a principle that will in general be found to be true.

"For example, let it be supposed that the passion of the figure represented is that of joy, the lines should seem to expand and swell, with every acting muscle, in the most delicate manner possible.

"But, on the contrary, if the subject displays deep sorrow, they should rather incline downward, partaking somewhat of the half straight, seeming to act apparently in perfect unison and conformity with the features of the face, with all due subordination to the general effect of light and shadow.

"Various observations may be made in this manner on the principal passions expressed in the human countenance, which are but few comparatively, even from the slightest movement to the boldest action. We often find, on examining the works of those masters who are not so conspicuous for great clearness of execution, that they have been occupied by the disposition and energy of the lines; as in the magnificent and masterly prints of the battles of Alexander, from the pictures of Charles le Brun, engraved by Gerrard Audran, where the executive department is no less conspicuous from the burin of the Chevalier Edelinck in the fine print of the tent of Darius; whilst Audran displays the true spirit of art, but rarely avails himself of much of the mechanical principles. The field and tumult of battle seemed admirably calculated to call forth his rapid powers, particularly in works of magnitude.

"The less active scenery of the tent of Darius was well adapted to the splendid talents of Edelinck, who was admirably qualified to display subjects of this nature. This is sufficiently obvious from the beautiful and interesting group of the queen mother, and her illustrious family, kneeling at the feet of the conqueror; his impressive print of the Magdalene, or his most admirable portraits of the dignified clergy, distinguished authors, and eminent artists. These, in point of engraving, are no less remarkable for taste in the execution, than for truth and nature in expression.

"In one of the battles of Alexander, the group where Porus is wounded and supported by the soldiers, the rough discrimination of line finely accords with that bold deportment of character in the grim visage of that gigantic

prince, whilst a more delicate line marks the youthful countenance of Alexander; a discrimination which is totally lost in the large Dutch copy by De Vos.

"In the same print the figures of Alexander and Clytus are finely relieved from the distant scenery by the varied description of engraving on their armour, drapery, and horses. The latter are managed with such freedom and spirit, that it is difficult to say whether the horses or figures teem the most with masterly execution; particularly the white war-horse on the right extremity of the print.[1]

"Had Audran superadded a still greater portion of the delicacy and clearness of handling so conspicuous in Edelinck and other eminent artists since that period, it would undoubtedly have given an additional beauty to his other transcendent acquisitions; namely, the vast spirit of his lines, and power in drawing.

"But it is seldom the lot of an individual to combine every excellence. Arts too have their infancy, for they generally require the labour of ages to bring them to maturity and perfection; and it yet remained to unite and ameliorate the polish of Edelinck, to the spirited style of Audran. Without prejudice or partiality, a considerable degree of this excellence will be found in the best works of British art, as we shall hereafter exemplify.

"Another fine specimen of linear engraving, and of a different class, is the celebrated storm of Balechow, from a picture of the famous Vernet. In this print he has transmitted with the graver a certain fluidity and action in representing the liquid element, to which the art had never before attained. To a grandeur of style in the bold swelling of the waves he has superadded the utmost transparency of line; at the same time having attended to all that light restless spray which seems sporting to the gales as they roll along. In a fanciful mood one might almost imagine they heard the motion of the water; so finely did this discriminating artist translate this admirable picture.

"When we consider the period in which this distinguished work was engraved, and that little or nothing had been previously done in that department of a similar excellence, it is hoped it will be a sufficient apology for the degree of admiration here expressed; for, as Lord Verulam truly observes, "we are too prone to pass those ladders by which the arts are reared, and generally reflect all the merit to the last new performer." We have already observed, they are seldom reared with rapidity, and oftentimes that which is considered an invention is only a long succession of trials and experiments, which have gradually followed each other, and ought rather to be considered as a series of human mind than the knowledge of an individual, being the works of ages. In any point of view, the present subject will ever be considered as a high improvement and an elegant acquisition in the annals of the linear art. But in historical subjects this artist is by no means equal in point of taste or discrimination. His print of St Genevive undoubtedly ranks high in the first classes of engraving. Had his taste in other respects been equal to his powerful clearness of execution, it would have been almost unparalleled; but it betrays a want of that essential, even in his mode of thinking. Patience and labour are everywhere too prevalent. It remained for Woollet to excel both in figures and landscapes.

"In the various styles and modifications of this expressive art, from the neat to the feeble, and from the bold to the extravagant, taste stands sole arbitress; in brief, it is she who distributes variety with spirit, and conceals the appearance of intricacy and labour; who, by a due modification of line, unites clearness to softness, arresting the hand of the skilful artist from every effort inconsistent with her powers; producing at once to the mind all that agreeable finished combination or harmony which ever accompanies and constitutes the perfection of true art.

"In the execution of subjects of imagination, there is a perpetual scope for calling forth the fancy of the engraver, as the various combinations of lines are inexhaustible, uncommon effects, such as aerial spirits, or celestial beings blended with the light, or ghosts commingled with the gloom, or fairy elves by moonlight, who trip the sands, and yet no footing seen; or wood nymphs laving their taper limbs in the limpid element. Such subjects, in point of style, depend entirely upon the beauty, lightness, and transparency of execution; for those that are merely ornamental or grotesque demand a style of a different cast from that of the serious or historical, as they require a less degree of truth even from the burin. In these cases the style may be as capricious as the subjects. Those of Raffaelle, in the Vatican, display an uncommon degree of taste, and particularly in the elegant flow of line with which they are composed.

"In all works of taste and genius, those which may appear the most simple at a transient glance, will be often found to contain the most art on a more mature investigation. The first impression may strike the fancy, but the second generally calls up the discriminating powers of the judgment.

"Arts generally rise in our esteem according to the degree of exertion of the mental powers which they require; and, as lines are capable of various styles, those which are most congenial to the subject represented ought to be adhered to in preference to every other consideration. Teniers and Gerrard Douw demand all the fidelity and delicacy of the burin in describing the various draperies and individualities which belong to that class of painting; but, in proportion as the contour is composed of fewer parts, and the forms more full and elegant, the beautiful flowing qualities of the graver are increased, and its lines glide more gracefully over the figures, as may be found in the works of Strange and others, from Guido and Correggio. This distinction will not appear so obvious on a superficial view of the art. But, on a due investigation, it will be found, that not only a different modification of lines is necessary to the various classes of painting, but that even a different description of style is requisite to characterize some of the masters in each particular class, from the sublime and elevated figures of a Raffaelle and Michel Angelo, to the simple cottagers of Adrian Ostade.

"When we take a more comprehensive view of the art, we often find, that the styles which are adopted in the different countries in Europe by the artists where the art has in any degree been cultivated, are generally regulated by the modes of painting, drawing, and even the colouring respectively in each, whether historical, portrait, or landscape, and is proportionably appreciated according to the effective beauty and elegance of the execution.

"It is not improbable that the clear mode, which at present constitutes the modern German school, is a refinement on the simple style of Cornelius Bloemart.

"In Italy, Jachimo Frey, that astonishing Swiss, from his masterly expertness in drawing, and a rapid use of the etching steel and the nitre, almost produced an entire revolution in the art. The unprecedented richness and ease, the freedom and energy of his style, and the number and magnitude of his works, attracted all Italy, and tended

[1] Whenever M. Bartolozzi happened to speak of these prints, he always expressed himself with a great degree of enthusiasm, thinking himself extremely fortunate in having works of such excellence in his possession.

greatly to improve the Roman school. About the year 1672 we find him working jointly with the nervous Dorigny Frezza, and Vanauden Aird. From this source we can perceive the style of Wagner, of Cars in France, and various masters now living; namely, Francisco Bartolozzi, Giovanni Volpato, Dominico Cunigo, and some of the early works of the excellent Raphael Morghen.

"In many instances Frey indicates, that if he had considered it of sufficient consequence to the art, he could have engraved with more clearness, particularly by his curious copy, from the celebrated print by Edelinck, of the Madona and Child, with St John and Angels, from Raffaelle; and, although but an imitation of another style, tends to show the versatility of his talents, when the judgment is for a while suspended to know which is the original. We find a performance of Frey's, entitled *La Charité Humaine*, dated 1723; a print was afterwards engraved from the same subject at Paris by Daulle, dated 1763, in which he has rather been too profuse in the more mechanical part of the art, and destitute of that ardour which a well engraved work should not only inspire but maintain.

"It is not enough for lines to be only well disposed, but also full of expression; neither is it enough for a line to be only clearly cut, but it must also be free; for in a certain free light spirited lines convey an idea of animation, and are suited to subjects of that description; while the long, sweeping, and bold lines are better adapted to the solemn and majestic productions of the pencil.

"A fine print, like a miniature picture, ought to be viewed near the eye; as in itself, from the nature of the art, will be found a due subordination of effect, ever receding, from the bold and articulated lines in the fore ground, to those which are more evanescent and remote.

"The graceful birch, the mountain ash, and the oak, have each their peculiar bark and texture; and these, when freely indicated, stamp their mark and character most completely to the eye. Much of this, as has been formerly mentioned, depends upon, and is regulated by, the peculiar style of the picture and the skill of the engraver.

"As lines seem to partake of motion, in proportion as they deviate in gentle bendings from the straight and precise; even so also in the motion of water seemingly increased, whether they undulate with the simplest wave, or swell with the fierce and tempest-curled surge. This character is sufficiently illustrated in the works of Balechow and Woollet.

"In the late Mr Brown's large print of St John preaching in the wilderness, no engraver has ever more fully displayed the true spirit of Salvator Rosa, particularly in the original mode of treating the rocks, and the bold style of the surrounding scenery; in short, in the aggregate it is a chef d'œuvre unparalleled in any country. This is freely acknowledged, not only by every man of taste, but by the first landscape engravers.

"But Brown was perhaps less happy in the companion to the above, from the celebrated Both, by adapting a similar mode to that finished and delicate painter. For the style should ever vary with the subject.

> Whate'er Lorrain light touched with softening hue,
> Or savage Rosa dash'd, or learned Poussin drew.

"His admirable etchings of the cottager and its companion, and the Celadon and Amelia, are fine specimens of his discriminating powers, and characterized with so near an approach to truth, that we cannot help exclaiming with the poet,

> He sees no other, nature's self who sees.

"The engraving of the above subjects was finished by the matchless Woollet with the same happy taste. And it must be acknowledged that it is but seldom that we see so many excellencies united; for it is equally rare to see the finest engraving united to the finest drawing, as to find it in painting combined with the choicest colouring; yet each have their decided fascinations in the gallery, the cabinet, or the portfolio.

"Woollet, whose works abound with nerve and intelligence in point of character, his style of landscape is delightfully descriptive; whether rocks, water, trees, or sky; as the Niobe, the Ceyx and Alcyone, and other masterpieces from the great Wilson, evince. In the winter scene from Smith of Chichester he has admirably contrived to convey the effect of the drifted snow by delicate dotting; and with no less precision he has described the transparent ice with clear lines. Of trees, he was the first that ever faithfully characterized the graceful larch; as may be seen in his views of the noblemen's seats. In the print of the fishery he is indebted to the masterly etching of John Brown, particularly the shipping, in which there is perhaps no subject more articulate and perspicuous. The engraving of this subject is finished by himself. In his figures he was the founder of a style most happily adapted for modern dresses and historical portraiture; a style in which he moved with unrivalled reputation. His print of the death of General Wolf, painted by Mr West, is an admirable example, and does honour to the British nation. It occupied him no less than four years. The print of the battle at La Hogue is another fine specimen of his knowledge of linear discrimination. In short, when we consider the talents of this artist, it is difficult to decide whether he most excelled in modern history or landscape. The art has to regret that he, who was so eminently qualified to adorn any line of the profession, has left no works in ancient history. We have little doubt, from his knowledge, and a real love of the art, he would have left a sufficient monument in that department also for the pleasure and contemplation of the real connoisseur and of posterity. Engraving in this country sustained a heavy loss when he died; and if the death of so excellent an artist may be considered as a public loss, it is certainly the more felt with respect to Woollet, who died while he was yet improving in that excellence.[1]

"Chattelaine has been termed a mannerist in his drawings, but he must certainly be allowed to be an excellent one; his etchings are variety itself. Perhaps in the department of etching no artist has so happily translated the pictures of Claude de Lorraine as Francis Vivares; that is, with respect to aerial perspective, the peculiar characteristic of Claude. But his merits are not confined to this master alone; for he followed Ruysdale, Berghem, Gainsborough, and Cuyp, with great success. He has such a free delivery of style, that almost every one who examines his works is irresistibly impressed with an idea of performing the very same. Few artists, it has been mentioned, have excelled in the etching department. We cannot, however, omit the name of Peranezzi; who, to originality of style, which is apparently spontaneous, joins a certain grandeur which had never been surpassed. He has transmitted to posterity so spirited a representation of the Greek and Roman edifices and ruins, that travellers have often confessed that they have raised their ideas beyond the magnitude of the superstructures themselves. It is certain that in works of this stupendous nature, a degree of ruggedness in the execution corresponds with the sublimity of the subjects, and thus produces a still great-

[1] Although we are now contemplating linear engraving, it is but proper here to observe, that chalk engraving, mezzotinto, and aquatinta, have also made ample improvements in this country in their various styles of excellence.

Engraving. er power over the mind than if they had been more polished. Some have censured his figures, and not without cause. This defect has been ingeniously palliated by an excellent artist, M. Bartolozzi. "For," said he, "if the purchasers of the works of Peranezzi get so much for their money in the building way, the figures may be supposed to be given for nothing." Doubtless those vast piles of perishing grandeur were never more judiciously presented to the eye than by this astonishing artist, or better calculated to affect the mind by calling forth its most sublime ideas.

"We have another striking instance of spirited etching in a different pursuit of the art, in the works of Ridinger, a name which brings along with it all the savage scenery of nature.

> Assembling wolves in raging troops descend..........
> They fasten on the steed, and pierce his mighty heart.

For we shall ever find some peculiar beauty to admire, even in the slightest productions of genius, as well as in the most perfect productions of the burin.

"There are few artists who do not regret that etching was unknown to Bolswert, who has done so much without its aid; from which we may easily suppose how much more he could have effected with this charming acquisition. For the truth of this remark we may appeal to his landscapes from Rubens, his animated portraits from Vandyke, and his productions from the Flemish school of history, particularly his large print of the taking down from the cross, from Rubens.

"There is a fine instance of linear effect in a print of a Flemish conversation piece by Wille. One of the figures is drinking out of a glass, and the artist has most deceptively described the texture of the drinker's face through the glass. In the same print a female figure shows great skill in this way; even the floor is characterized by lines; and the whole strongly marks the most proper mode of treating subjects of a mere local nature. The beautiful print of the *Petit Physicien* is also an admirable imitation, particularly the little pellucid globule which has just mounted from the shell. When lines are engraved in a square acute method of crossing, they generally convey the idea of hardness to the subject represented. The scientific Picart seems to have been so much aware of this, that in a print of his engraving of a large marble group of horses, from the animated chisel of Perriere, he adopted this style in order to heighten the imitation.

"Mason's print of Marshal Harcourt is one of the many fine efforts of portrait engraving; and although it was executed at an early period of the art, it abounds with no small degree of taste. The celebrated print (called the table-cloth), from Titian, of the Last Supper, also contains a considerable degree of linear discrimination, although he sometimes carries it to affectation. He is rather singular in his mode of engraving hair. Yet the portraits of Marshal Harcourt and Brisasiere the secretary may be deemed exceptions.

"While, by the magic of his tooling, he is too apt at times to give his works indiscriminately the appearance of bronze; and we frequently find the same in the figures of Balechow; but it seems to have been reserved for Strange to give the softness of carnation to copper, and to Woollet to give force and clearness with discriminating taste; Bartolozzi in his lines, elegance, delicacy, and drawing; while the works of Audran teem with boldness and simplicity. In the prints of Sir Robert Strange, the greatest excellence is perhaps his rich and harmonious tones, as well as the whole effect, which is supported by an expressive style, which he seems in a great measure to have invented for his most favourite painters, Correggio, Titian, Guido, and Guerchino. The softness, the gusto, and the flowing draperies in the works of these masters, were his delight. His sleeping Cupid from Guido, and the prints of the Venus and Danaë from Titian, will ever be esteemed as *chef d'œuvres* in the linear art." Engraving

Having thus attempted to fulfil our original intention of discriminating the most expressive combinations of lines, and of analyzing and illustrating their various powers and effects in engraving, we shall now conclude these observations; and if, from the nature of the subject, and from the limits of the sketch, we have failed in marking every brilliant star in the galaxy of the art, it must at least be acknowledged that we have not omitted some of those of the first magnitude.

Engraving *upon Steel.* On the first discovery of the art of printing from engraved metals, experiments would most probably be made with a view of ascertaining the fittest metal for the purpose. Indeed it is known that copper, tin, and silver were employed by the early artists; and there are some prints by Albert Durer which are considered as impressions from plates engraved or etched on steel. In the collection of Albert Durer's prints in the British Museum there are five of these prints, the chief of which are, *Christ in the Garden*, a print six inches by eight and a half, dated 1515; the *Lady and the Monster*, twelve inches by eight and a fourth, dated 1516; and the *Canon*, twelve and three fourth inches by eight and a half, dated 1518.

But, for the usual purposes of engraving, copper has, till within a few years, been supposed to have some advantages, which have led to its being nearly always employed in preference to other metals; and in one instance only have we found that steel-plate was used for engraving upon in this country, before the late attempts to prevent the forgery of bank-notes. The plate we allude to is the Ceiling of the Star Chamber, in the *Topographical Illustrations of Westminster*, engraved by Mr J. T. Smith in 1805.

The great expense of renewing plates for bank-notes, when any superior engraving is introduced for rendering imitation difficult, suggested the idea of employing a harder material than copper to engrave upon. Steel-plate was tried, and found capable of affording from twenty to thirty times the number of impressions that could be obtained from a plate of copper, whilst it was not much more difficult to engrave upon. The advantages derived from employing steel were first made public in this country in 1818, by the inquiry respecting the prevention of forgery, instituted by the Society for the Encouragement of Arts in London, when a specimen of engraving on soft steel was presented to the society by the late Mr Charles Warren; and it appeared from evidence collected by the committee, that notes with ornamental borders, printed from steel-plates, were then in use in America. Soon after this period Messrs Perkins and Fairman from America, in conjunction with Mr Heath, an eminent engraver of London, formed an establishment for printing notes and other engravings from steel blocks.

The methods of engraving on steel now universally adopted are similar to those employed in engraving on copper; differing only as far as was necessary on account of the nature of the material and the process of hardening the plates in use in the earlier stages of this invention. In addition to these methods, Perkins, Fairman, and Heath employ a mechanical process for increasing the number of steel plates. They first make the engraving on a thick plate of soft steel; the plate is then hardened, and the impression is transferred, in a spring press, to the surface of a soft steel cylinder, by rolling the cylinder repeatedly to and fro on the engraved plate, under a very considerable pressure. The transfer thus ob-

tained is in relief; and the cylinder being hardened, it is made, by the same spring press, to repeat as many impressions as may be desired on soft steel, or on copperplates, for the purpose of printing from. They usually impress steel blocks, each of which will afford several thousand impressions; and when the cylinder becomes worn by transferring, a new one may be impressed from the original engraving; and, consequently, an inconceivable number of plates may be obtained from one original plate.

It ought, however, to be remarked, that an engraving cannot be transferred from steel to steel without injury; and that the injury will be greater in proportion to the delicacy of the work. Indeed, where engravings are to be considered as works of art, it will always be preferable to engrave or etch on softened steel, and print from it without hardening. A sufficient quantity of impressions may thus be obtained, and of a superior kind; because steel being harder and more compact than copper, it is consequently less worn by the process of wiping off the printing ink either with the cloth or the hand.[1] But the power of transferring is of great value in all cases where a great number of impressions is the chief object desired, as in notes, plates for school-books, ornamental borders for pottery, labels, and the like.

In preparing steel-plates, either for engraving or etching, the surface should be well polished, so as to render it compact, of an equable degree of hardness, and perfectly smooth. The same tools are used as for copper, but they should be of the kind of steel which is endowed with the greatest degree of toughness. When a plate is to be etched, the point which removes the varnish should be sufficiently hard to penetrate the polish on the surface of the plate; the acid will then bite more freely, and to a greater depth, without spreading so as to produce a broad and shallow line. A point of diamond is, we believe, sometimes employed, particularly where the lines are drawn with the *ruling-machine* invented by Mr Wilson Lowry, the founder of a new school of engraving, which has been of infinite use in diffusing correct taste in architecture and sound knowledge in mechanics. The same ingenious artist observed, in the first etchings on steel, that the lines were broad without depth; and, in consequence, tried to find a *menstruum* which would answer the purpose better than the common acids. In this he perfectly succeeded, and was enabled to bite the lines deep, and yet preserve the desired degree of fineness.

Of the common acids, diluted muriatic acid seems to answer best; but diluted nitric and nitrous acids produce nearly the same effect.

When the graver is to be much employed on a plate, it should be annealed, in order to render it uniformly soft. The plate, after being engraved, may be hardened most effectually, and with the least injury to the engraving, or risk of warping the plate, by heating it in a metallic bath, and quenching the whole in a cooling fluid. A bath of the fusible alloy of lead, tin, and bismuth, which Dr Wollaston proposed for hardening delicate steel-work, will perhaps answer better than any other. (See CUTLERY.) It will always be an advantage to employ a perfectly fluid medium for cooling; and we have reason to conclude, from some hasty experiments, that water heated to its boiling-point is better than cold water for cooling steel. The quick abstraction of heat, by converting water into steam, seems to have more effect than the mere cooling power of a large body of cold water. Plates to be hardened should be about half an inch thick.

Being engaged to get up about 100,000 one-pound notes, and not having had time to case-harden the plate, the writer was enabled to produce the quantity by means of partially repairing it; and upon mentioning to Sir David Brewster the circumstance, he accounted for it on the ground that steel, when soft, is tougher and closer in the grain than when hardened.

Mezzotinto engraving on steel is also found to answer well; and upon that metal some very fine prints have lately been done; and the great number of impressions which a steel plate affords will cause this beautiful style of engraving to be more generally cultivated.

As printing from engraved steel is now much used as a means of preventing forgery, we shall close this article with a few remarks on that subject. It appears to us that there should be nothing complex in the figures which are selected for the engraving; their excellence should consist in the perfect evenness and parallelism of lines, whether straight or curved; but curved lines of difficult kinds should be preferred. Many crossings render a pattern intricate and confused; they distract the attention and dazzle the sight. Wavy patterns, with scattered lights, have the same effect. In such cases it is difficult to compare one specimen with another, and a general imitation is not so easily detected. It will be desirable to combine the work of an artist with that of a mechanical engraver; and in such cases the subject should be of sufficient size to allow of its being distinctly made out, because it will increase the difficulty of imitation. Where the circulation of notes is limited, good engraving on the note will be some check upon forgery; but the notes of different banks should be made as distinct as possible, instead of the same work being introduced in different notes; as may easily be done with steel cylinders. Where a whole empire is served with one kind of notes, the temptation to forge is so great that it cannot perhaps be altogether prevented; and, therefore, whilst every proper expedient should be used to increase the difficulty of forgery, no apparent difficulty of copying should render bankers and others less on their guard against it.[2]

The invention of the ruling machine by Lowry was sure to produce other methods of shortening the labour incident on engraving entirely by the hand; and thus we have the ingenious modes practised by the Americans in their bank-notes, bills, &c., and also the process known by the name of anaglyptography. The public are in possession of some very beautiful copies both of ancient and modern art—the work of that machine—in what may be called *basso-relievo;* but after the death of the inventor, Mr Bate, the art was taken up by Mr Stokes, who carried the invention to such excellence as to produce copies from entire statues.

Stokes's engraving machine is constructed to give a perspective likeness of the statue operated on. It consists of two parts, which are fixed on a stand. The first part is what is called a section apparatus; and the second part a projection rod. The section apparatus consists of two conically-shaped arms, jointed together and balanced on an axis—this axis being parallel to the axis by which the conical arms are jointed together—thus compelling the end of the smallest arm attached to a sliding frame to move in a plane at right angles to the axis on which they are suspended; thereby giving the plane of the sections on the

---

[1] A steel-plate which had not been hardened has been known to afford 95,000 impressions without material injury.

[2] At the ordinary meeting of the Society of Arts, held December 1854, a paper was read "On the New Bank of England Note, and the substitution of surface-printing from electrotypes for the ordinary copperplate-printing." Mr Smee stated that he had proposed to the Bank a system whereby surface-printing from electrotype should be substituted for the plate-printing, and that, with Mr Hensman and Mr Coe, typography had been brought into successful operation for all the numerous forms of notes and checks required. The originals of the devices and letters were never employed for printing, but are simply used as mould-makers, from which electro-casts are taken by the use of the ordinary Smee's battery and precipitating trough. The bank-notes, by this system, are printed at a steam-press, constructed by Napier; and no less than 3000 notes are printed per hour. By this system the most perfect identity would be insured. This method has now been put in operation at the Bank of England.

statue an inclination of 45 degrees to the plane of the drawing board on which the copy is to be made, and always parallel to itself whilst it is moved up and down a prism-shaped pillar, which is accurately graduated by a dividing apparatus.

The projection rod is a light hollow arm, which is strengthened by stays and tension wires, and balanced by a universal joint to a fulcrum firmly fixed on the stand. At one end of the rod is a slider, moving freely between four friction rollers, the slider being also attached to the section apparatus by a universal joint; while at the other end of the rod is the etching point, working against a vertical drawing board.

When the machine is to be used, the universal joint on which the projection is balanced is adjusted to the point of view at which it is determined previously the copy of the statue shall be made.

The section apparatus being raised sufficiently high, the operator takes the slider of the projection rod, and presses it lightly against the statue, while moving it from one side to the other. As the section apparatus is attached to the slider, it causes it to move in the plane which it describes, and allows it to move freely between the friction rollers in the projection rod. The slider thus describes the outline of a surface, or makes a section of the statue, while the etching point at the other end of the projection rod describes a perspective projection of the same on a prepared plate fixed on the drawing board. The operator then lowers the section apparatus one division, and proceeds as before; thus alternately lowering one division and describing a line, until the whole of the statue has been carefully passed over.

See *Report of Committee of the Society of Arts, on the Mode of Preventing the Forgery of Bank Notes*, 8vo, Lond., 1819; *Edinburgh Philosophical Journal*, vol. iii., p. 140.

The method of engraving on copper, in which the lines or strokes, instead of being cut with a tool or graver, are eaten in with aquafortis, is styled ETCHING. It is of later invention than engraving with the tool, of which it was at first only an imitation, practised by painters and other artists, as offering greater facilities of working than the graver. But being considered at first as a counterfeit kind of engraving, and inferior to the other, it was little cultivated; the closeness of the resemblance of the work to that performed by the graver being made the test of its merit, and the principal aim in those who pursued it. This restriction of the art of etching to the imitation of engraving greatly retarded its advancement, and many of the most able masters cramped their talents by the observance of so narrow a rule. This may be seen in the instances of Sadelers, Swaneberg, Villamena, and particularly Le Bosse, who, in his treatise on engraving, has laid it down as a principle, that the perfection of this kind consists in the close similitude of the work to that executed with the tool. But this absurd prepossession is now removed; and the method of working with aquafortis has been so far improved, that instead of being now deemed a spurious kind of engraving, it evidently appears, in many modern works, the foundation of an excellence that could never have been produced without it; since, though the neatness and uniformity of the hatchings which attend the use of the graver is more advantageous with respect to portraits, yet the liberty and facility of etching gives great opportunity to exercise the force of genius and fancy in historical engraving, where the effect of the whole, and not the minute exactness in finishing all the parts, constitutes the principal value.

There are two methods practised of engraving in this way; the one with a hard varnish or ground, and the other with a soft. The hard varnish was at one time much used, being better accommodated to the intention of imitating the engraving with the tool; as the firmness of the body of the varnish gave more opportunity of retouching the lines, or enlarging them with the oval-pointed needles, called by the French *echoppes*, as was practised by Le Bosse and others for that purpose. The soft varnish has now almost wholly superseded the use of the other, by the free working it admits of; which affords a power of expression incompatible with the greater inflexibility of the hard varnish, that confines the lines and hatches to such a regularity and sameness, as give stiffness of manner and coldness of effect to the work.

The combination of the use of scratching tools and aquafortis, which are now both employed in many cases, has given to etching that perfection it at present possesses. The truth and spirit of the outline which the method of working with aquafortis affords, and the variety of shades which the different kinds of black produce in this way, as well as other means of expressing the peculiar appearance and character of particular subjects, furnish what was defective in the sole use of the tool; whilst, on the other hand, the exactness and regularity of the lines, which are required for finishing many kinds of designs, are supplied by the tools; and by a judicious application of both, that complete finishing is obtained which either of them alone must necessarily want.

The manner by which this is performed, is by covering the surface of the plate with a proper varnish, or *ground*, as it is called, which is capable of resisting aquafortis, and then scoring or scratching away, by instruments resembling needles, the parts of this varnish or ground, in the places where the strokes or hatchings of the engraving are intended to be; then, the plate being covered with aquafortis, the scored and scratched parts (which are exposed by the removal of the ground or varnish) are corroded or eaten away, whilst the remaining portion of the plate, being secured and defended from the action of the acid, is untouched.

There are two methods of etching, as has been already observed, the difference of which consists as well in the kind of the varnish or ground as in that of the aquafortis adapted to each kind; but the general methods of performing them are alike in both cases. These varnishes or grounds are distinguished by the names of *hard* or *soft;* for in their consistence, or the resistance which they give to the needles, lies their essential variation from each other. The hard varnish, it is with good reason conjectured, was not the first in use, but soon took the place of the other, and was for some time the most received in practice, on account of its admitting the work to be made more like that of the graver; the soft has since, however, in its turn prevailed, to the exclusion in some degree of the hard, except in the case of particular subjects, but not so entirely as to take away the expediency of showing how it is performed. The manner of etching with the soft varnish is now, however, one of the most important objects of the art of engraving; and it is at present in universal use, sometimes alone, but more frequently intermixed with the work of the tool, and in some cases with great advantage, even where the whole is intended to pass for being performed by the graver.

Preparation of the soft varnish, according to Mr Lawrence, an eminent English engraver at Paris.—"Take of virgin wax and asphaltum each two ounces, of black pitch and Burgundy pitch each half an ounce. Melt the wax and pitch in a new earthenware glazed pot, and add to them, by degrees, the asphaltum, finely powdered. Let the whole boil till such time as that, taking a drop upon a plate, it will break when it is cold, on bending it double two or three times betwixt the fingers. The varnish, being then enough boiled, must be taken off the fire, and, letting it cool a little, must be poured into warm water, that it may work the more easily with the hands, so as to be formed into balls, which must be rolled up, and put into a piece of taffety for use."

It must be observed, first, that the fire be not too violent, for fear of burning the ingredients, a slight simmer-

ing being sufficient; secondly, that whilst the asphaltum is putting in, and even after it is mixed with them, the ingredients should be stirred continually with the spatula; and, thirdly, that the water into which this composition is thrown should be nearly of the same degree of warmth with it, in order to prevent a kind of cracking that happens when the water is too cold.

The varnish ought always to be harder in summer than in winter; and it will become so if it be suffered to boil longer, or if a greater proportion of the asphaltum or brown resin be used. The experiment above mentioned, of the drop suffered to cool, will determine the degree of hardness or softness that may be suitable to the season when it is used.

Preparation of the hard varnish used by Callot, commonly called the Florence Varnish.—Take four ounces of fat oil, very clear, and made of good linseed oil, like that used by painters; heat it in a clean pot of glazed earthenware, and afterwards put to it four ounces of mastich well powdered, and stir the mixture briskly till the whole be well melted; then pass the whole mass through a piece of fine linen into a glass bottle with a long neck, that can be stopped very securely; and keep it for the use that will be below explained.

Method of applying the soft varnish to the plate, and of blackening it.—The plate being well polished and burnished, as also cleansed from all greasiness by chalk or Spanish white, fix a hand-vice on the edge of the plate where no work is intended to be, to serve as a handle for managing it when warm; then put it upon a chafing-dish, in which there is a moderate fire, and cover the whole plate equally with a thin coat of the varnish; and whilst the plate is warm, and the varnish upon it in a fluid state, beat every part of the varnish gently with a small ball or dauber made of cotton tied up in taffety; which operation smoothes and distributes the varnish equally over the plate.

When the plate is thus uniformly and thinly covered with the varnish, it must be blackened by a piece of flambeau, or of a large candle which affords a copious smoke; sometimes two or even four such candles are used together, for the sake of despatch, that the varnish may not grow cold; which if it does during the operation, the plate must then be heated again, that it may be in a melted state when that operation is performed; but great care must be taken not to burn it, which, when it happens, may be easily perceived by the varnish appearing burnt and losing its gloss. The following expedient is made use of for the more commodiously blackening the varnish, and is particularly necessary where the plates are large: Fix a strong hook in the roof of the room, through which pass four pieces of cord of equal length, at the end of which are fixed four iron rings of about four inches in diameter, for supporting the corners of the plate. The plate, being thus suspended in the air, with the varnished side downwards, may be blackened with great convenience; but this is not, however, absolutely requisite, excepting in the case of large plates, which could not, without difficulty, be suspended, unless this or some other such contrivance were made use of.

It is proper to be very cautious in keeping the flambeau or candle at a due distance from the plate, lest the wick should touch the varnish, which would both sully and mark t. If it appear that the smoke has not penetrated the varnish, the plate must again be placed for some little time over the chafing-dish; and it will be found that, in proportion as the plate grows hot, the varnish will melt and incorporate with the black which lay above it, in such a manner that the whole will be equally pervaded by it.

Above all things, in this operation, the greatest caution should be used to keep the fire all the time moderate; and to move frequently the plate, and change the place of all the parts of it, that the varnish may be alike melted everywhere, and kept from burning. Care must also be taken, that during this time, and even till the varnish be entirely cold, no filth, sparks, or dust, fly on it; for they would then stick fast and spoil the work.

Method of applying the hard varnish.—This is precisely the same as that for the soft; it is spread equally over the warm plate with the taffety-ball, and smoked in the same manner; only, after it is smoked, it must be baked, or dried over a gentle fire of charcoal, till the smoke from the varnish begins to decrease; taking care not to overheat the plate, which would both soften it and burn the varnish.

The plate being thus prepared, and an exact drawing of the outlines of the design made upon thin paper, the other side of the paper must be well rubbed with chalk or Spanish whitening, or, which is better, with red chalk scraped to a powder: the loose chalk is then cleared off with a linen rag, and the stained side of the paper is laid upon the varnish, fixing the corners to the plate with wax or wafers, to prevent its shuffling; and with a blunted needle or pointer the drawing is slightly traced, and communicates to the varnish an exact outline of the design to be etched.

A variety of pointers is necessary for the work. Those used for the broad large strokes ought to be very blunt, exceedingly round, and well polished at the point; the sole of a shoe answers very well for polishing the points. The finest ought to be as sharp as a needle. If any scratches or false strokes happen in the working, they are to be stopped up with a hair pencil dipped in Venetian varnish mixed with lamp black, by which means these places will be defended from the action of the aquafortis.

The next operation is that of eating or corroding the plate with aquafortis, in order to which a border of soft wax, being a composition of bees-wax melted and tempered with a little Venice turpentine and tallow, must be fastened round the plate about an inch high, in the form of a little wall or rampart, to contain the aquafortis. At one of the corners of this border a gutter is usually made, which serves for commodiously pouring the aquafortis off the plate. The plate being thus bordered, take a due quantity of the refiner's aquafortis, mix it with half its quantity of common water, and pour it gently on, till it rise a finger's breadth above the surface of the plate; then, if all things have been rightly conducted, it will soon be seen that the aquafortis exerts its action in the hatchings which have been strongly touched; but those more weakly engraved will appear at first clear, and of the colour of the copper. The menstruum must therefore be suffered to continue on the plate till its effects become visible on the more tender parts; then the aquafortis should be poured off, the plate washed with clean water, and dried before the fire; after which take a small pencil dipped into the Venetian varnish, and cover with it the lighter parts of the plate. This being done, the aquafortis must again be poured on, and suffered to continue a longer or a shorter time, according to the strength of the menstruum or the nature of the engraving; after which it must be poured off as before, and the plate immediately washed with water.

It may be observed that, when the aquafortis is on the plate, a feather should be used to cleanse away the foulness of the verdigris that gathers in the hatchings by the operation of the aquafortis, and to give it more room to exert its action; for by moving the aquafortis to and fro on the plate by the feather, and brushing away the black saline matter where it appears to be formed, the hatchings will be cleansed and the aquafortis exert its whole force equally on every part.

The plate being thus sufficiently corroded by the aquafortis, and well washed with water, it must be warmed at the fire, and the border of wax removed; after which it must be made hotter till the varnish melt; then it must be well wiped with a linen cloth, and afterwards rubbed well with oil of olives, when it will be ready to be retouched and finished by the graver.

Etching *on Steel* is performed in the same manner as on copper. Of late years steel has generally been preferred to copper for this purpose, as, owing to its superior hardness, a much greater number of perfect impressions can be taken from the plate.

Etching *on Glass* is performed in the same manner, by first laying on a ground of bees' wax; then drawing on this surface with the needle, as in etching on copper; then pour on it sulphuric acid and flour spar, or fluoric acid sprinkled on it. After remaining on the glass for four or five hours, it may be taken off, and the work cleaned with oil of turpentine.

Engraving *on Precious Stones* is the representing of figures or devices, in relief, or indented, on various kinds of hard polished stones.

This art is at least as ancient as the time of Moses. From the Book of Exodus (xxviii. 9) we learn that he was commanded to take two onyx stones and engrave on them the names of the children of Israel, according to their birth, with the work of an engraver on stone, like the engravings of a signet. From this passage we may conclude that the Israelites had acquired a knowledge of the practice of gem and seal engraving, as well as of other arts, during their captivity in Egypt.

In the Book of Exodus (xxxv. 32) we learn that Bezaleel, the son of Uri, "had knowledge in all manner of workmanship, to devise curious works in gold, and in silver, and in brass, and in the cutting of stones to set them; and with him was Ahobab, an engraver and a cunning workman."

The art of engraving on precious stones is one of those in which the ancients excelled; there being various antique agates, cornelians, and onyxes, which surpass anything of the kind which the moderns have produced. Pyrgoteles among the Greeks, and Dioscorides under the first emperors of Rome, are the most eminent engravers we read of. The former was so esteemed by Alexander, that he forbade anybody else to engrave his head; and Augustus's head, engraven by the latter, was deemed so beautiful that the succeeding emperors chose it for their seal. The extravagant passion of the Roman matrons for engraved gems was satirized by Juvenal, and Pliny remarks that they "loaded their fingers with princely fortunes;" but these costly ornaments were not limited to the person;—this extravagance gradually extended to the wearing apparel of both sexes, and to other articles, and the dress of the wealthy Romans sometimes absolutely glittered with engraved gems.

All the polite arts having been buried under the ruins of the Roman empire, that of engraving on stones met with the same fate. It was retrieved in Italy at the beginning of the fifteenth century, when one John of Florence, and after him Dominic of Milan, performed works of this kind no way to be despised. From that time sculptures of this kind became common enough in Europe, and particularly in Germany, whence great numbers were sent into other countries; but they fell far short of the beauty of those of the ancients, especially those executed on precious stones; for, as to those on crystal, the Germans, and after them the French, &c., have succeeded well enough.

In this branch of engraving artists make use either of the diamond or of emery.

The diamond, which is the hardest of all stones, is only cut by itself, or with its own matter. The first thing to be done in this branch of engraving is, to cement two rough diamonds to the ends of two sticks large enough to hold them steady in the hand, and to rub or grind them against each other till they be brought to the form desired. The dust or powder which is rubbed off serves afterwards to polish them; and this is performed with a kind of mill that turns a wheel of soft iron. The diamond is fixed in a brass dish, and, being thus applied to the wheel, it is covered with diamond dust, mixed with oil of olives; and when the diamond is to be cut facet-wise, first one face, and then another, is applied to the wheel. Rubies, sapphires, and topazes, are cut and formed in the same way on a copper wheel, and polished with tripoli diluted in water. As to agates, amethysts, emeralds, hyacinths, garnets, rubies, and others of the softer stones, they are cut on a leaden wheel, moistened with emery and water, and polished with tripoli on a pewter wheel. Lapis-lazuli, opal, and some others, are polished on a wooden wheel. To fashion and engrave vases of agate, crystal, lapis-lazuli, or the like, a kind of lathe, like that used by pewterers, is made use of to hold the vessels, which are to be wrought with proper tools. That of the engraver generally holds the tools, which are turned by a wheel; and the vessel is held to them to be cut and engraved, either in relief or otherwise—the tools being moistened from time to time with diamond dust and oil, or at least emery and water. To engrave figures or devices on any of these stones when polished, such as medals, seals, and the like, a little iron wheel is used, the ends of whose axis are received within two pieces of iron, placed upright, as in the turner's lathe, and so adjusted as to be brought closer, or set further apart, at pleasure. At one end of the axis are fitted the proper tools, which are kept tight by a screw. Lastly, the wheel is turned by the foot, and the stone applied by the hand to the tool.

The tools are generally of iron, and sometimes of brass. They vary in form, but generally bear some resemblance to chisels, gouges, and the like. Some have small round heads like buttons; others are like ferrels, to take the pieces out; and others again are flat. When the stone has been engraved, it is polished on a hair brush-wheel with tripoli.

For engraving on stone, see Lithography. (w. h. l.)

ENGOULEE, in *Heraldry*, a term applied to crosses, saltires, &c., when their extremities enter the mouths of beasts, as lions, leopards, &c.

ENGRAINED, in *Dyeing*, dyed in the raw material.

ENGUERA, a town of Spain, province of Valencia, and 32 miles S.S.W. of the town of that name. Pop. 5244.

ENHARMONIC. See Music, §§ *Harmony* and *Modulation.*

ENIGMA. See Ænigma.

ENIPEUS, now the Fersaliti, a river of Thessaly, rising in Mount Othrys, and which, after uniting its waters with those of the Apidanus, falls into the Peneus. There is also a small river of this name in Macedonia, and another in Elis.

ENKHUYZEN, a fortified town of Holland, province of North Holland, on the Zuyder Zee, 28 miles N.N.E. of Amsterdam. The harbour, which was formerly very commodious, is now, from the accumulation of sand, all but useless. It has, however, extensive herring fisheries, and some trade in cheese, fish, salt, timber, &c. Pop. 6000.

ENLISTMENT, in British naval and military affairs, denotes a voluntary engagement to serve as a private soldier or sailor. The term of service in the army may be either indefinite, as during the continuance of a war, or for a fixed period; which period varies in the different classes of troops. In the infantry, this period cannot exceed ten years; in the cavalry, artillery, or other ordnance corps, twelve years; and in the East India Company's service it may be either indefinite, or for twelve years. In each case, if the recruit be under eighteen years of age, his term of service is to be reckoned from the day of his attaining that age. The term of enlistment in the marine forces is limited to twelve years. (See acts 10th and 11th Vict., cap. 39.)

In the British navy, according to an act passed in 1835, a man is allowed to enlist for a period not exceeding five

years; and on the expiration of that term he is entitled to his discharge, under certain restrictions, if he should desire to quit the service.

ENMANCHE (Fr. *manche, a sleeve*), in *Heraldry*, an epithet used when lines are drawn from the centre of the upper edge of the chief to the sides, to about half the breadth of the chief, as if it had sleeves upon it.

ENNEAGON, in *Geometry*, a polygon with nine sides.

ENNEATICAL (ἐννέα, *nine*), relating to the ninth of anything; as the enneatical days (or every ninth day) of a disease.

ENNIS, a municipal and parliamentary borough and market-town of Ireland, capital of the county of Clare, situated on the Fergus, here crossed by 4 bridges. Distance from Limerick, 20 miles W.N.W. The town is meanly and irregularly built. The principal edifices are the parish church, a Roman Catholic chapel, used as the cathedral for the diocese of Killaloe, a Methodist meeting-house, an endowed and two national schools, county court-house, fever hospital, infirmary, gaol, workhouse, and market-house. At a short distance from the town is Ennis College, founded by Erasmus Smith. Ennis has a considerable trade in grain, flour, and other commodities, which are conveyed in lighters for shipment to Clare, 3 miles lower down the river. There are extensive flour mills in the town. Market-day, Saturday. Races are held annually in the neighbourhood. A railway is in course of construction between this town and Limerick. Ennis returns a member to parliament. Electors (1851) 143. Pop. (1851), in town 7800; in workhouse 3542; gaol 727; infirmary 96.

ENNISCORTHY, a market-town of Ireland, county of Wexford, and 13 miles N.N.W. of the town of that name. The town, which is situated on the declivities of steep hills, on both sides of the river Slaney, is well built and thriving. The chief public buildings are the parish church, Roman Catholic chapel, convent, Methodist and Quaker meeting-houses, court-house, market-house, hospital, bridewell, and an old castle. It is a place of considerable trade; and two extensive quays have been constructed along the river. There are tanneries, breweries, flour-mills, a distillery, rope-walk, and an earthenware manufactory. Market-days, Thursday and Saturday. Pop. (1851) 7735. In the vicinity of the town is Vinegar Hill.

ENNISKILLEN, a municipal and parliamentary borough and market-town of Ireland, capital of the county of Fermanagh. It is situated on an island in the strait or river which connects the upper and lower lakes of Lough Erne, 102 miles N.W. from Dublin. The town occupies the whole island, and is connected with two suburbs on the mainland on each side by two bridges. The chief public buildings are the parish church, a Roman Catholic chapel, Presbyterian and Methodist meeting-houses, county court-house, prison, infirmary, town-hall, Royal School founded by Charles I. and richly endowed, three national schools, union workhouse, and three barracks. It has also a brewery, two tanneries, and a small manufactory of cutlery; and a considerable trade in cattle, timber, coal, provisions, and linen. Market-days, Tuesday and Thursday. Enniskillen distinguished itself during the war of 1689 by its attachment to the liberal side, and by its resisting and defeating a superior force sent against it by James II. Part of the brave defenders of the town were subsequently formed into a regiment of cavalry, which still retains the name of the Enniskillen Dragoons. Pop. (1851) 5998. It returns a member to parliament. Registered electors (1851) 172.

ENNISTYMON, a market-town of Ireland, county of Clare, on a small river of the same name, near its mouth in Liscanor bay, 14 miles W. by N. of Ennis. Pop. (1851) 1729, exclusive of 1070 in workhouse and 12 in bridewell.

ENNIUS, Q., a celebrated Roman poet, born at Rudiæ in Calabria, B.C. 239. Of his early life nothing is known, save a tradition that he entered the Roman army and rose to the rank of centurion. In the thirty-eighth year of his age he went to Rome under the protection of Cato; but he left it shortly afterwards, and served in the Greek campaigns under M. Fulvius Nobilior. Through the son of this commander, Ennius, when far advanced in years, obtained the rights of citizenship, at that time the greatest honour for which an alien could look in the Roman commonwealth. During the wars with Greece he made himself thoroughly master of the language and literature of that country; and on his return to Rome he formed the bold design of modelling the Latin language on the basis of the Greek, especially in so far as the metres of the latter tongue were capable of being adapted to the genius of the former. The success with which he worked out this idea, and his general reputation as a man of learning (for he spoke no fewer than three different languages—a very rare accomplishment in those days), gained for him the respect even of the haughtiest patrician families whose children he instructed. With the Scipios, in particular, he lived on terms of the greatest intimacy; and when at length he died in the seventieth year of his age (B.C. 169), he was buried in the tomb of that illustrious family.

The works of Ennius have long since perished; though at what date cannot be exactly determined. A. G. Cramer believes them to have existed entire so late as the thirteenth century, though there are good reasons for doubting the correctness of this statement. Such portions of his works as are quoted by Cicero and other ancient writers, though they amount in all to some hundreds of lines, are yet so fragmentary and unconnected that it is impossible to form from them any estimate of the works from which they are extracted. Some few of these quotations are in themselves complete and perfect pictures, often of much originality and force, such as that preserved by Aulus Gellius, in which the duties of a client to a patron are set forth. Though we cannot now judge for ourselves of Ennius's merits as a poet, yet if the testimony of the most competent judge among his own countrymen be believed, he possessed no mean claims to the title of the Roman Homer. As in the case of the Grecian bard, there arose a race of men who earned a livelihood by reciting his martial strains to the rural population in the Roman provinces, and even to the more refined audiences of the metropolis. It is no mean attestation to the genuine worth of Ennius's lays that they suited the tastes of every grade of Roman society, and retained their popularity unimpaired till the days of the empire. Cicero more than once speaks of Ennius as the greatest of Roman poets; and Virgil not only praised him, but borrowed from him some of the finest thoughts which adorn the *Æneid*.

The service which Ennius rendered to the Latin as a national tongue we have already alluded to. The benefits which he conferred upon it are analogous both in kind and in degree to those which Chaucer conferred upon the English tongue. Before his time the Romans could hardly be said to possess a regularly constructed language, or any literature beyond the rude ballads which they received by oral tradition from their ancestors. He left them both a language and the basis of an independent and national literature.

In the fragments of his works which have survived to our day we observe traces of the most intense nationality. They all breathe a high spirit of independence, and display loftiness and vigour of thought, and an energy of expression such as none of the later poets of Rome ever attained, and which amply compensate the trouble of mastering the archaic forms in which he delighted. The reader who will not allow himself to be repelled by the apparent clumsiness or even coarseness of this antique phraseology, will probably admit that after all they are better adapted for expressing that style of thought which Ennius cultivated than the more refined dialect of a later era.

The most important of his works was his *Annalium Libri XVIII.*; an epic poem in which was related the history of Rome, with all its mythological and fabulous incrustations, from the era of Mars and Rhea till the end of the second Punic war. Next in importance were his plays, which were for the most part translated or adapted from the Greek, the original metres being preserved. Of his tragedies, the titles and fragments of twenty-six have been preserved. Similar remains of four comedies have come down to us. His satires, which may rank third in importance, were written in four or six books, and in a great variety of metres. His other works are very miscellaneous in their character. These are—*Scipio*, a panegyric upon the elder Africanus; *Epicharmus*, a didactic poem, which, from some fragments which have descended to us, may be conjectured to have borne a strong resemblance to Lucretius's great work; *Phagetica*, a treatise upon edible fishes, believed to be a translation from Archestratus; *Epigrams*, of which only two upon Scipio now remain; *Protreptica*, a work on practical ethics, but whether prose or poetical, cannot now be decided. The first edition of the poetical fragments of Ennius appeared at Paris in 1564, from the press of the Stephenses; but a much more complete and correct edition appeared at Naples about the close of the same century, under the care of Jerome Colonna, which was reprinted with the notes of Voss and Delrio at Amsterdam in 1707. This must still be regarded as the best edition of Ennius.

ENOCH, one of the antediluvian patriarchs, son of Jared, and father of Methuselah. After a life of 365 years spent in walking with God, he was miraculously translated into heaven. The apocryphal book bearing his name was composed originally in Chaldee or Hebrew, but both the original version and the Greek translation seem now irrecoverably lost. The loss of these has been partly supplied by the Ethiopic version, which Bruce brought home with him from Abyssinia, and which was translated into English by Dr Lawrence in 1821. From the chronological notes to be found in the book itself, Dr Davidson supposes it to have been written probably about B.C. 40: and, on this supposition, it throws considerable light on the Christology of the age preceding our Saviour's advent. Lücke and Stuart, however, suppose it to have been written by a Jew already instructed in Christianity. The language ascribed to Enoch in the Epistle of Jude, is to be found, with some variation, in this work.

ENOS, the ancient *Ænos*, a seaport-town of European Turkey, province of Rumili, sanjiac of Gallipoli, and 38 miles N.W. of the town of that name. It is situated on the S. side of the gulph of Enos, near the mouth of the Maritza, and is in fact the seaport of Adrianople. Its position is admirably adapted for trade; but a sandbank has been allowed to form at the mouth of the harbour, so that none but vessels of the smallest size can now enter, all others being obliged to load and unload outside the bank. Pop. of town about 7000. The gulf of Enos is 14 miles in length, by 5 in breadth.

ENS (from *esse, to be*), in *Metaphysics*, entity, being, existence. This the schoolmen call *ens reale* and *ens positivum*, to distinguish it from their *ens rationis*, which exists but in the imagination.

ENS, a town in the Austrian province of the Upper Ens, situated on a steep bank, near the junction of the Ens with the Danube, 10 miles S.E. of Linz. It is surrounded by old walls, and has some manufactures of iron and steel. Pop. 3500. Ens was the headquarters of Napoleon in 1809.

ENS, or ENNS, a river of Austria, falling into the Danube. It forms the boundary between the two provinces of the Lower and Upper Ens, commonly called Lower and Upper Austria, and constituting the Archduchy of Austria. See AUSTRIA.

ENSEELED, in *Falconry*, is said of a hawk that has her eyes closed by a thread drawn through her upper eye-lid and made fast under the beak.

ENSHAM, a village, formerly a market-town of England, county of Oxford, on the Isis, 64 miles from London. It has two handsome stone bridges over the Isis, a fine Gothic church, a singular and very ancient tapering cross, and remains of an extensive abbey. Pop. of parish (1851) 1941.

ENSIGN, in the military art, a flag or banner under which soldiers are ranged according to the different companies or parties to which they belong.

The Turkish ensigns are horses' tails; those of the European nations generally are made of silk, and ornamented with divers figures, colours, arms, and devices. We learn from Xenophon that the ensign borne by the Persians was a golden eagle on a white ground: the Corinthian standard was the winged horse or Pegasus: the Athenians adopted the owl: the Messenians the Greek letter M: the Lacedæmonians the A. The Romans, at different times, had various ensigns, as the wolf, minotaur, horse, and boar; till at length they assumed the eagle, in the second year of the consulate of Marius. A military ensign on a medal of a Roman colony indicates a colony peopled with veterans.

ENSIGN is also the designation of the officer who carries the colours. He is the lowest commissioned officer in a company of infantry. See COMMISSION, *Military*.

Naval ENSIGN, a large standard or banner hoisted over the poop of a ship on a long pole called the *ensign staff*. It is used to distinguish ships of different nations, or to characterize the different squadrons of the same navy. The British ensign in ships of war is known by a double cross, viz. that of St George and St Andrew, formed upon a field which is either red, white, or blue.

ENT, SIR GEORGE (1604–1689), an English physician, born at Sandwich in Kent. He received his medical degree at Padua; was afterwards president of the college of physicians in London; and received the honour of knighthood from Charles II. His principal work is a defence of his friend Harvey, entitled *Apologia pro Circulatione Sanguinis, contra Æmilium Parisanum.*

ENTABLATURE, in *Architecture*, that part of an order which rests upon the abaci of the columns. It is composed of the architrave, the frieze, and the cornice. See ARCHITECTURE, Plate LXII. fig. 1.

ENTAIL, an arrangement for adjusting or limiting the succession to landed property in a line of succession predetermined by the entailer. The term, though it is of frequent use in the legislature and the courts of justice, is rather colloquial than technical, being applicable in England and Ireland to the form of estate technically called a *Fee Tail*, and in Scotland to the destination technically called a *tailzie*. The word is of doubtful origin: some would derive it from the Latin *talis*, as being an indication of certain persons who are to succeed; but the most commonly received derivation is from the same root with the French *tailler*, to cut; and Spelman tells us, that a fee is called *talliatum* when certain faculties are cut away from it so that it can pass to no heirs save those springing from a particular body. Under the head of the Law of Entail it has been customary to treat the policy of restraints on the right to possess and dispose of landed property, in connection with history, politics, and political economy; and though the intricacies and niceties which have been adopted to carry out particular destinations, or to defeat them, are of considerable importance in the science of conveyancing, it is in connection with the policy of restraining or freeing the commerce in land that the subject of entails is chiefly interesting.

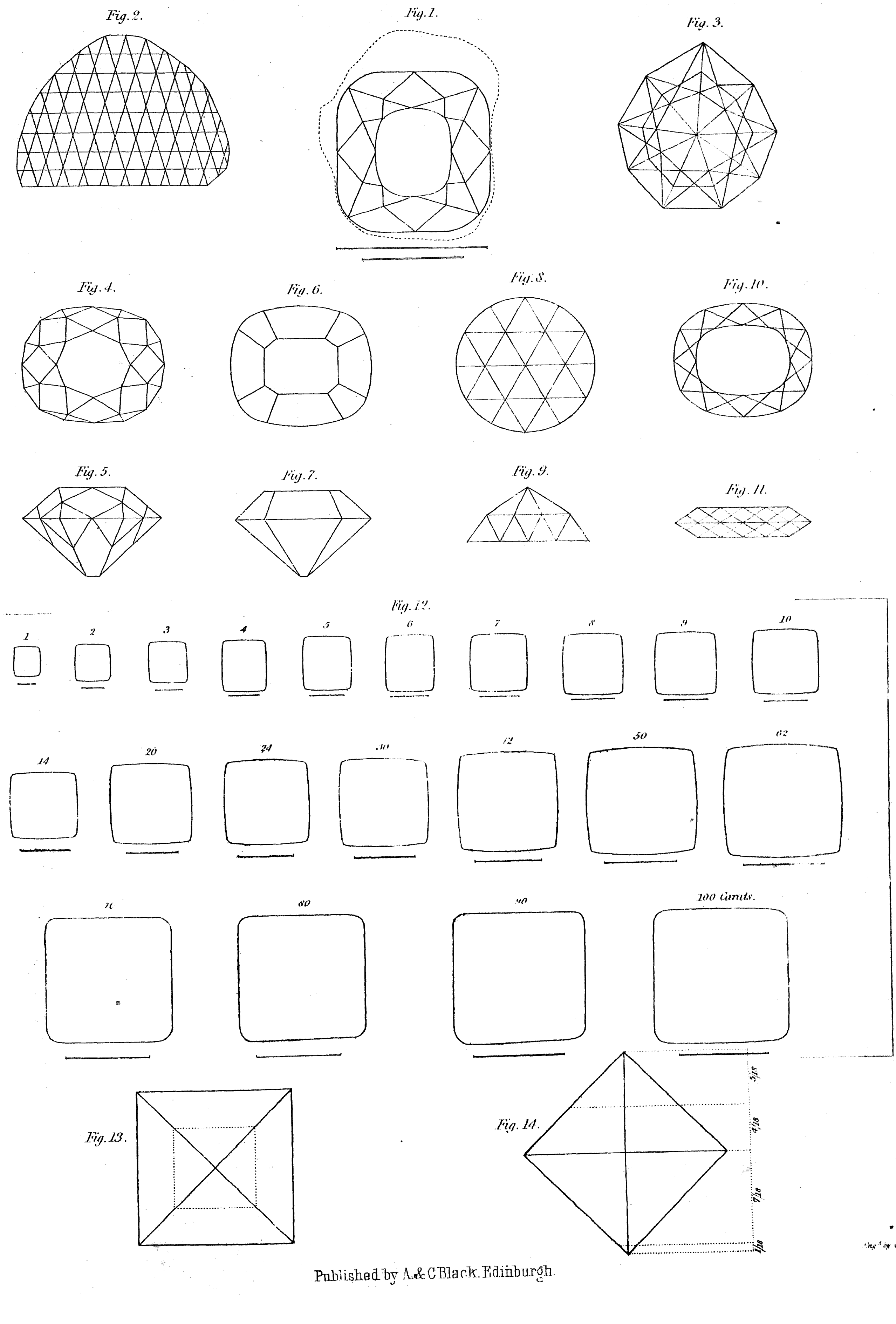
There has been a remarkable difference in the history of the entail system in England and Scotland, connected with the differing political progress of the two countries. It is said that from very early times the judges administering the common law in England were accustomed to aid in stripping

destinations of land of their conditions and limitations, by giving effect to fictitious sales by tenants in possession and reconveyances into their hands, which endowed them with fee-simple or unlimited ownership. The passing of the statute of Westminster, in 1285, is generally supposed to have been a remedy sought by the aristocracy against those practices of the common lawyers which they deemed an infringement of their territorial power. This statute is peculiar and argumentative in its phraseology, complaining that in certain enumerated cases "feofees had power to alien the land so given, and to disherit the issue of the land contrary to the minds of the givers, and contrary to the form expressed in the gift;" and it enacts, "that the will of the giver, according to the form in the deed of gift manifestly expressed, shall be from henceforth observed." Blackstone tells us, that during about two centuries when this statute was observed,—"Children grew disobedient when they knew they could not be set aside; farmers were evicted of their leases made by tenants in tail; for if such leases had been valid, then under colour of long leases the issue might have been virtually disinherited; creditors were defrauded of their debts; for if tenant in tail could have charged his estate with their payment, he might have also defeated his issue by mortgaging it for as much as it was worth; innumerable latent entails were produced to deprive purchasers of the lands they had fairly bought—of suits in consequence of which our ancient books are full; and treasons were encouraged—as estates-tail were not liable to forfeiture longer than for the tenant's life." (B. ii. chap. vii.) It is said to have been owing to the encouragement which, for this last reason, King Edward III. extended to a judicial remedy, that the judges in the celebrated case of Taltarum gave countenance to a new fiction for checking the course of entails. When it was brought into form, it was known by the name of *common recovery*. This was a judgment in a fictitious suit, in which the tenant of the estate was made defendant. In its simpler form the tenant or possessor appeared to the action, and called upon a fictitious person to vouch or warrant his title. That person's default was the break which judicially stopped the course of the entail, and other proceedings more or less complex, according to circumstances, restored the estate in fee-simple to the tenant. The form became a systematic but complex department of English conveyancing, until it was simplified in 1832, by the passing of the 3d and 4th Will. IV., c. 74, which substituted a deed enrolled for the fictitious process. A subsequent act, passed in 1838, facilitated the realization of entailed estates for the benefit of creditors. In Scotland, the history of the entail system is so far different, that it was there created and strengthened by the ingenuity of lawyers, who, as fast as their brethren discovered assailable points in the usual form of the deed, fortified it with new clauses. The simplest form of the deed was a mere nomination of a certain series of heirs, or direction to invest them,—this was easily defeated, and the "prohibitory clause" was inserted to prohibit the heir in possession from altering the destination. Still when he did alter it, it was but a precept disobeyed, and did not change the condition of the property; hence the claues "irritant" was introduced, by which the contravener forfeited his title. There was still a deficiency—the forfeiture might be incurred, yet no one had a right to come forward and enforce it by claiming the estate forfeited, and the form was completed by the introduction of the clause "resolutive," which devolved the forfeited estate on a claimant who might prosecute on the forfeiture as the true owner. Sir Thomas Hope, a lawyer famous in the religious disputes of the seventeenth century, has the reputation of being the inventor of these clauses, which were sanctioned in the year 1685, by a statute which reduced entails in Scotland to a systematic form. An entail scientifically and accurately constructed, not only deprived the heir in possession of all power to alter the line of succession, but protected the estate from his creditors, and transmitted it untouched to the next in succession. It precluded provision to widows and children; but measures were adopted for partially remedying this part of the evil effects.

During the eighteenth, and nearly the half of the nineteenth century, the practice of entailing crept like some great blighting disease over the soil of Scotland, not only perpetrating gross injustice to creditors, and creating great personal hardships by condemning to destitution the children of parents enjoying large estates, but checking the progress of agriculture, and interrupting the commerce in land. The practice of the law made a curious and faint protest against the progress of the system, by requiring that the terms of an entail were to be held *strictissimi juris;* that is, that the meaning of the clauses should never be sought for, or be explainable by even the simplest and most obvious process of interpretation, but that any defect, such for instance as a clerical error in the deed or the record by the omission of a word, should vitiate the entail.

The effects of the system were felt as sufficiently alarming by the public at large; but the great patrimonial interests involved in existing entails seemed to unite in their defence a body too formidable to be assailed, while the tract of country already subject to the influence of the restraints was so large as to render any remedy which was not capable of disentangling existing restrictions comparatively ineffective. In 1847, when the evil had reached its climax, the legal administration in Scotland was fortunately in the hands of Andrew Rutherfurd, then Lord Advocate, a man of very signal attainments, and among the greatest British lawyers —certainly the greatest Scottish lawyer of his age. Being engaged in a general plan for the simplification of the tenure and transference of landed property (see CONVEYANCING), he undertook the arduous task of an equitable adjustment of the entail question. The main objects were the protection of all interests founded on just expectations—a freedom to dispose of such well-founded interests at the option of the owners, for the purpose of disentangling property of the restraints of an entail, and general freedom to the holders under future entails to convert their limited holdings into property. For this object, the first of August 1848 was made the turning point. Persons then in existence, and holding under entails of prior date, were enabled to disentail them only by certain intimations and equitable consents. Persons unborn at that date had greater facilities, and entails made after the assigned date were placed at the virtual disposal of the heir in possession when of full age. The number of advertisements containing the statutory notices of disentails which followed this measure gave ample evidence of its success; and there is no doubt that it will greatly increase the productive value of land in Scotland, and promote the general prosperity of the country. (J. H. B.)

END OF VOLUME EIGHTH.



Published by A. & C. Black, Edinburgh.

DIVING.

PLATE CCIV.

Fig. 1.

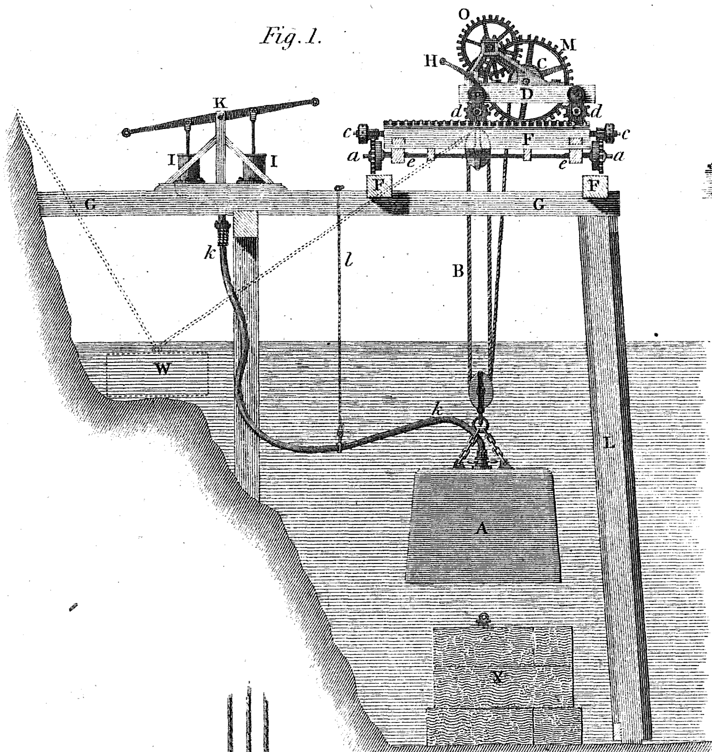
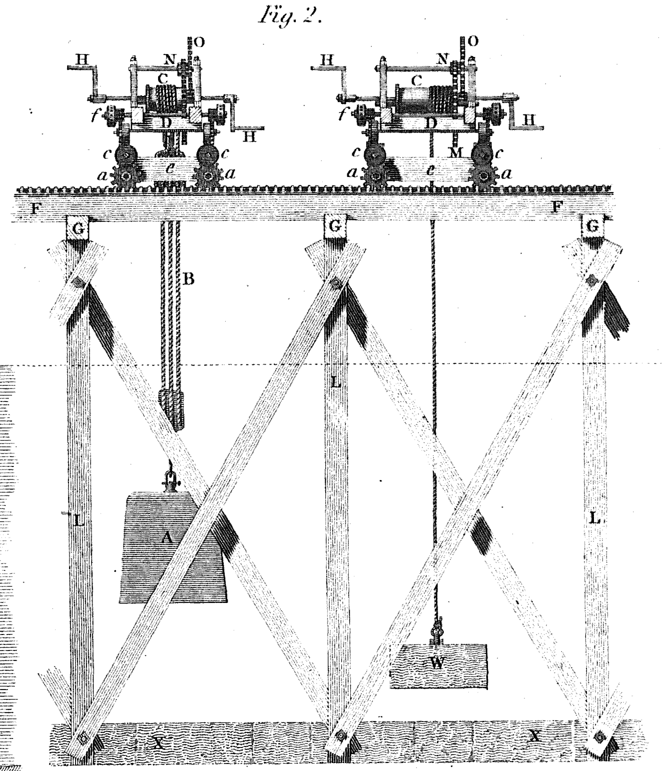


Fig. 2.



5 10 15 20 25 30 Feet.

Fig. 5.

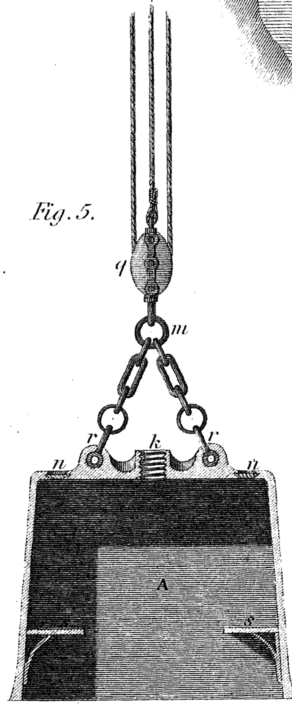
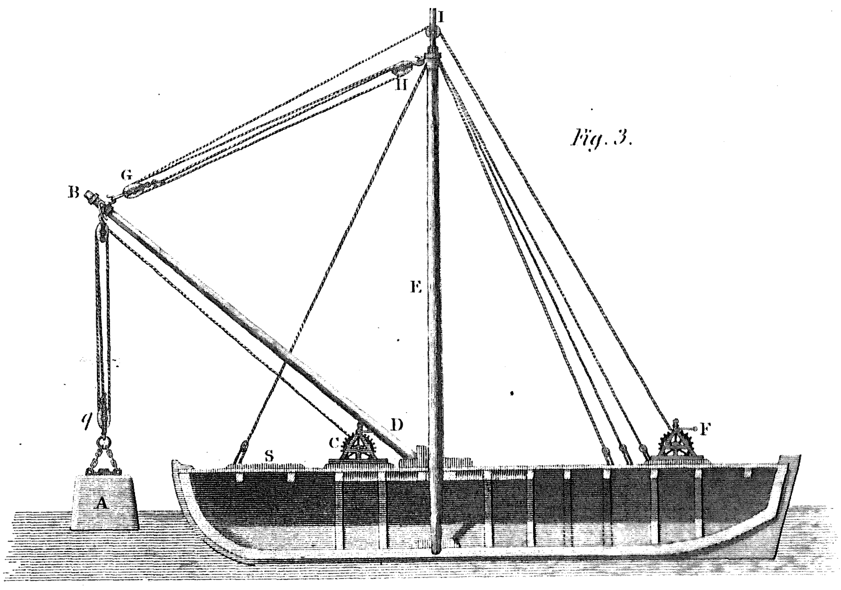


Fig. 3.



1 2 3 4 5 6 7 8 Feet

5 10 20 30 40 50 60 Feet.

Fig. 6.

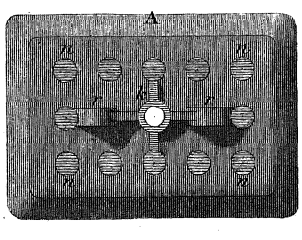
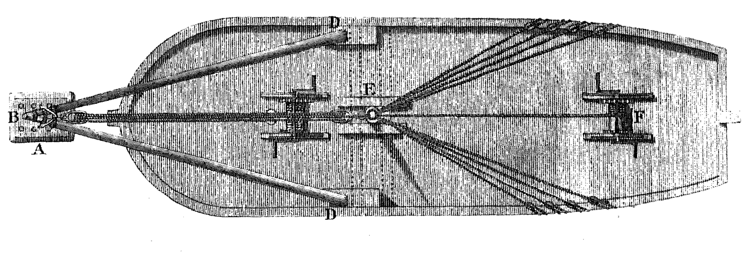


Fig. 4.



Drawn by J. Farey.

Published by A & C. Black, Edinburgh.

Eng^d by G. Aikman, Edin^r.

KLINGERT'S DIVING APPARATUS.

Fig. 1.

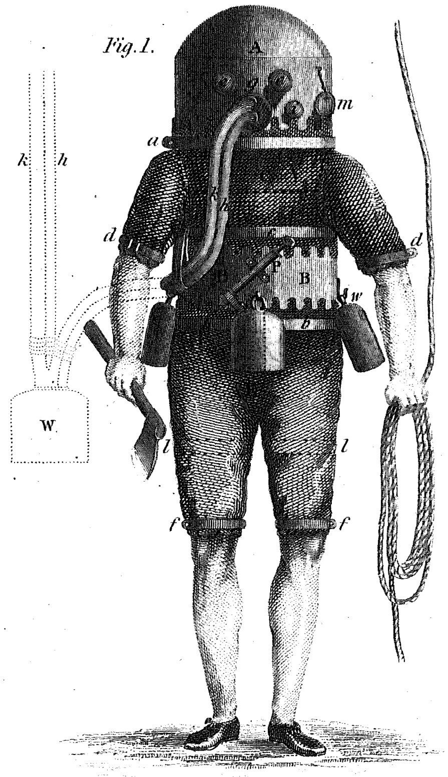
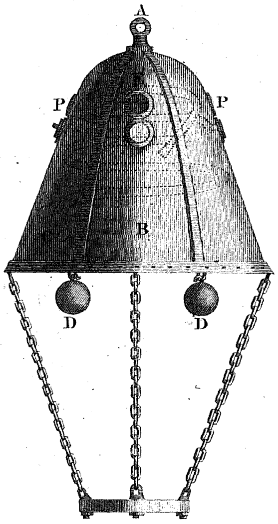


Fig. 6.

TRIEWALD'S DIVING BELL.



ROWE'S DIVING CHEST. Fig. 4.

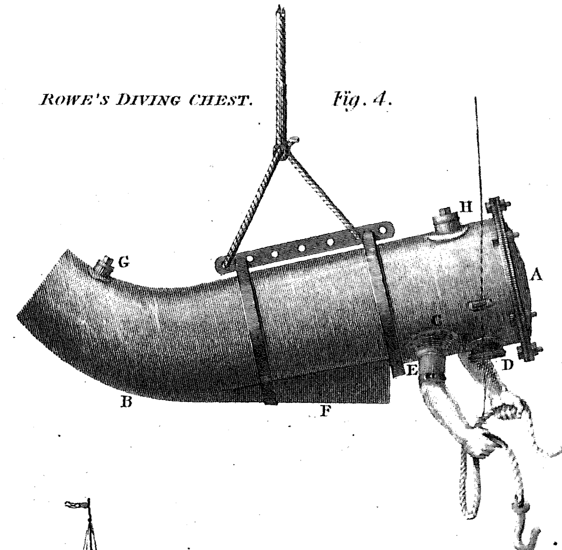


Fig. 2.

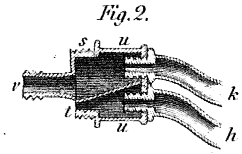
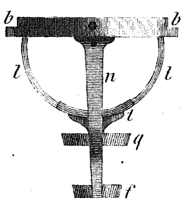
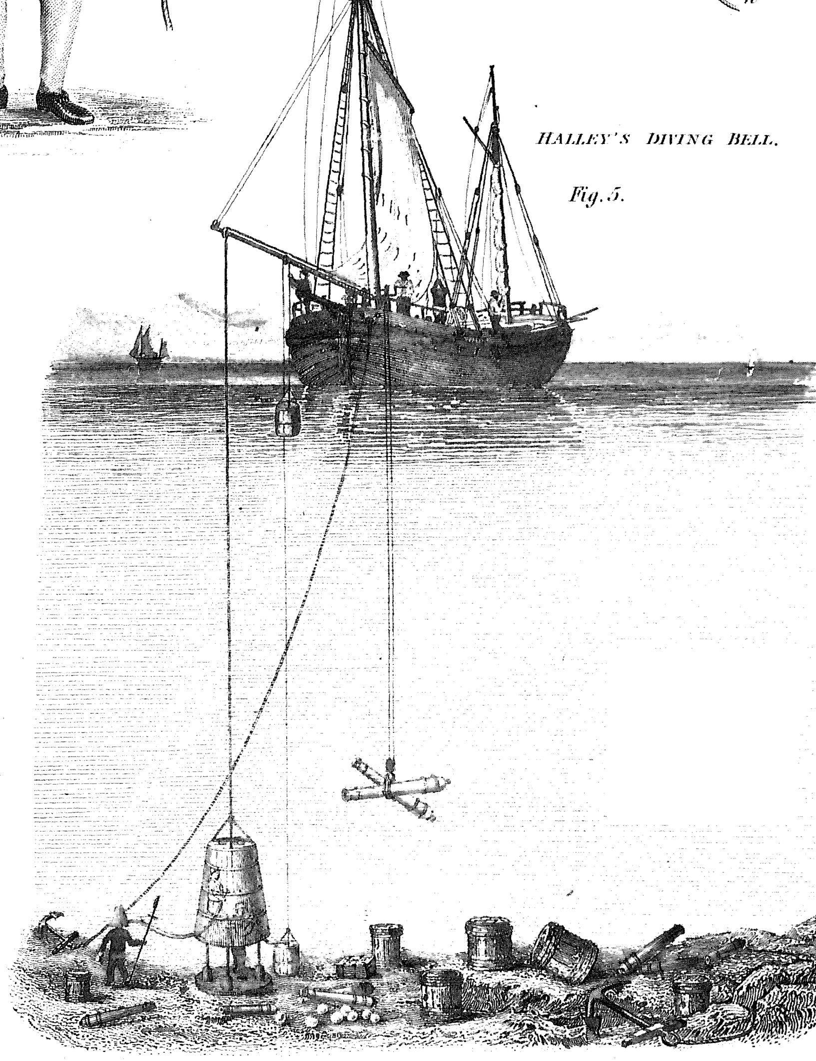


Fig. 3.

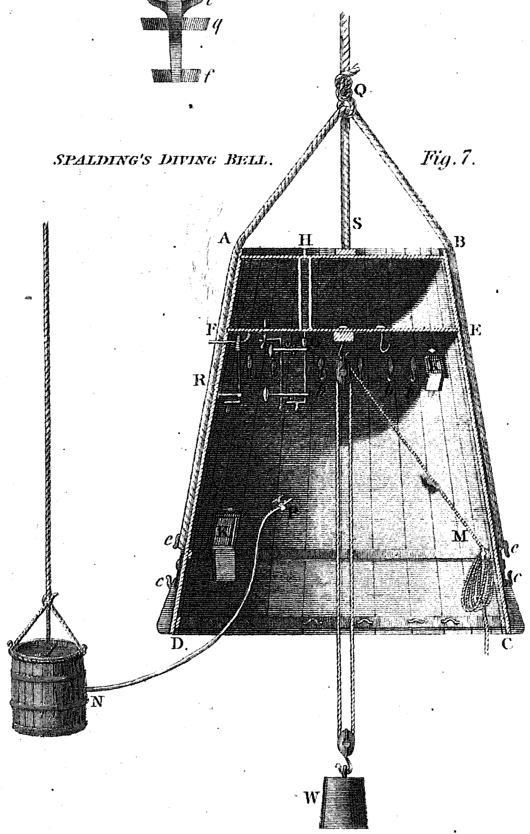


HALLEY'S DIVING BELL.

Fig. 5.



SPALDING'S DIVING BELL. Fig. 7.



Published by A & C. Black, Edinburgh.

Eng.d by G. Aikman, Edin.

Fig. 1.

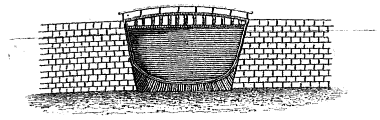
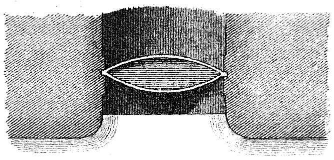
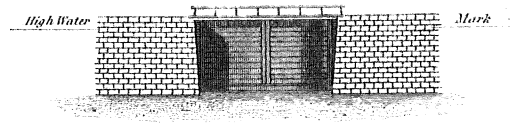


Fig. 2.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH A FLOATING DAM.

Fig. 3.



ELEVATION
OF THE ENTRANCE TO THE DOCK WITH SWINGING GATES.

Fig. 5.

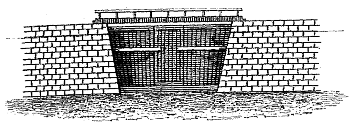
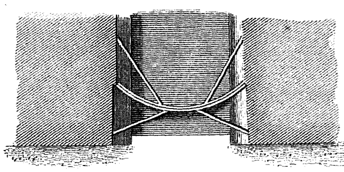
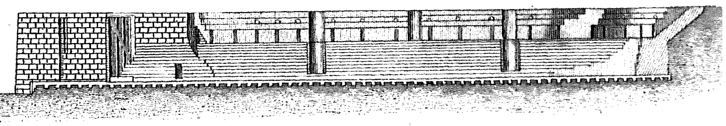


Fig. 6.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH WICKET GATES.

Fig. 4.



SECTIONAL ELEVATION OF THE DOCK.

Fig. 7.
PLAN OF A DOCK.

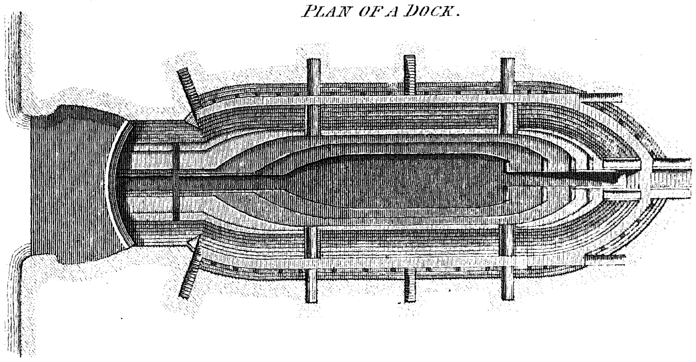


Fig. 8.

TRANSVERSE SECTION OF A ROOF OVER THE HEAD OF THE DOUBLE DOCK AT PLYMOUTH, ERECTED IN 1817. DESIGNED BY SIR R. SEPPINGS, SURVEYOR OF THE NAVY.

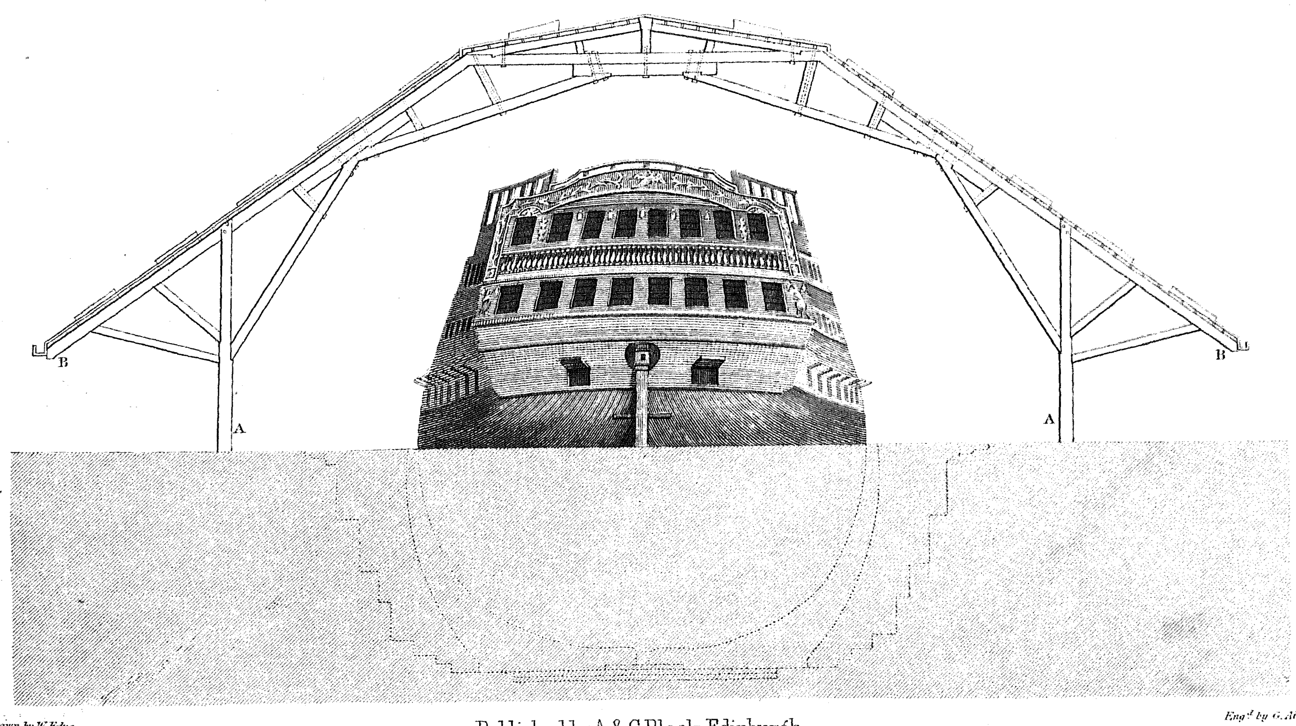


Fig. 8. Drawn by W. Edye.
Published by A & C Black, Edinburgh.
Engd by G. Aikman, Edin.

Fig. 1.

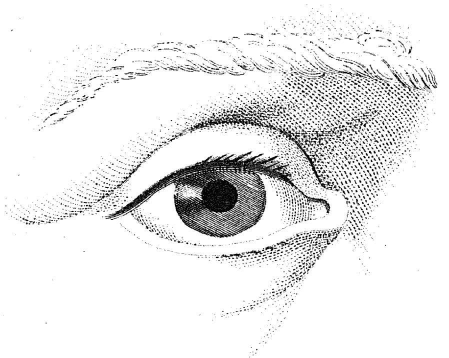


Fig. 2.

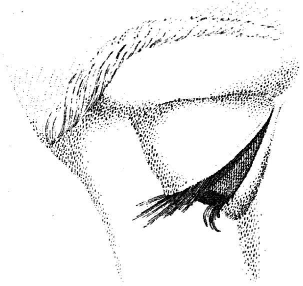


Fig. 3.

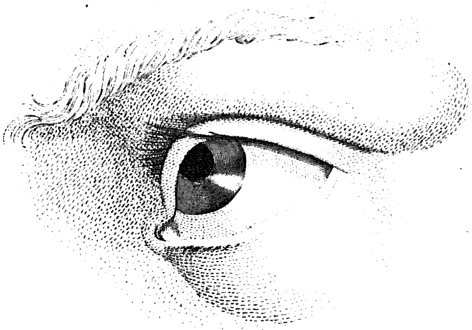


Fig. 4.

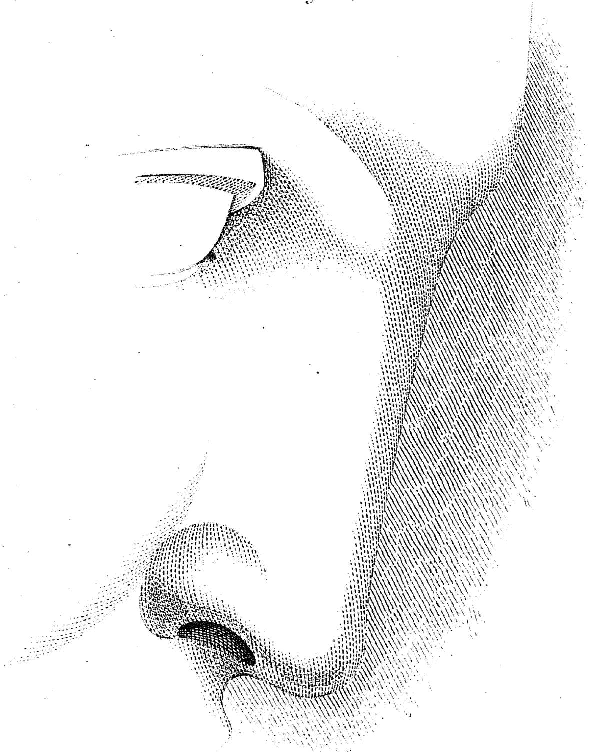


Fig. 5.

Fig. 6.

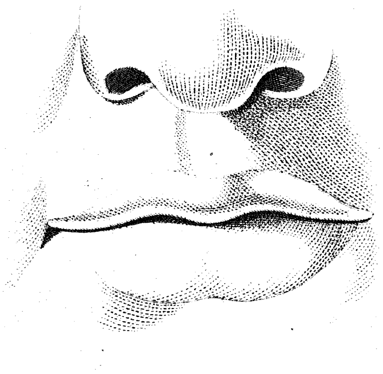


Fig. 7.

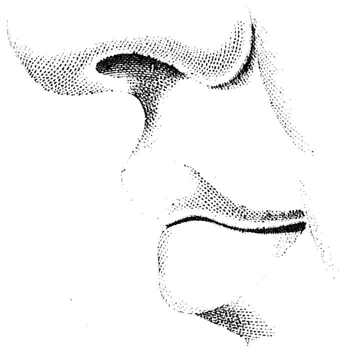
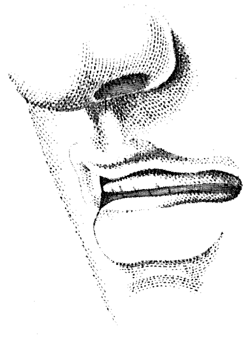


Fig. 8.



Eng^d by G. Aikman, Ed.

Published by A.&C. Black. Edinburgh.

Fig. 1.

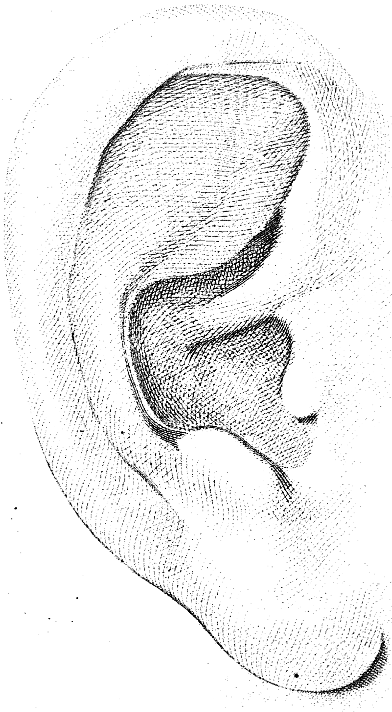


Fig. 3.

Fig. 2.

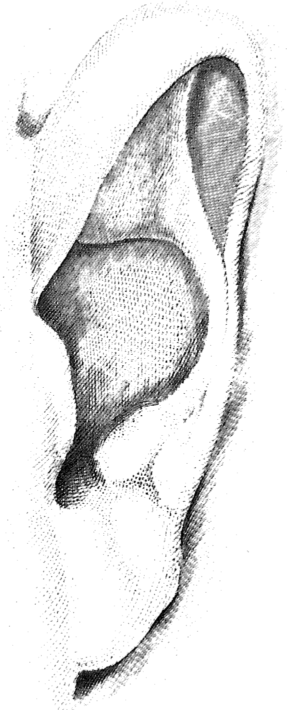


Fig. 4.

Fig. 5.

Published by A. & C. Black, Edinburgh.

Engd by G. Aikman.

Fig. 1.

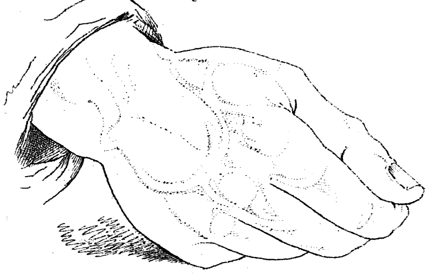


Fig. 2.

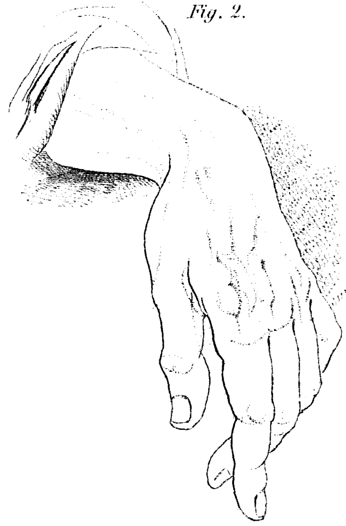


Fig. 3.

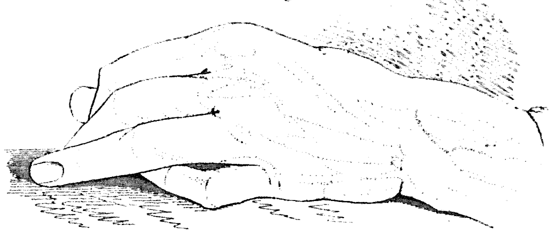


Fig. 4.

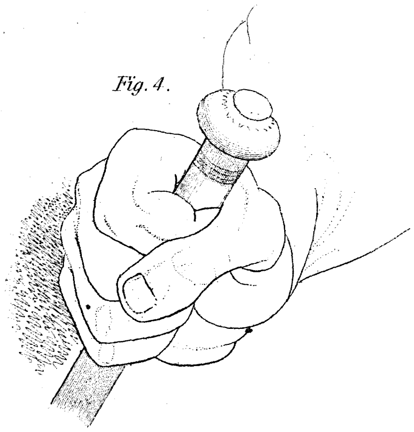


Fig. 6.

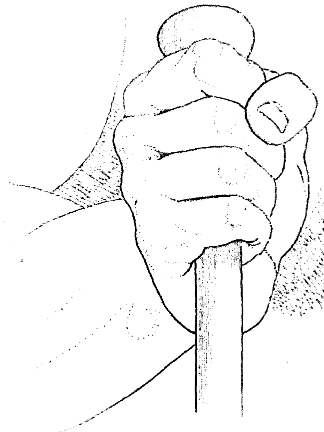


Fig. 5.

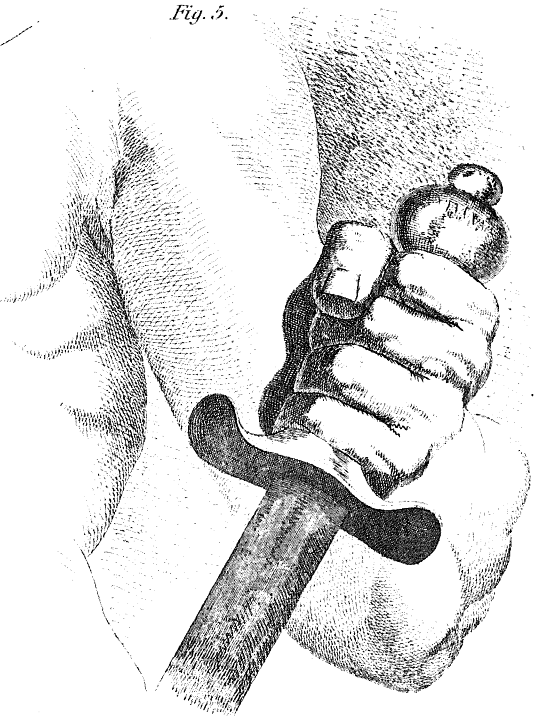


Fig. 7.

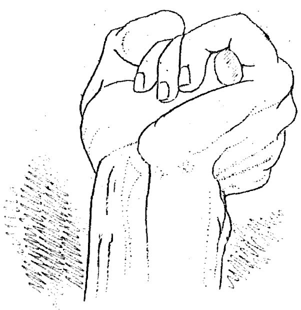


Fig. 8.

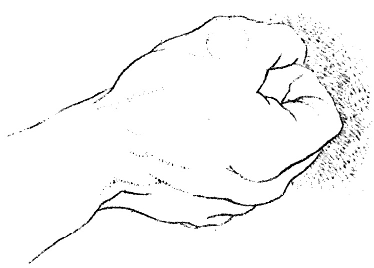


Fig. 9.

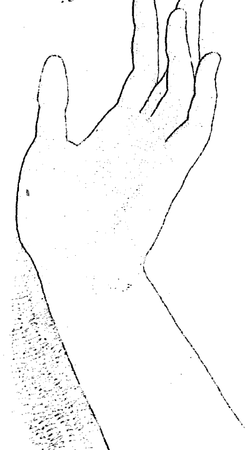


Fig. 10.

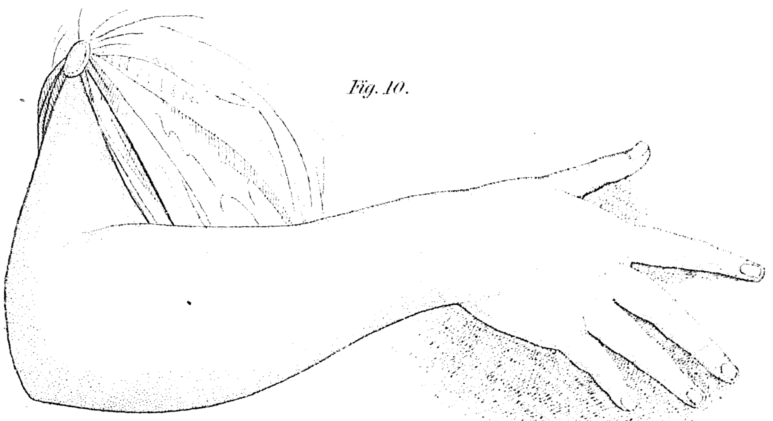


Fig. 11.

Published by A.&C. Black, Edinburgh.

Engd by G. Aikman, Edinr

Fig. 2.

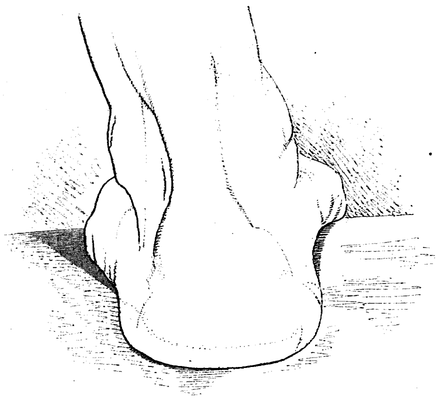


Fig. 1.

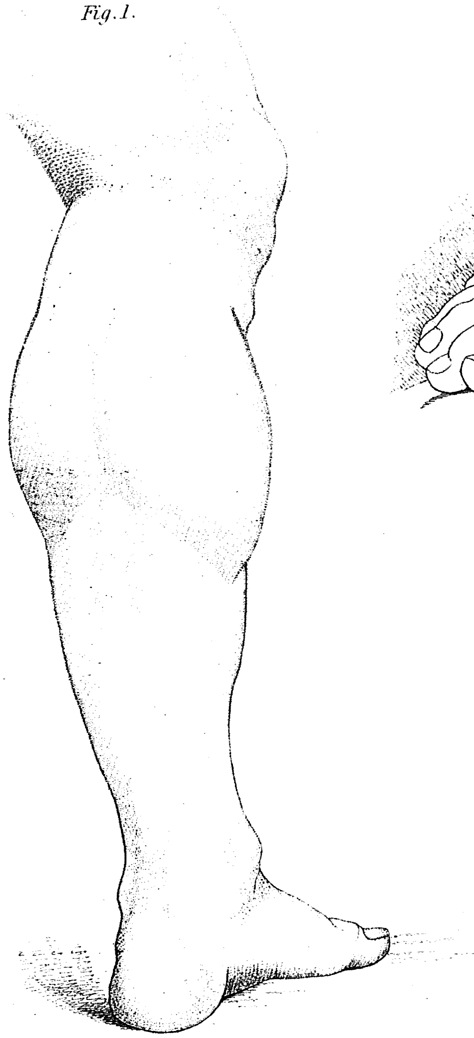


Fig. 3.

Fig. 5.

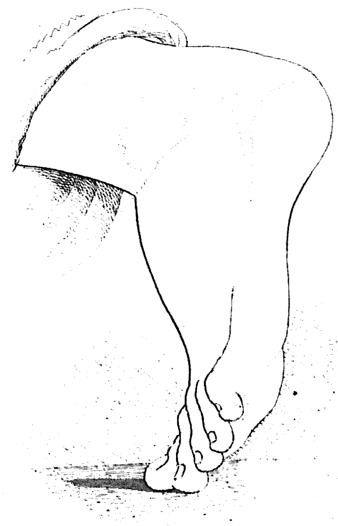


Fig. 4.

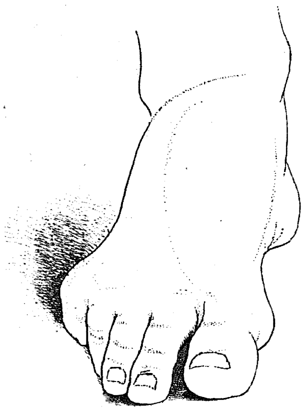


Fig. 6.

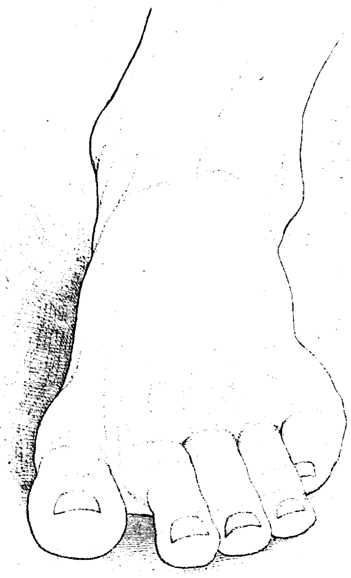
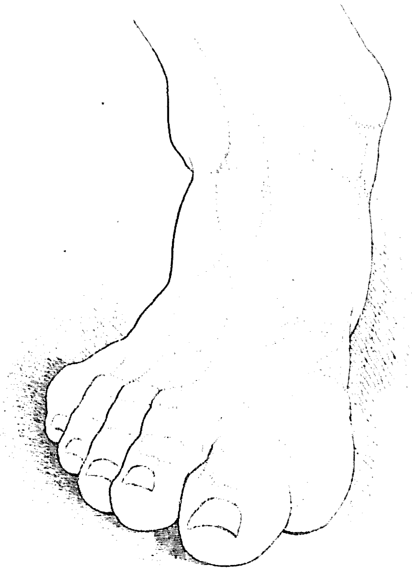


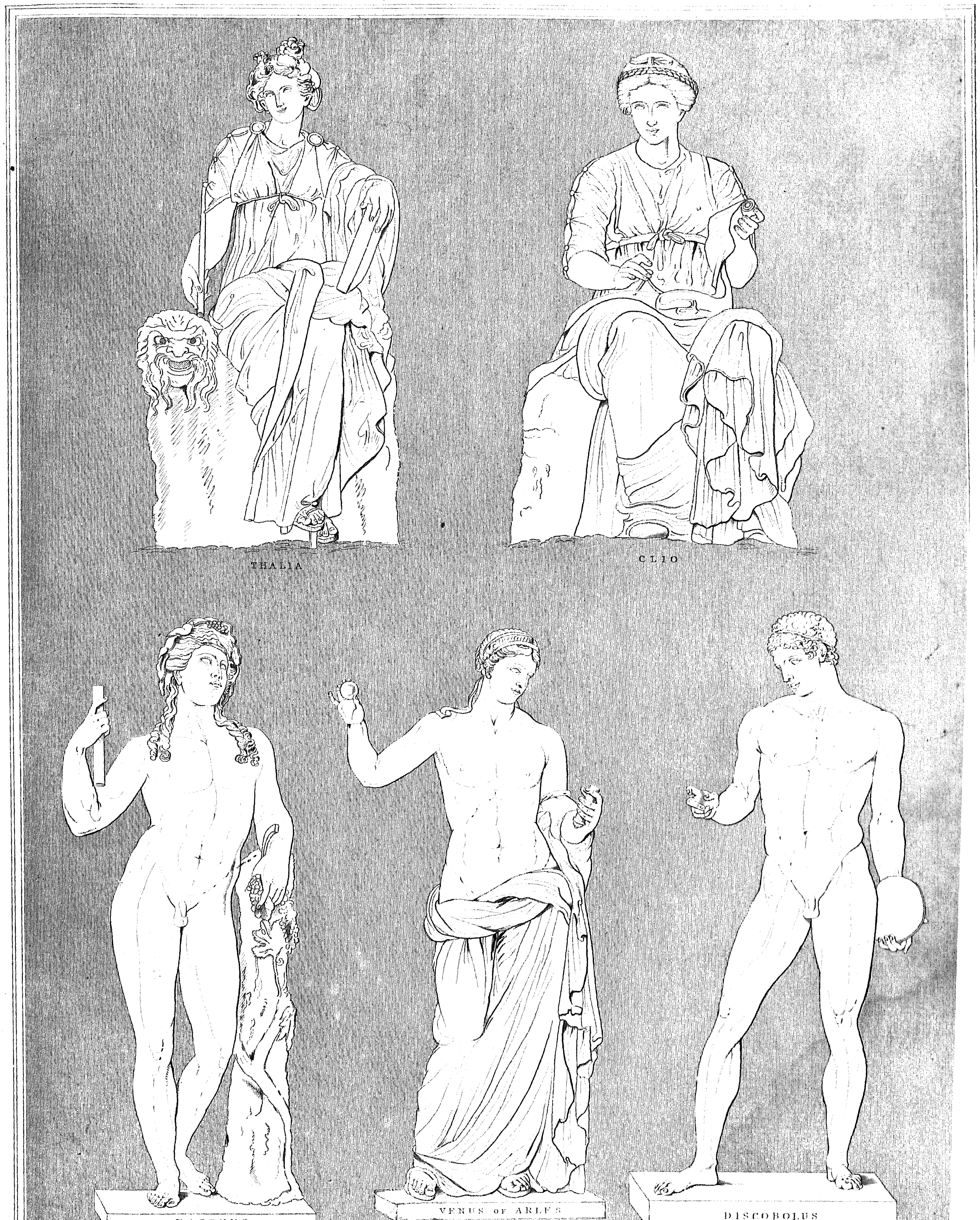
Fig. 7.

Fig. 8.

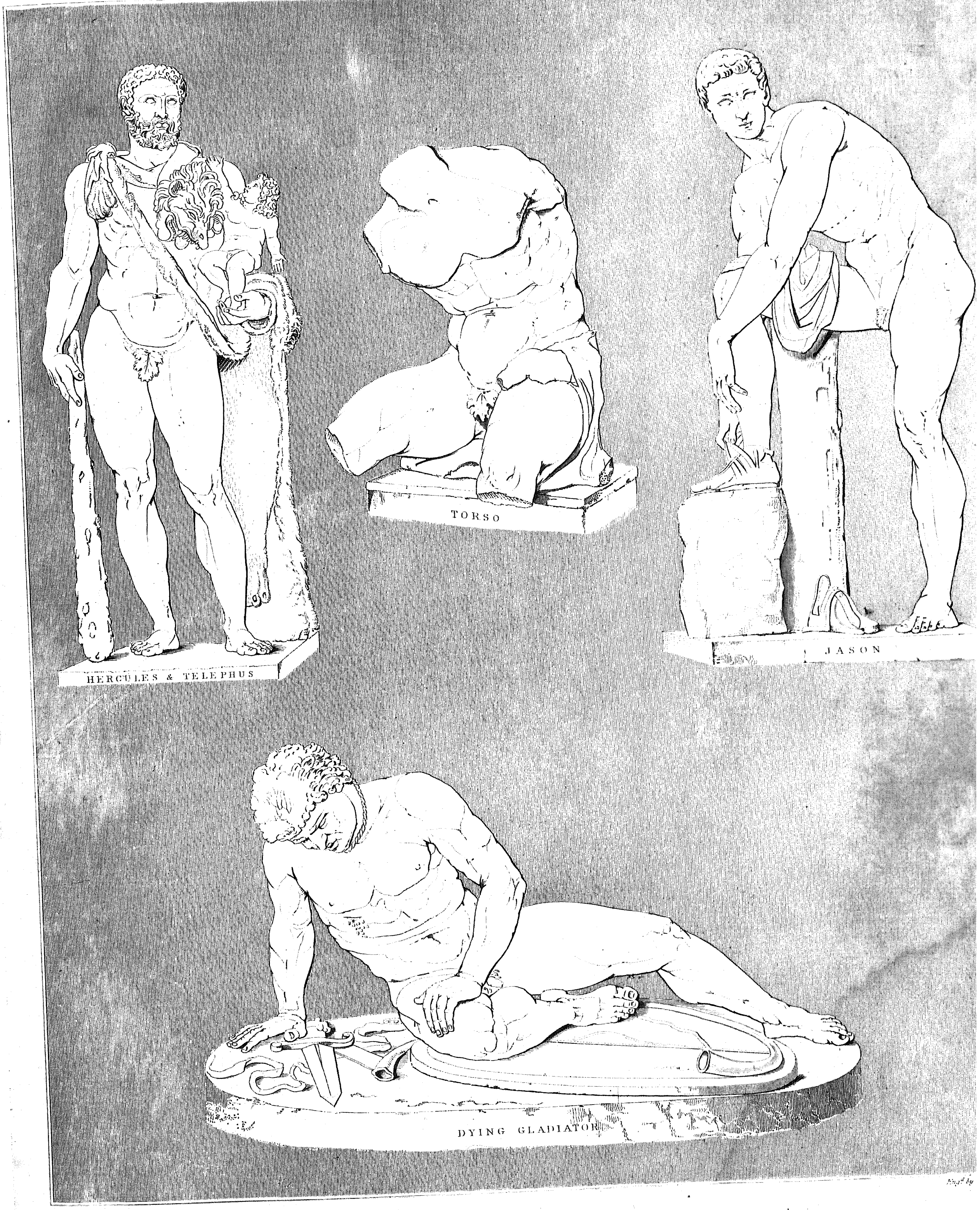


Published by A. & C. Black, Edinburgh.

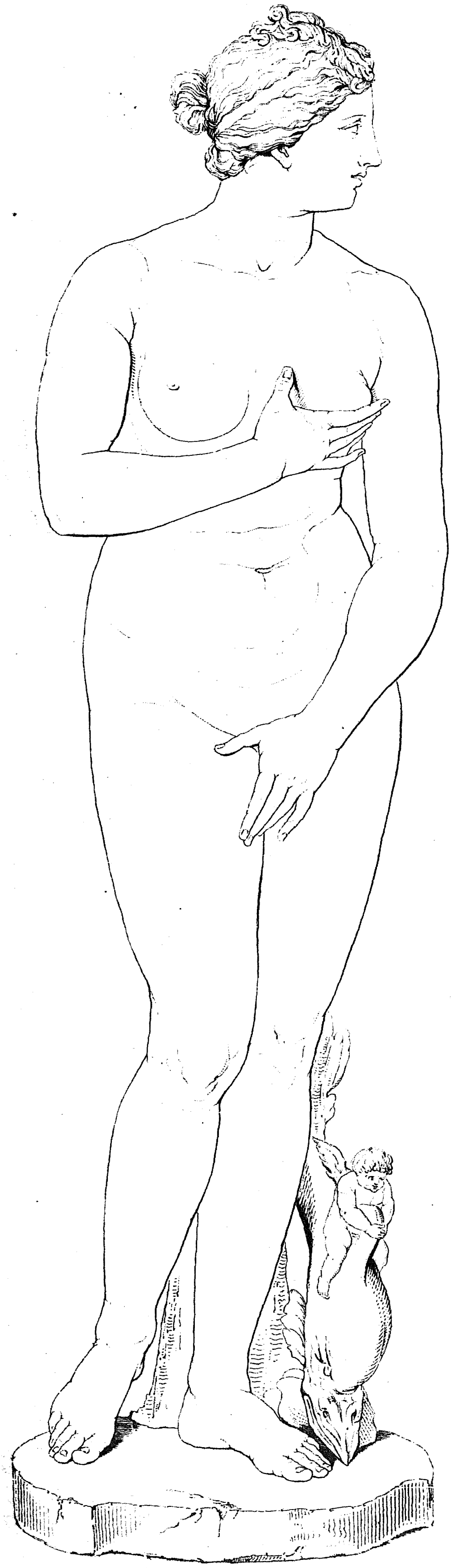
Engd by G. Aikman



Published by A.&C. Black, Edinburgh.



A & C Black Edinburgh



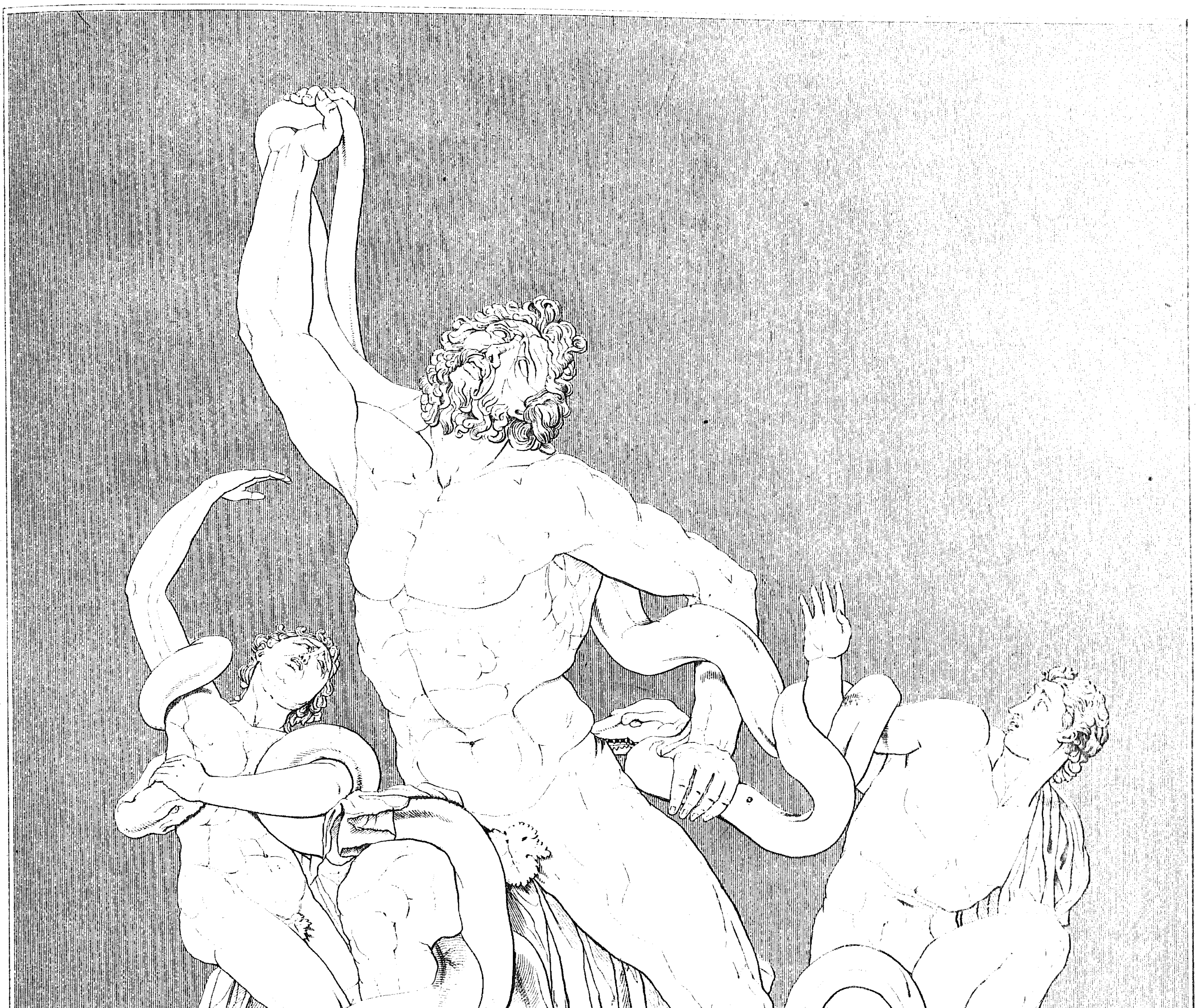
VENUS DE MEDICIS.

VENUS OF THE CAPITOL.

Engd by G. Aikman, Edin.

Published by A. & C. Black, Edinburgh.

Published by A. & C. Black, Edinburgh.



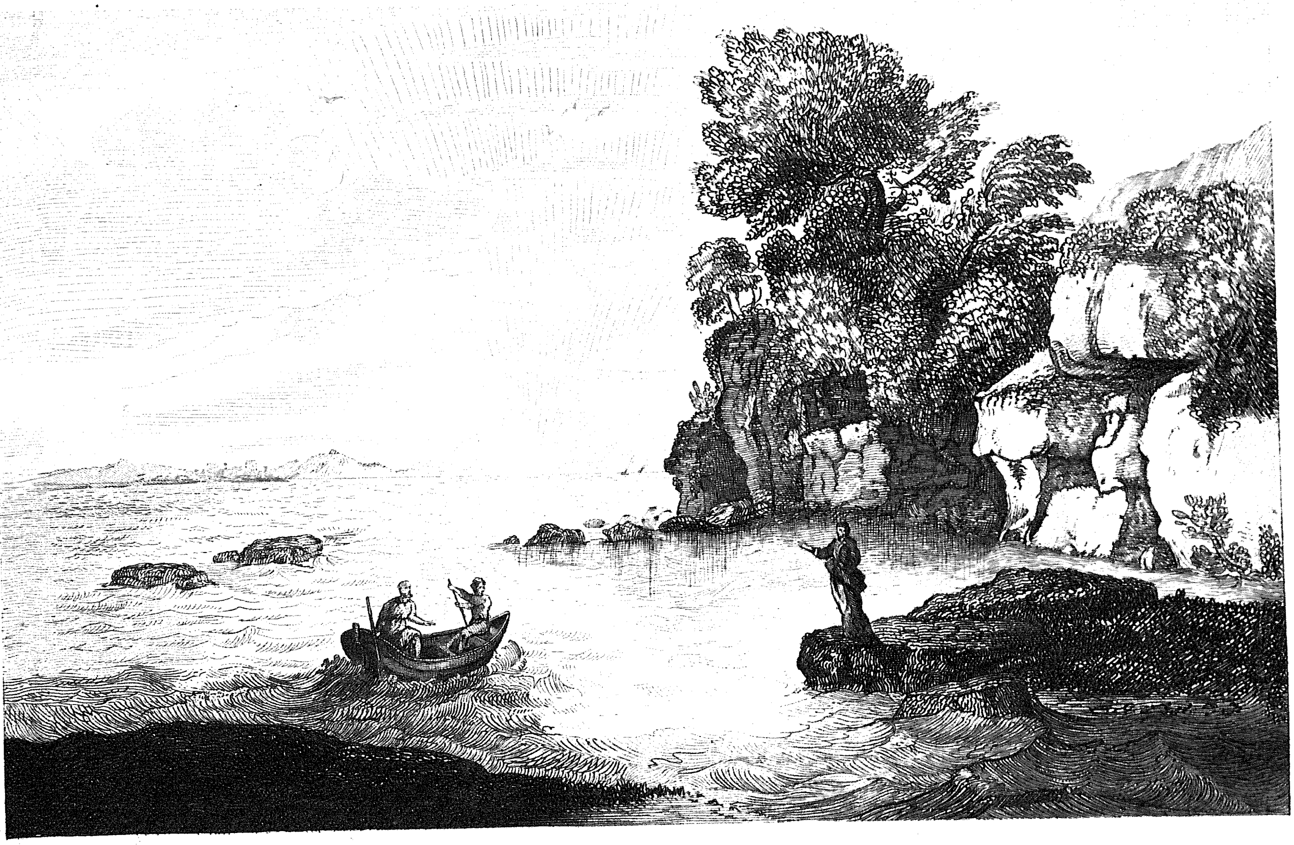
GROUP OF THE LAOCOON.

Eng^d by G. Aikman, Edin^r

Published by A & C. Black, Edinburgh.

Specimen of Sketching by Raphael.

SPECIMENS OF LANDSCAPE SKETCHING BY CLAUDE.



Eng^d by G. Aikman, Edin^r

Published by A.&C. Black, Edinburgh.

Fig. 1.

Drawn by R. Gibb, S.A. R.L.A.

Outline.

Fig. 2.

First Progression.

Fig. 3.

Second Progression.

Fig. 4.

Drawn by R. Gibb, S.A. R.L.A.

Engd by R. M. M. Lotte.

Finished Landscape.

Published by A. & C. Black, Edinburgh.

DYEING.

Fig. 1.
Section of Liquor Tub.

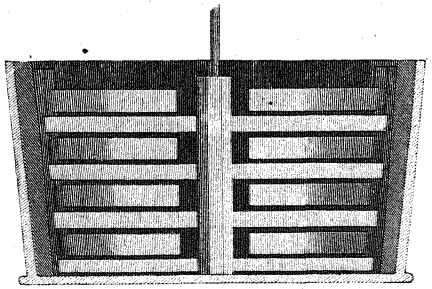


Fig. 3.
End Elevation of Padding Machine.

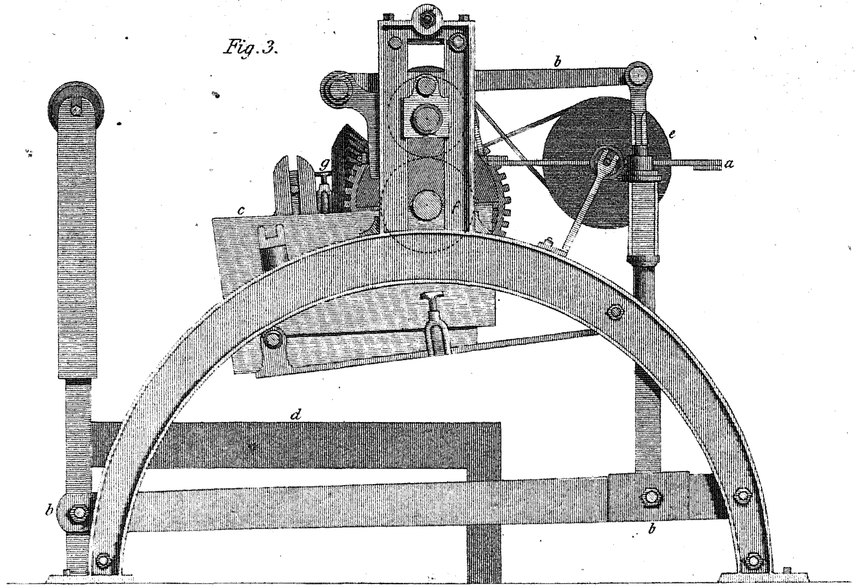


Fig. 2.
Plan of Liquor Tub.

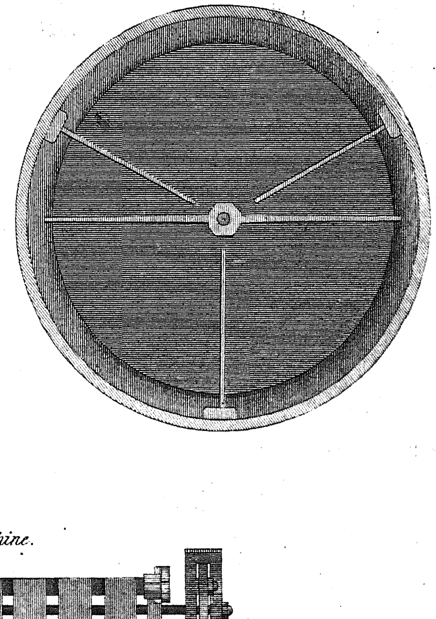


Fig. 4.
Front Elevation of Padding Machine.

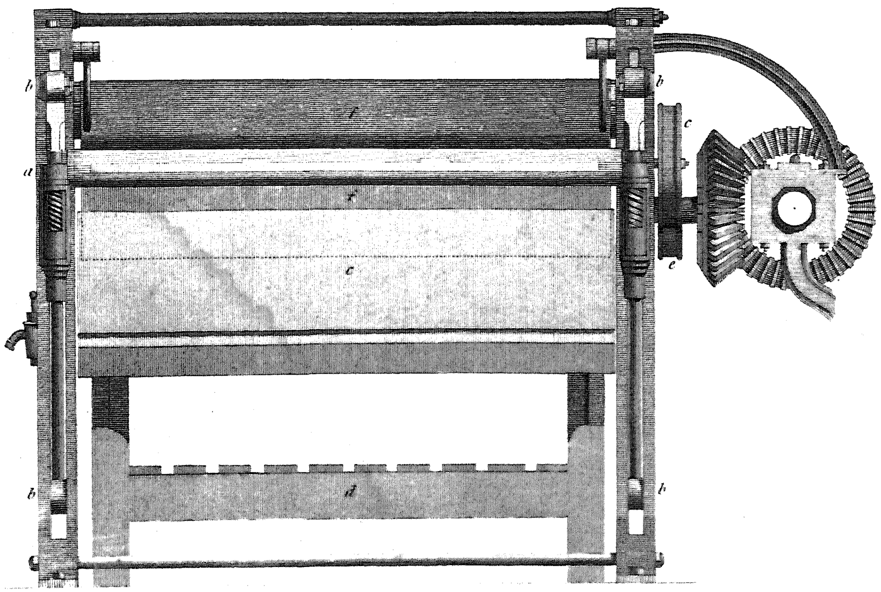
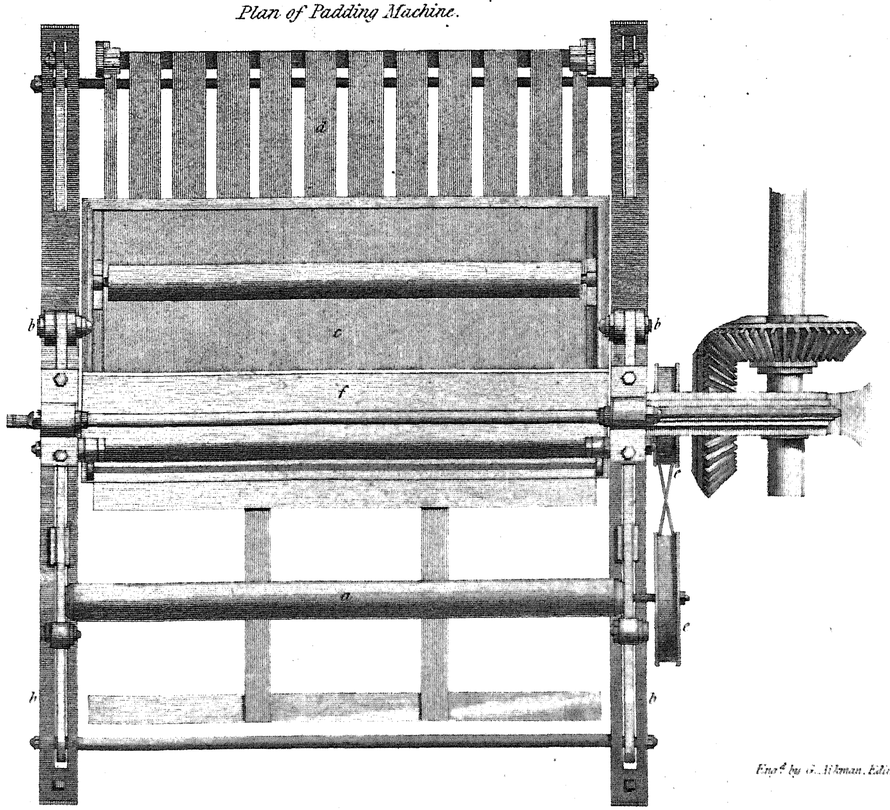


Fig. 5.
Plan of Padding Machine.



Drawn by W. Ross.

Eng^d by G. Aikman, Edin^r.

Fig. 6.
Elevation of Dyeing Box.

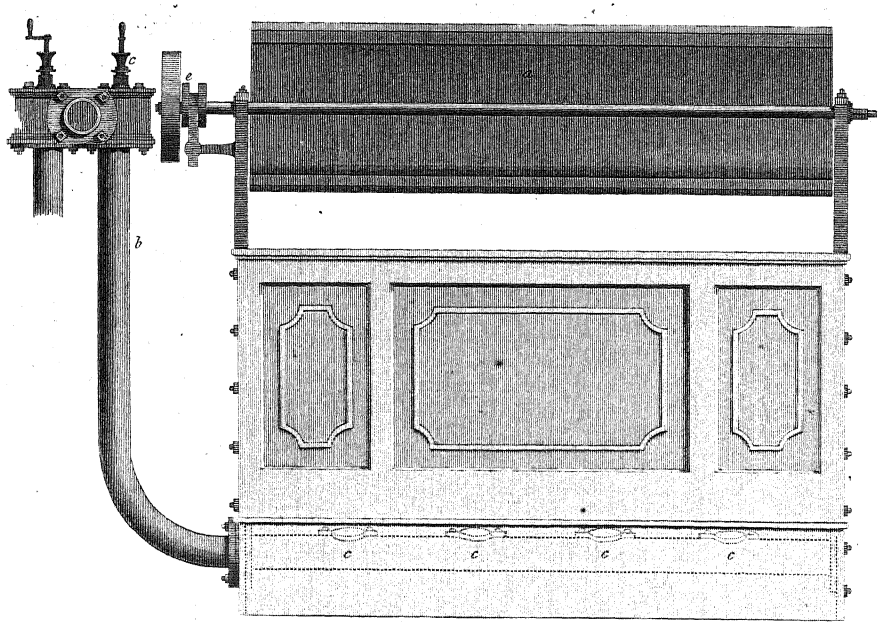
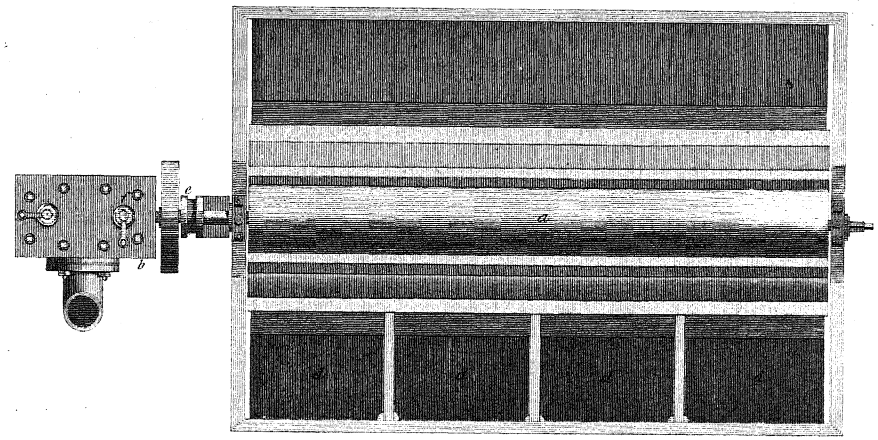


Fig. 7.
Plan of Dyeing Box.



Section of Clearing Boiler.
Fig. 8.

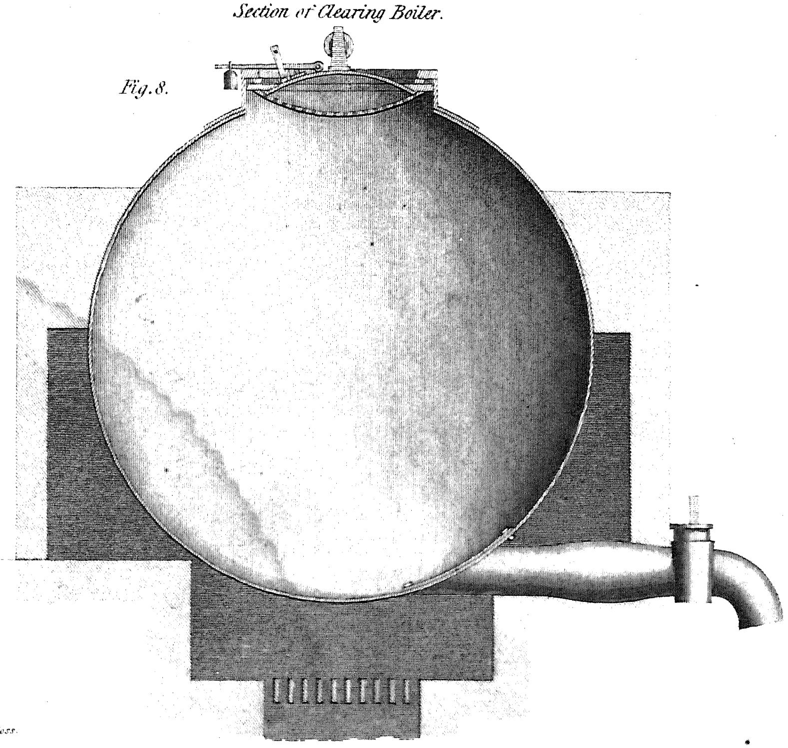


Fig. 9.
Elevation of Clearing Boiler.

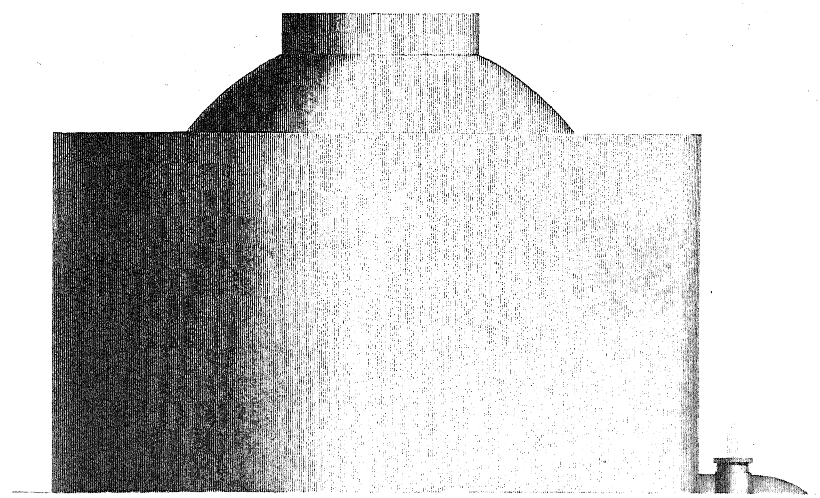
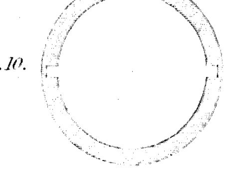
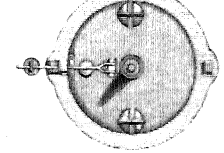


Fig. 10.



Plan of Boiler Top.

Fig. 11.



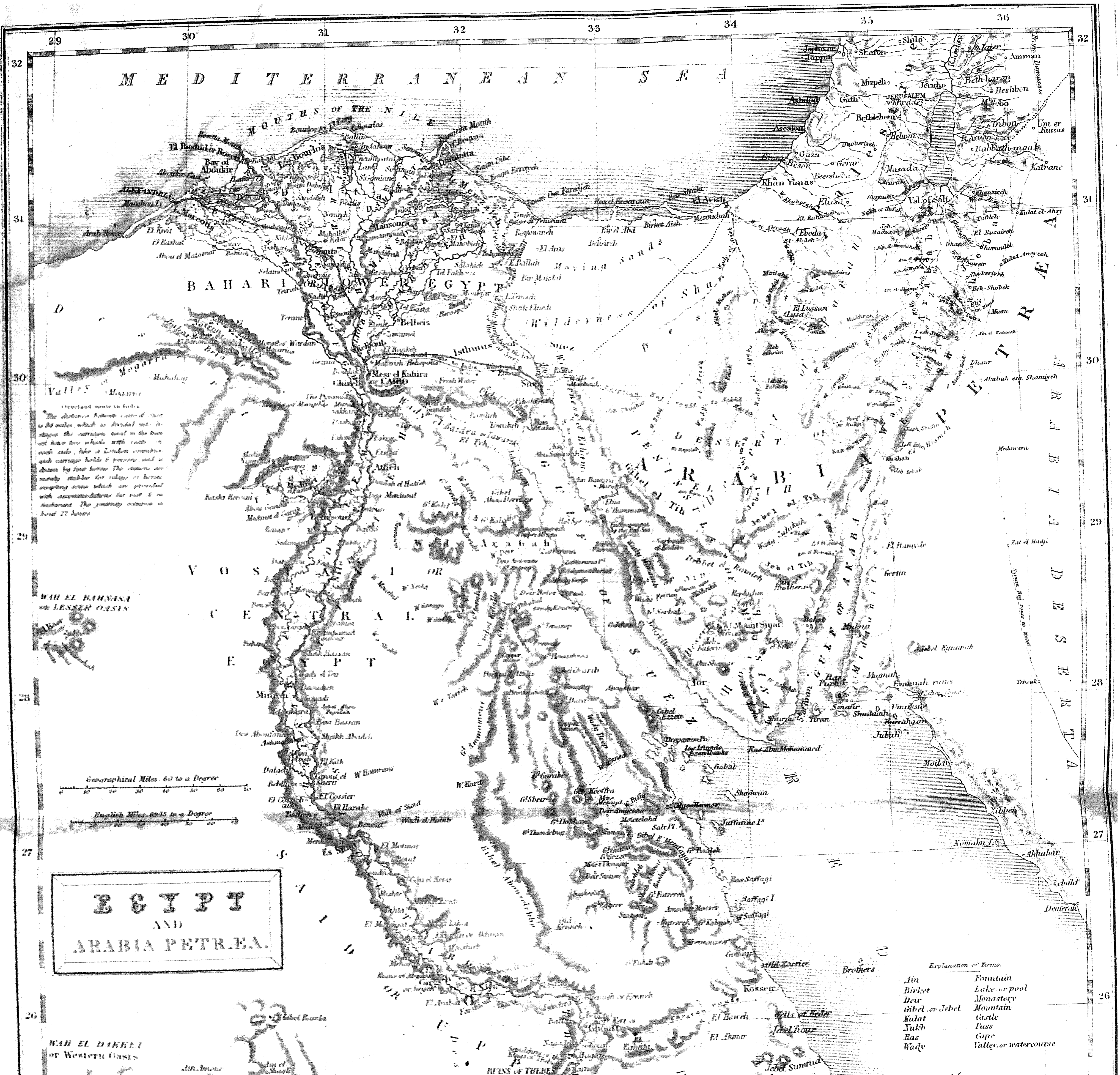
Plan of Cover.

Drawn by W. Pass.

Published by A. & C. Black, Edinburgh.

Engd by [illegible] Edinr

PLATE CCXXI.


MEDITERRANEAN SEA
MOUTHS OF THE NILE
ALEXANDRIA
Bay of Aboukir
Damietta
BAHARI OR LOWER EGYPT
Mesr el Kahira
CAIRO
Suez
Isthmus of Suez
Wilderness of Shur
Moving Sands
El Arish
Gaza
JERUSALEM
Jericho
Hebron
Ashdod
Ascalon
Val of Salt
ARABIA PETRÆA
DESERT OF EL TIH
Jebel el Tih
Mount Sinai
Gulf of Akaba
Gulf of Suez
Ras Abu Mohammed
Tor
ARABIA DESERTA
VOSTANI OR CENTRAL EGYPT
Valley of Mogarra
Overland route to India
WAH EL BAHNASA or LESSER OASIS
Minieh
Es Siout
SAID OR UPPER EGYPT
Geographical Miles 60 to a Degree
English Miles 69.15 to a Degree
EGYPT AND ARABIA PETRÆA.
WAH EL DAKKEL or Western Oasis
El Khargeh
WAH EL KHARGEH or GREAT OASIS
RUINS OF THEBES
Esneh
Edfou
Kosseir
Brothers
Explanation of Terms.
Ain — Fountain
Birket — Lake or pool
Deir — Monastery
Gibel or Jebel — Mountain
Kulat — Castle
Nukb — Pass
Ras — Cape
Wady — Valley or watercourse
Emerald Mts
Ruins of Berenice
Ras Benas
Jebel Macour or Emerald Mt
Tropic of Cancer
NUBIA
Derr
THE RUINS OF PETRA
THE PYRAMIDS OF GHIZEH
THE RUINS OF THEBES
River Nile
Karnak
Luxor
Memnonium
Medinet Habou
Longitude East from Greenwich
29
30
31
32
33
34
35
36
23
24
25
26
27
28

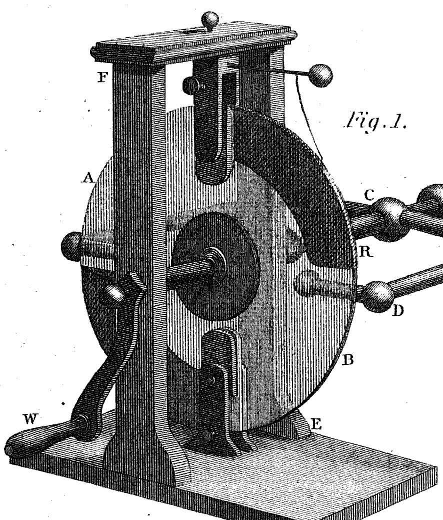


Fig. 1.

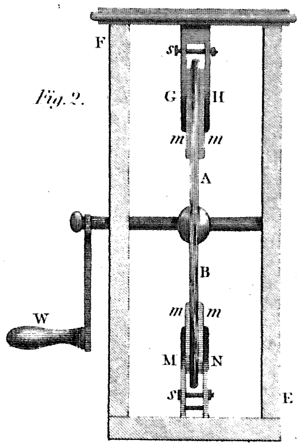


Fig. 2.

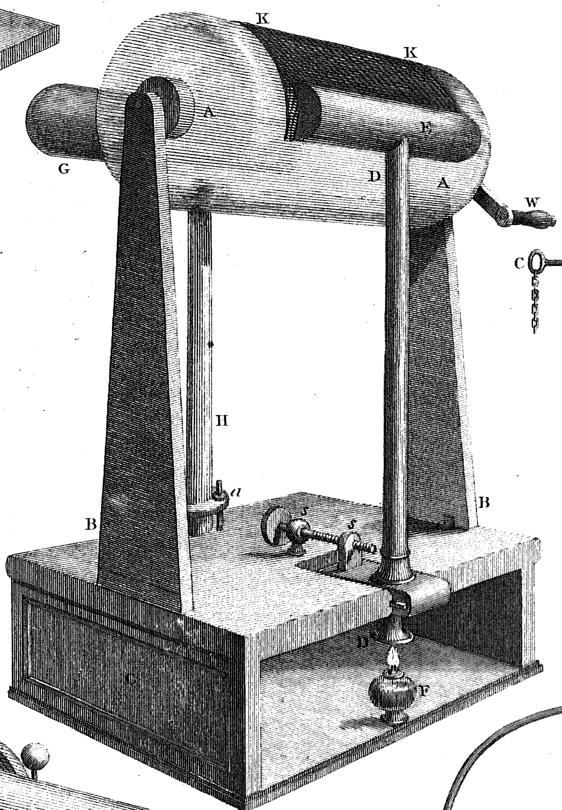


Fig. 3.

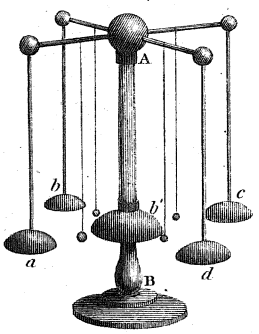


Fig. 4.

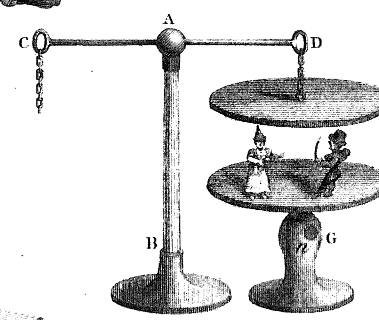


Fig. 5.

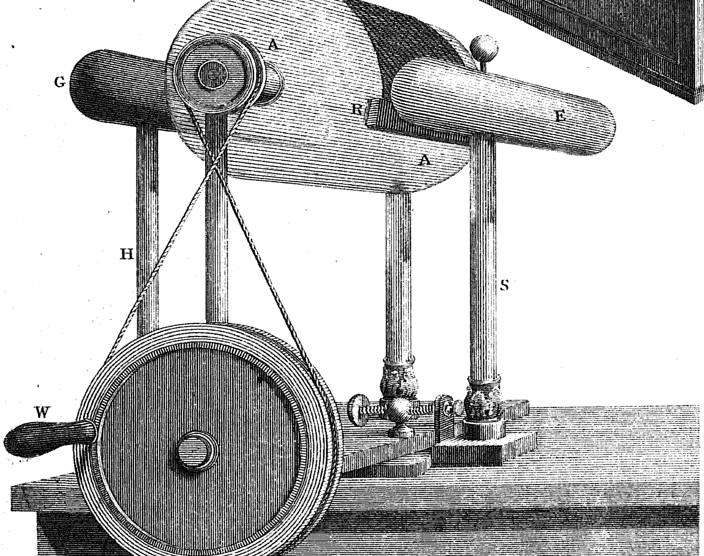


Fig. 6.

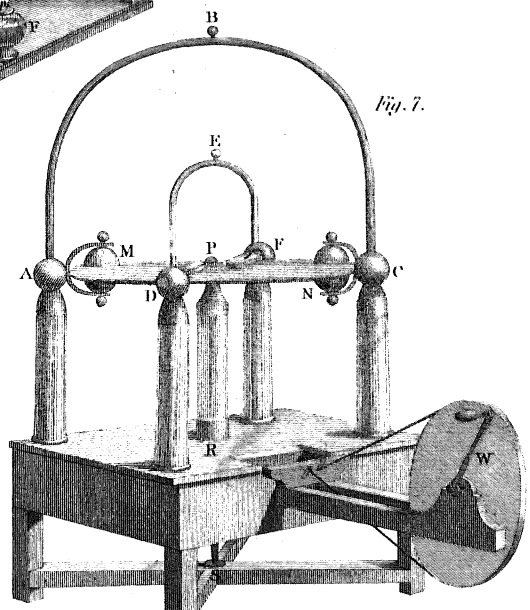


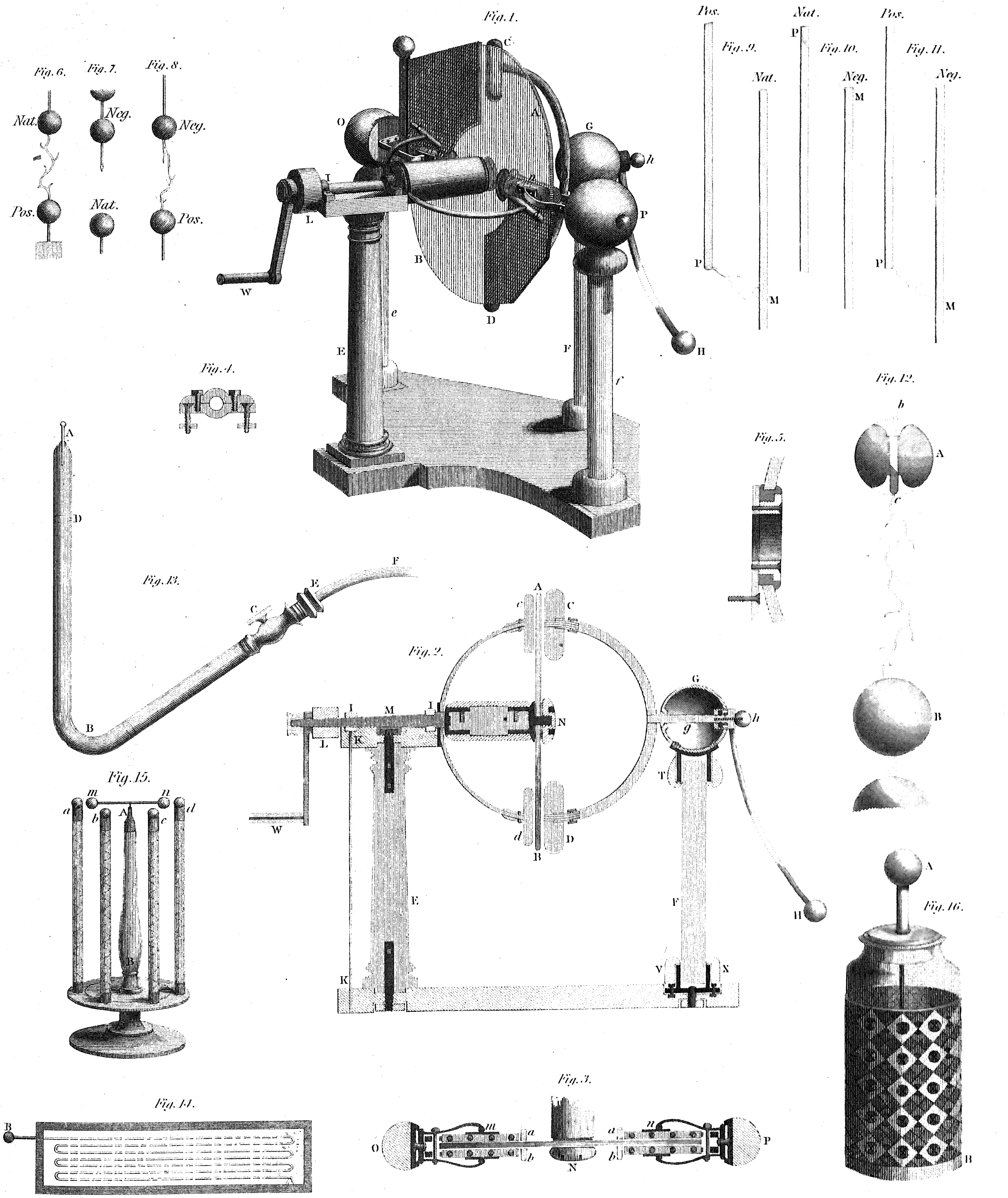
Fig. 7.

Engd by G. Aikman

Published by A.&C.Black, Edinburgh.

ELECTRICITY.

PLATE CCXXI



Published by A. & C. Black, Edinburgh.

Eng^d by G. Aikman, Edin^r

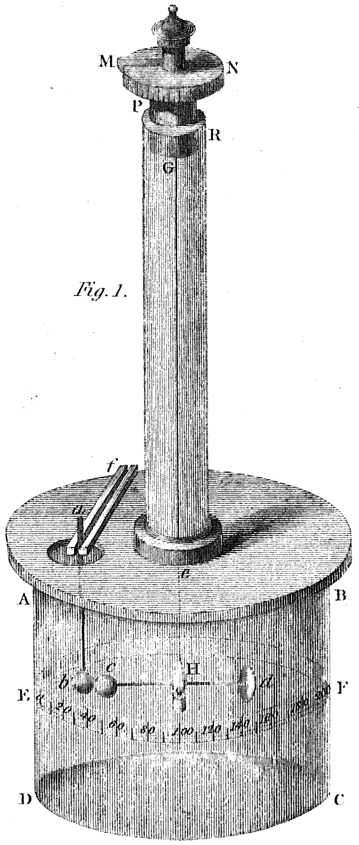


Fig. 1.

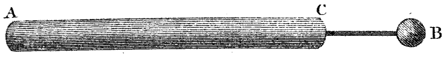


Fig. 2.

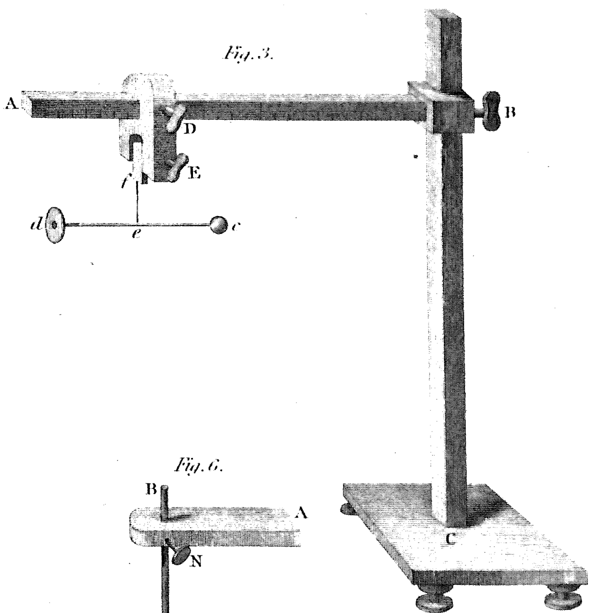


Fig. 3.

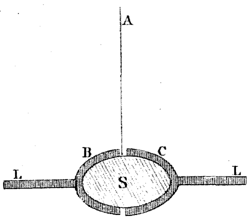


Fig. 4.

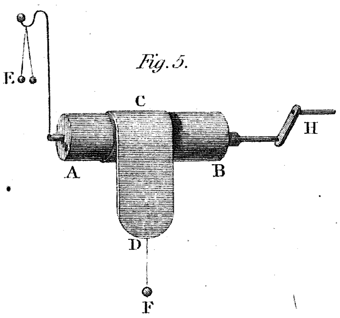


Fig. 5.

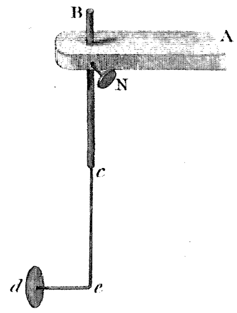


Fig. 6.

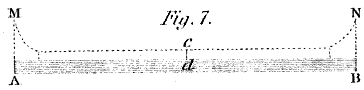


Fig. 7.

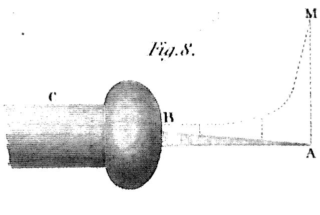


Fig. 8.

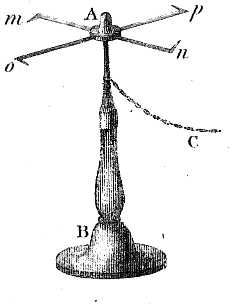


Fig. 9.

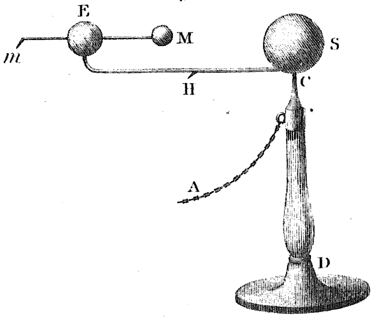


Fig. 10.

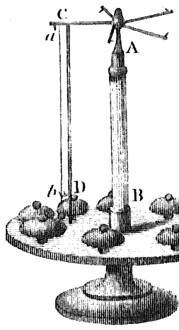


Fig. 11.

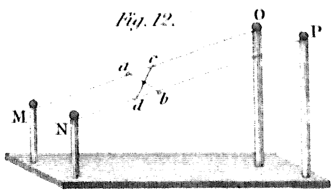


Fig. 12.

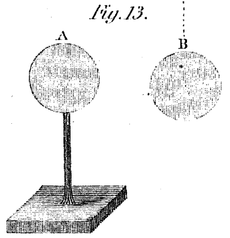


Fig. 13.

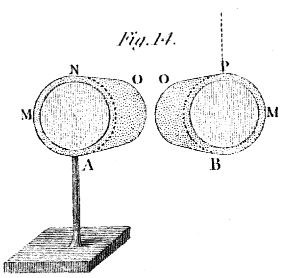


Fig. 14.

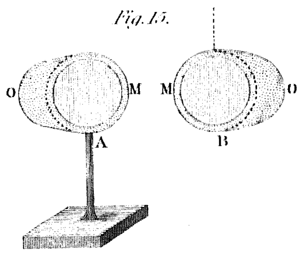


Fig. 15.

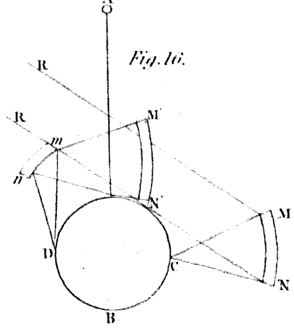
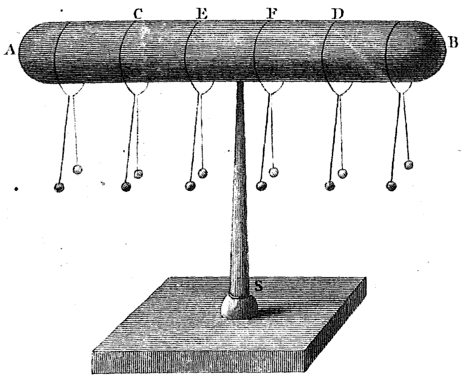


Fig. 16.

Engd by G. Aikman Edinr

Published by A.&C. Black, Edinburgh.

Fig. 1.



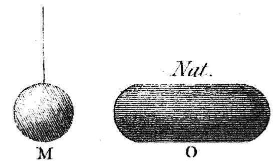


Fig. 2.

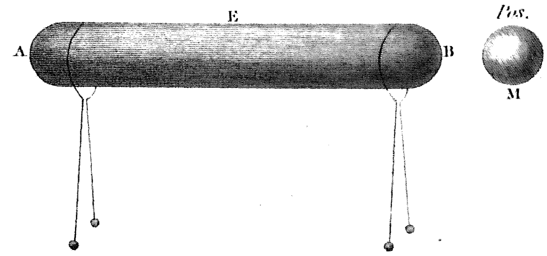


Fig. 3.

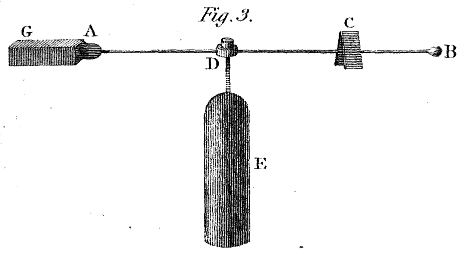


Fig. 5.

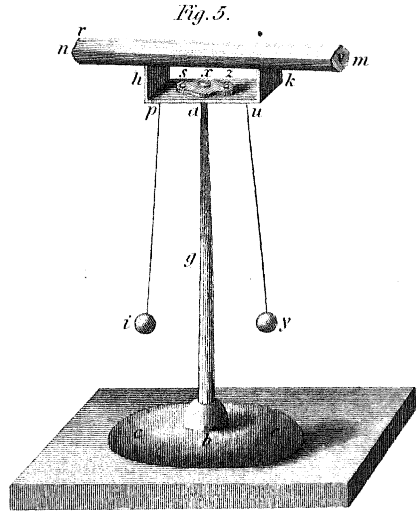


Fig. 4.

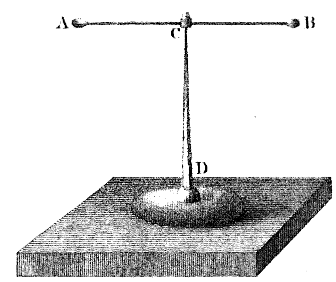


Fig. 6.

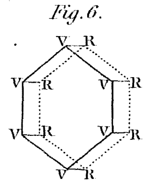


Fig. 7.

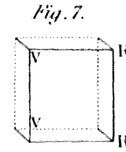


Fig. 9.

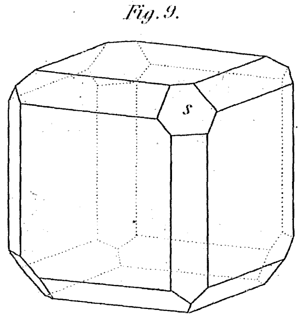


Fig. 8.

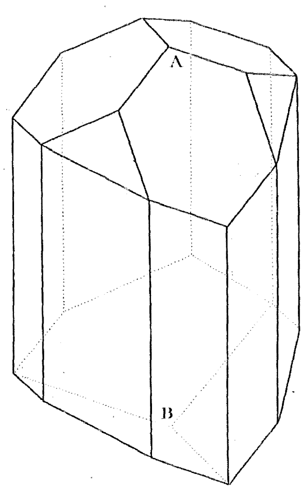


Fig. 10.

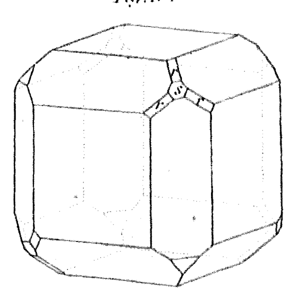


Fig. 11.

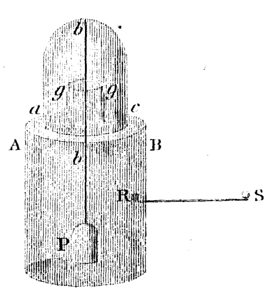
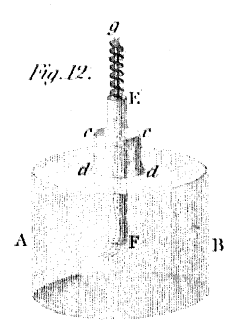


Fig. 12.



Published by A. & C. Black, Edinburgh.

TORPEDO.

Fig. 1.

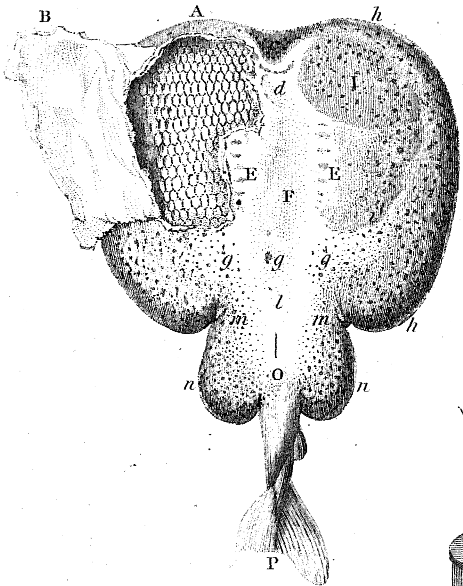


Fig. 2.

GYMNOTUS.

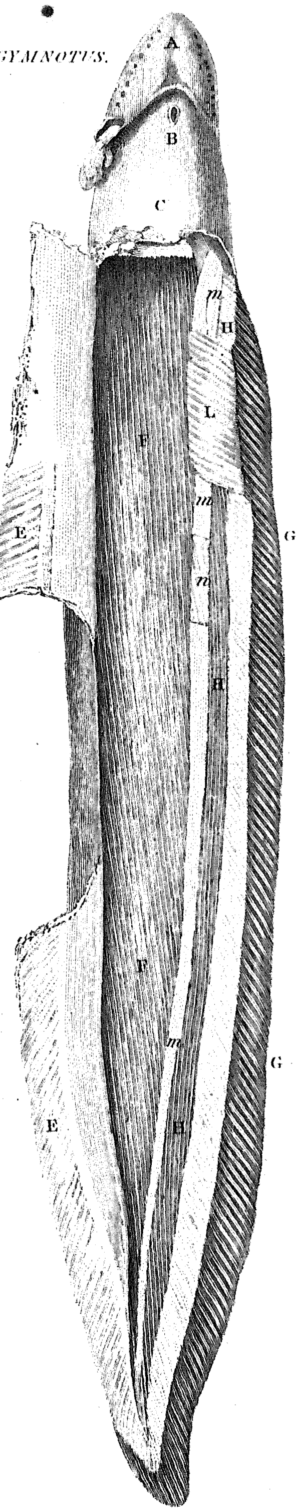


Fig. 3.

SILURUS.

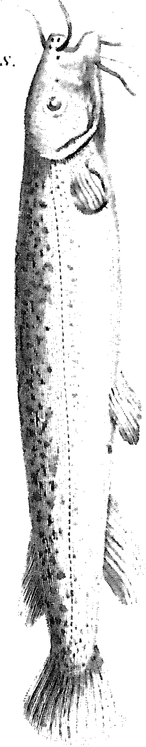


Fig. 4.

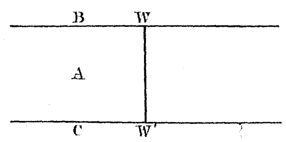


Fig. 5.

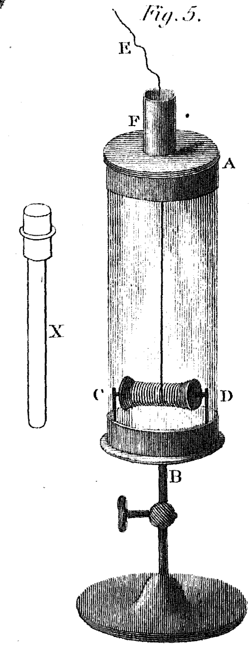


Fig. 6.

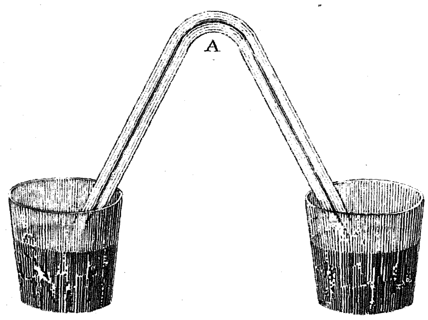


Fig. 7.

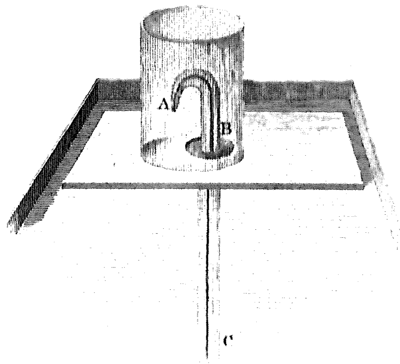


Fig. 8.

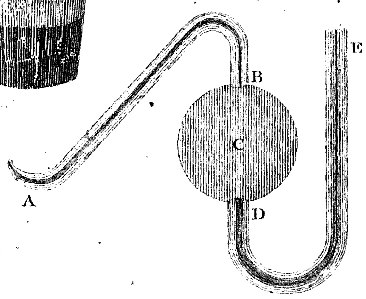


Fig. 9.

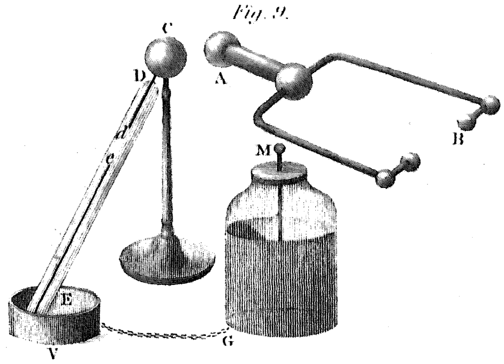


Fig. 10.

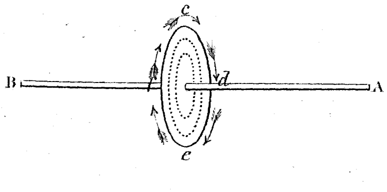
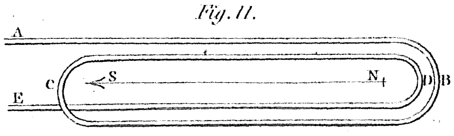
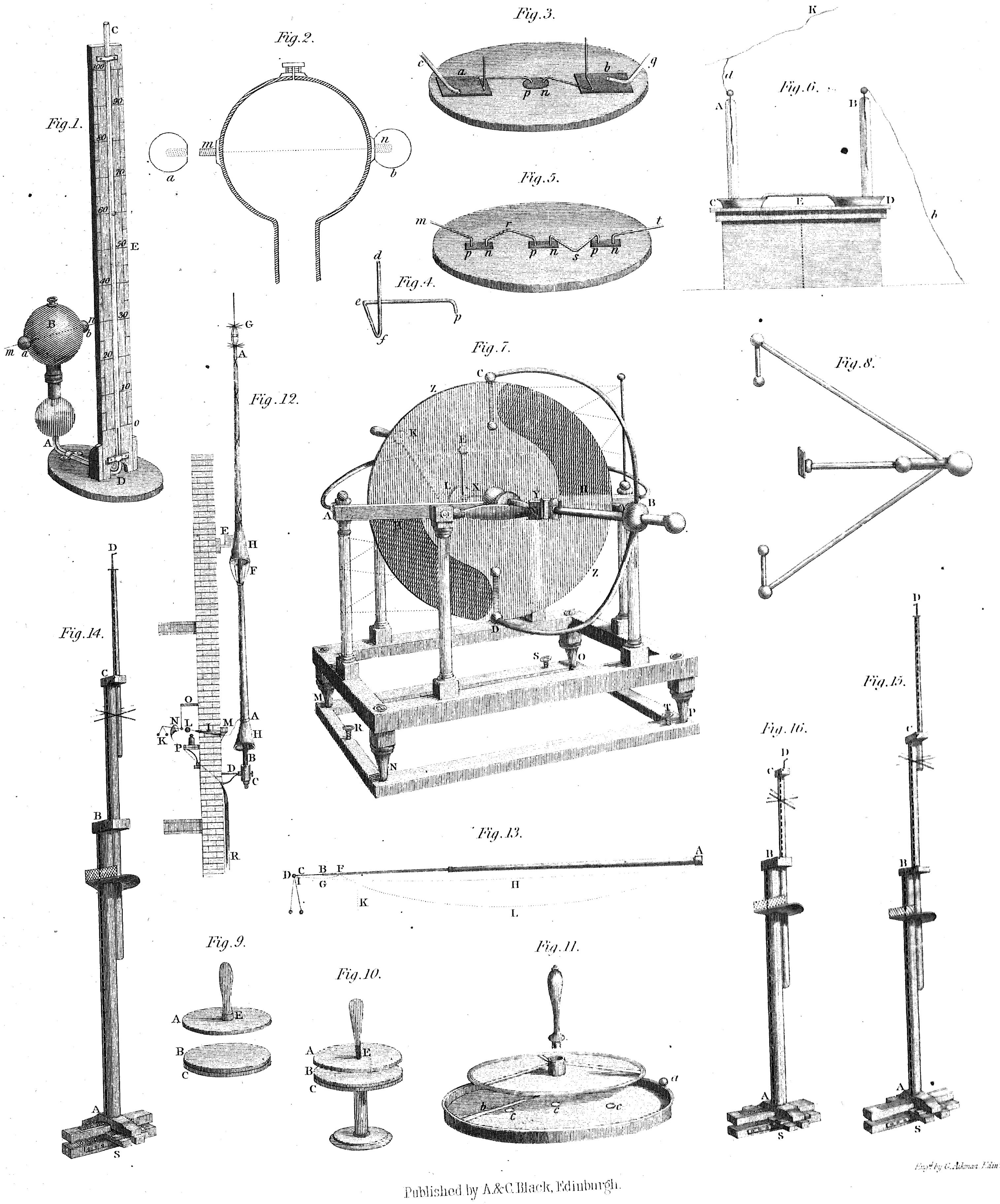


Fig. 11.

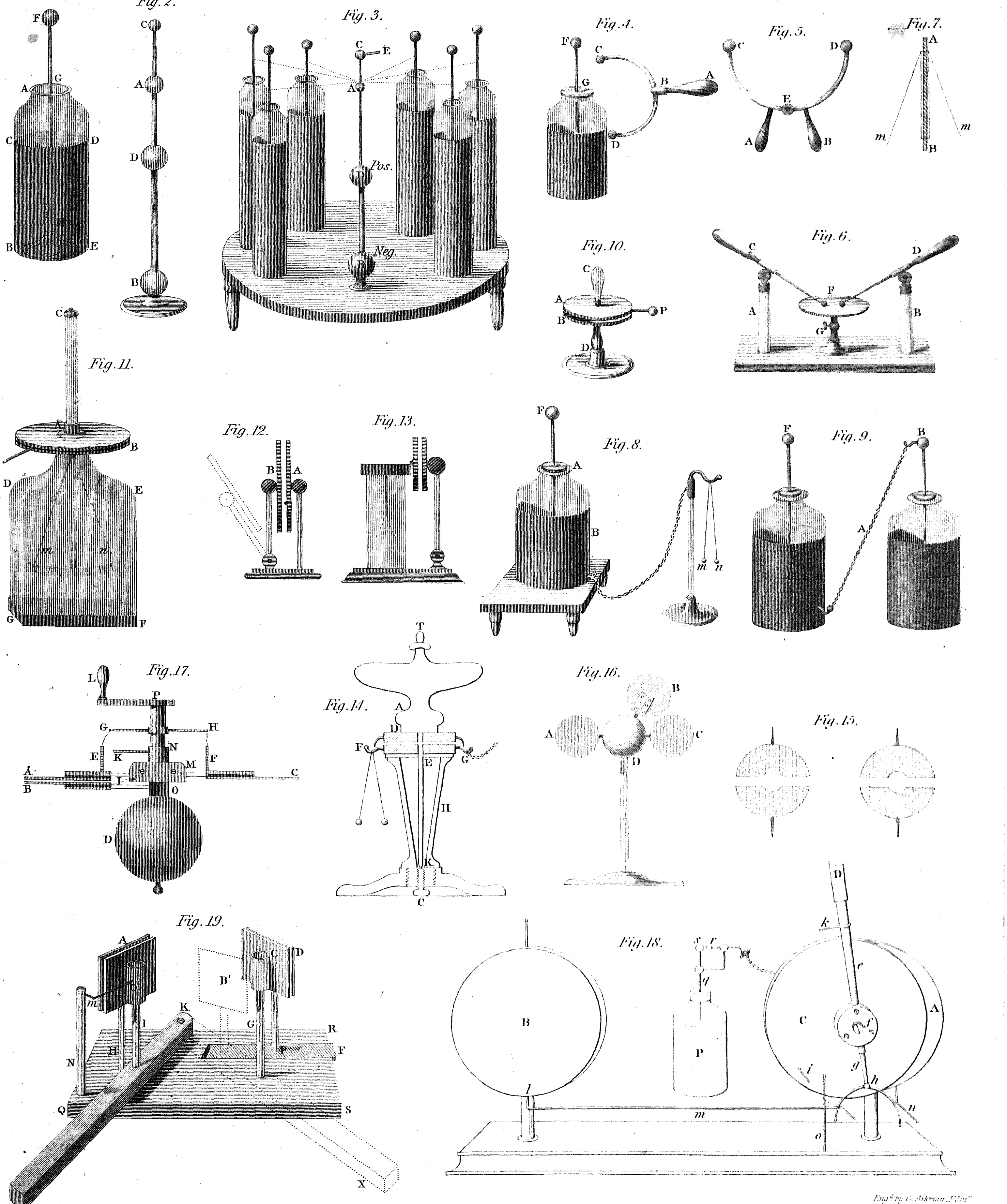


Published by A&C.Black, Edinburgh.

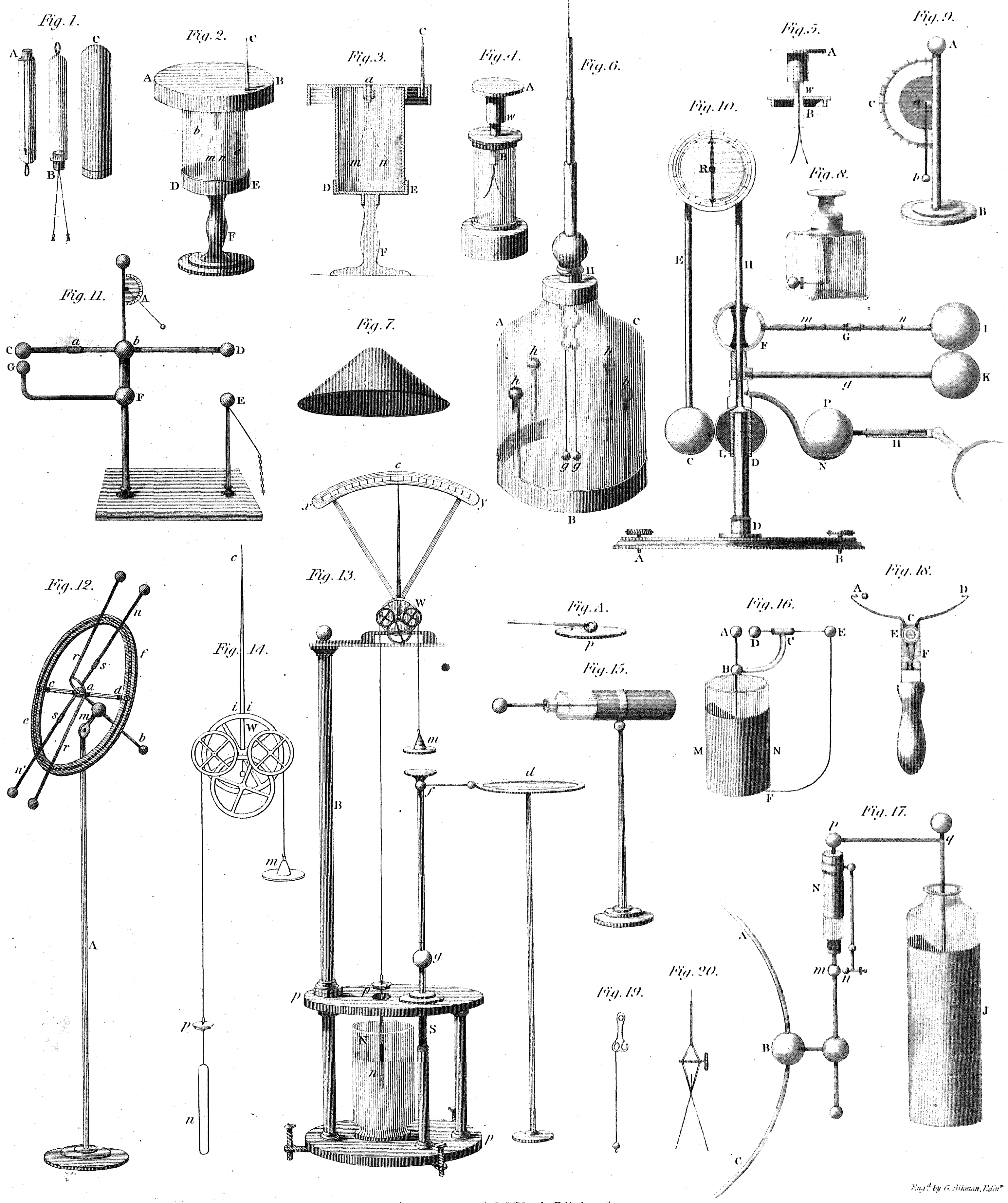


Engd. by G. Aikman Edinr.

Published by A.&C. Black, Edinburgh.



Engd by G. Aikman, Edinr
Published by A.&C. Black, Edinburgh.



Engd by G. Aikman, Edinr

Published by A. & C. Black, Edinburgh.

Fig. 6.

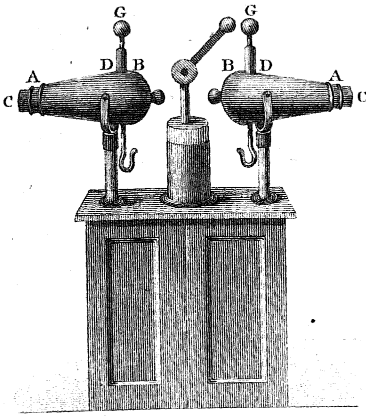


Fig. 4.

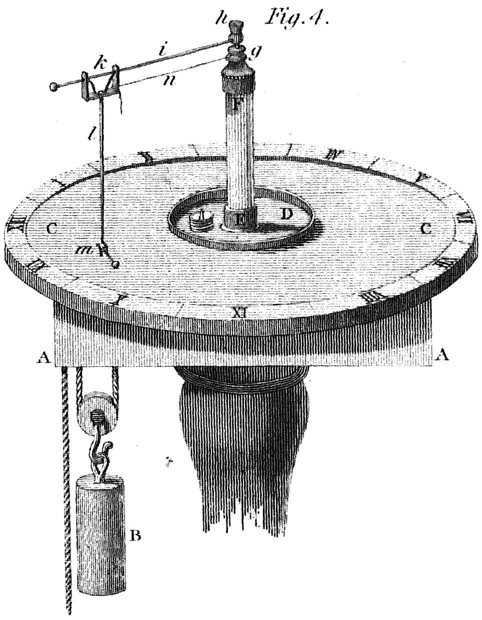


Fig. 3.

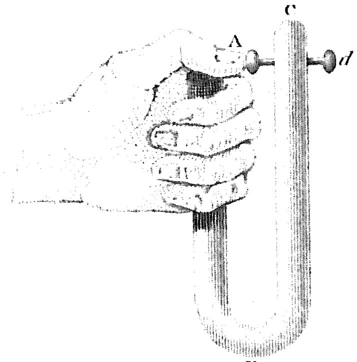


Fig. 2.

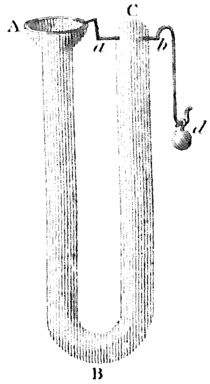


Fig. 5.

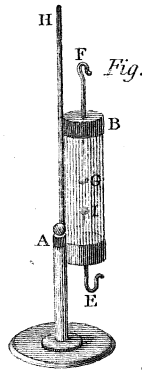


Fig. 9.

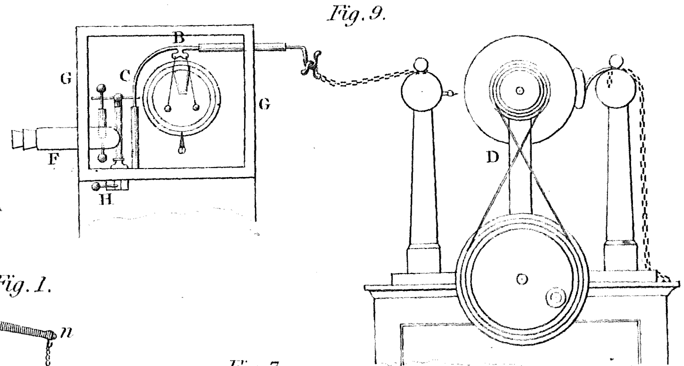


Fig. 1.

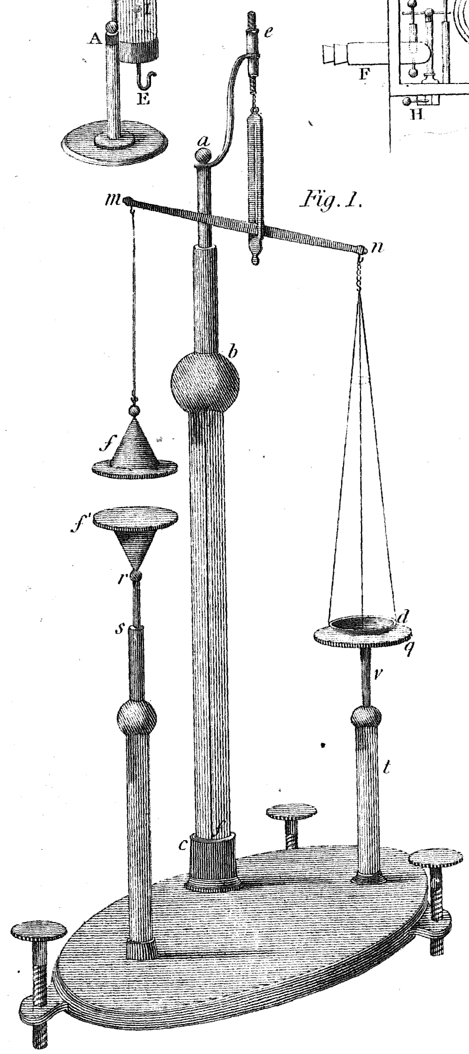


Fig. 7.

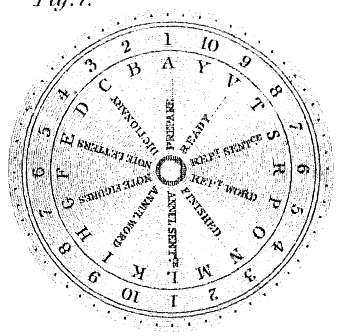


Fig. 10.

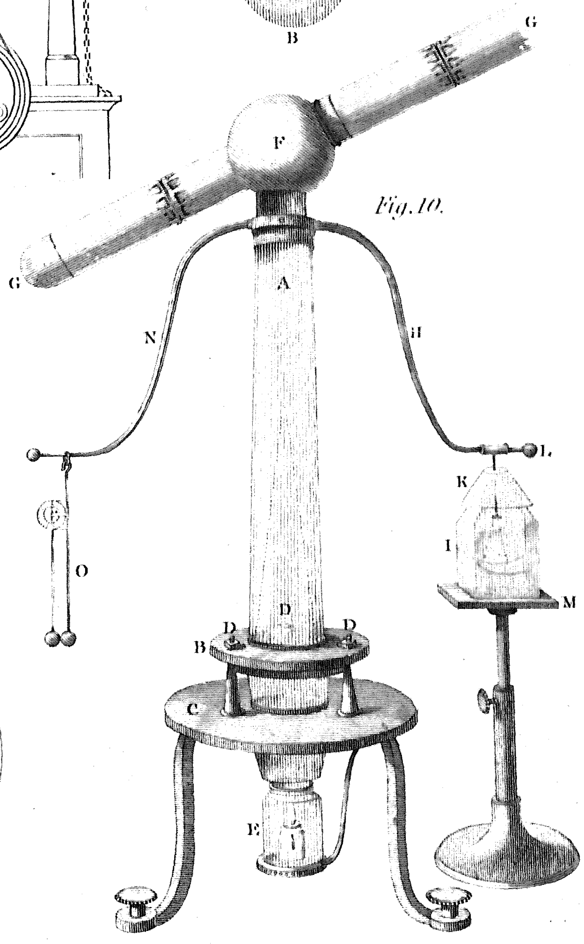
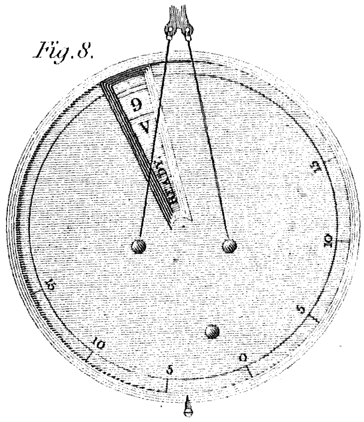


Fig. 8.



Published by A & C. Black, Edinburgh.

Eng.d by G. Aikman, Edin.r

ELLIPTOGRAPH.

Fig. 1.

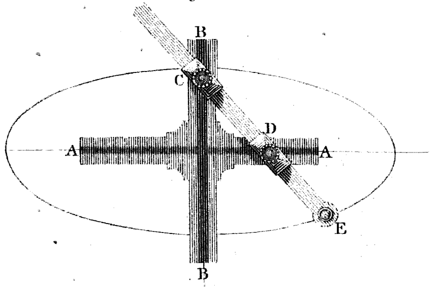


Fig. 7.

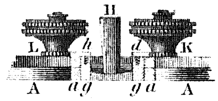
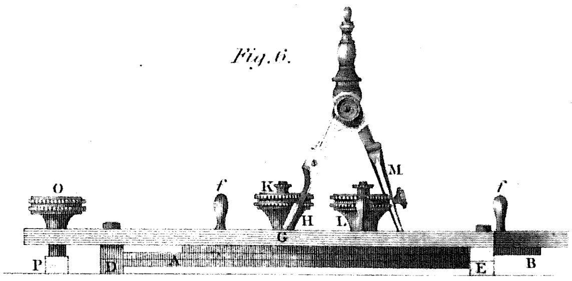


Fig. 6.



ELLIPTIC TURNING.

Fig. 2.

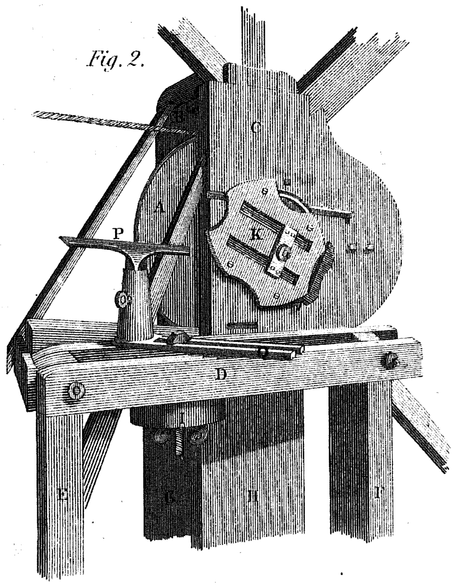


Fig. 3.

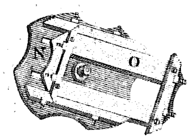


Fig. 4.

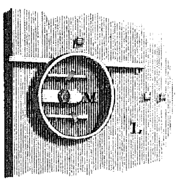
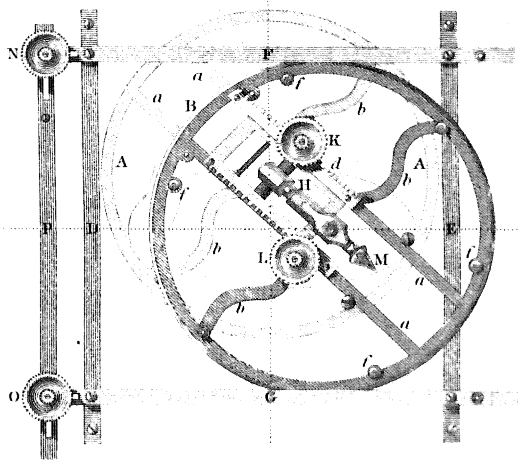


Fig. 5.



EMBANKMENT.

Fig. 1.

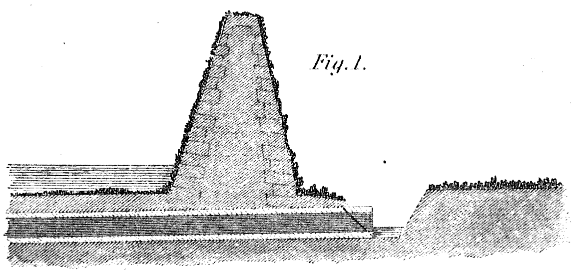


Fig. 2.

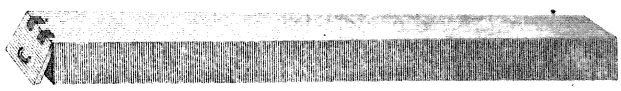


Fig. 3.

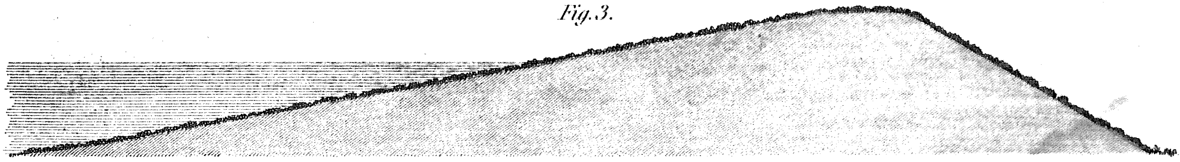


Fig. 4.

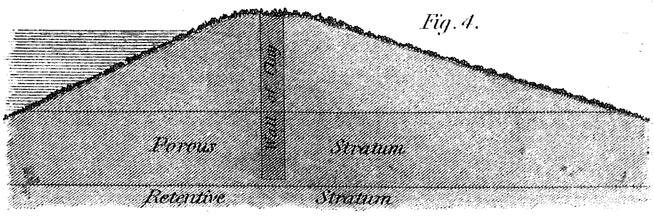
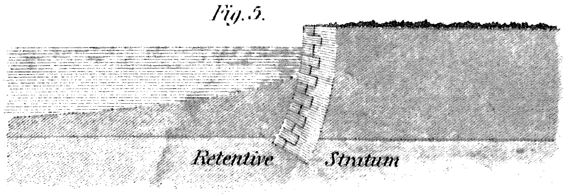


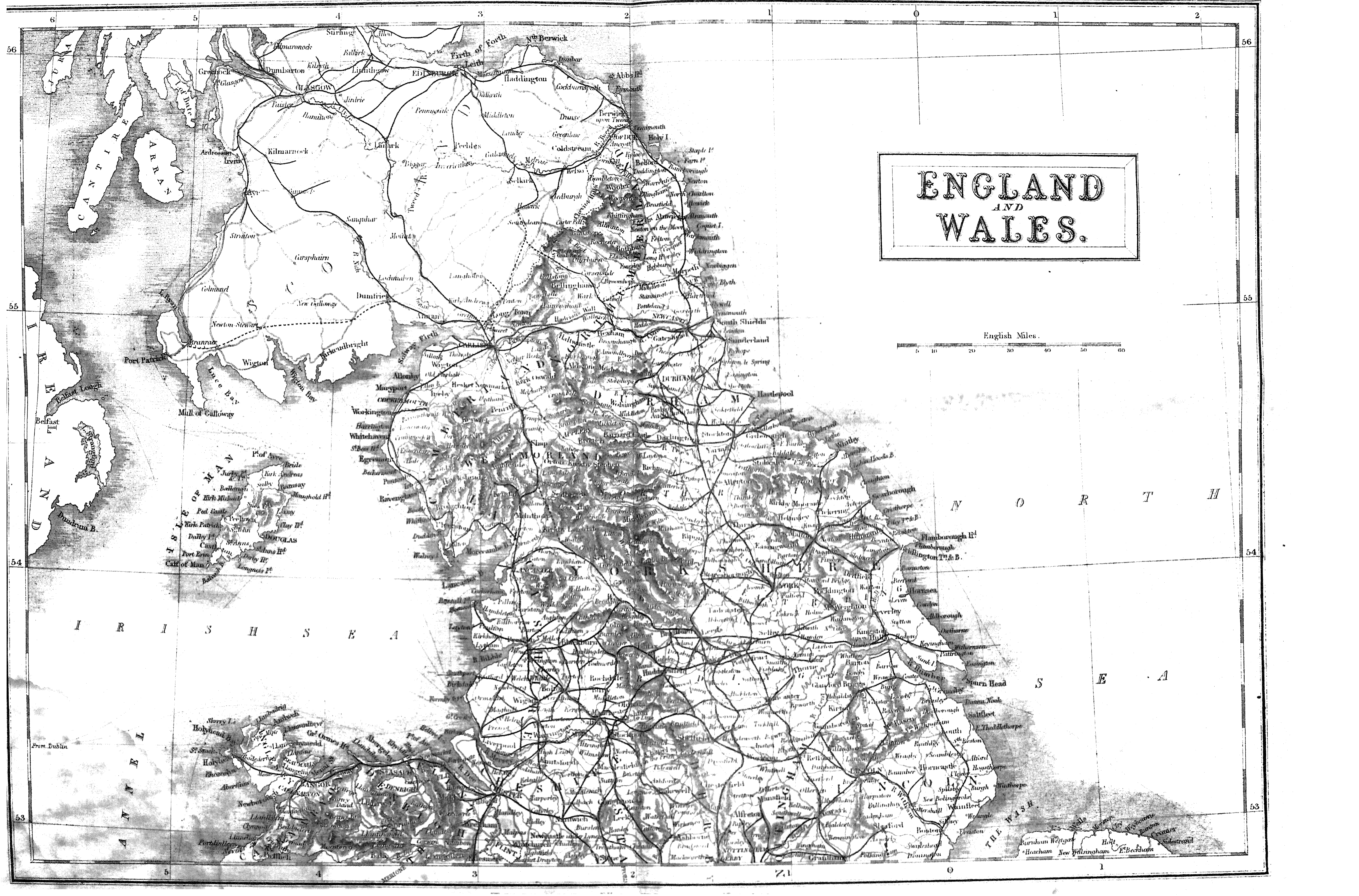
Fig. 5.

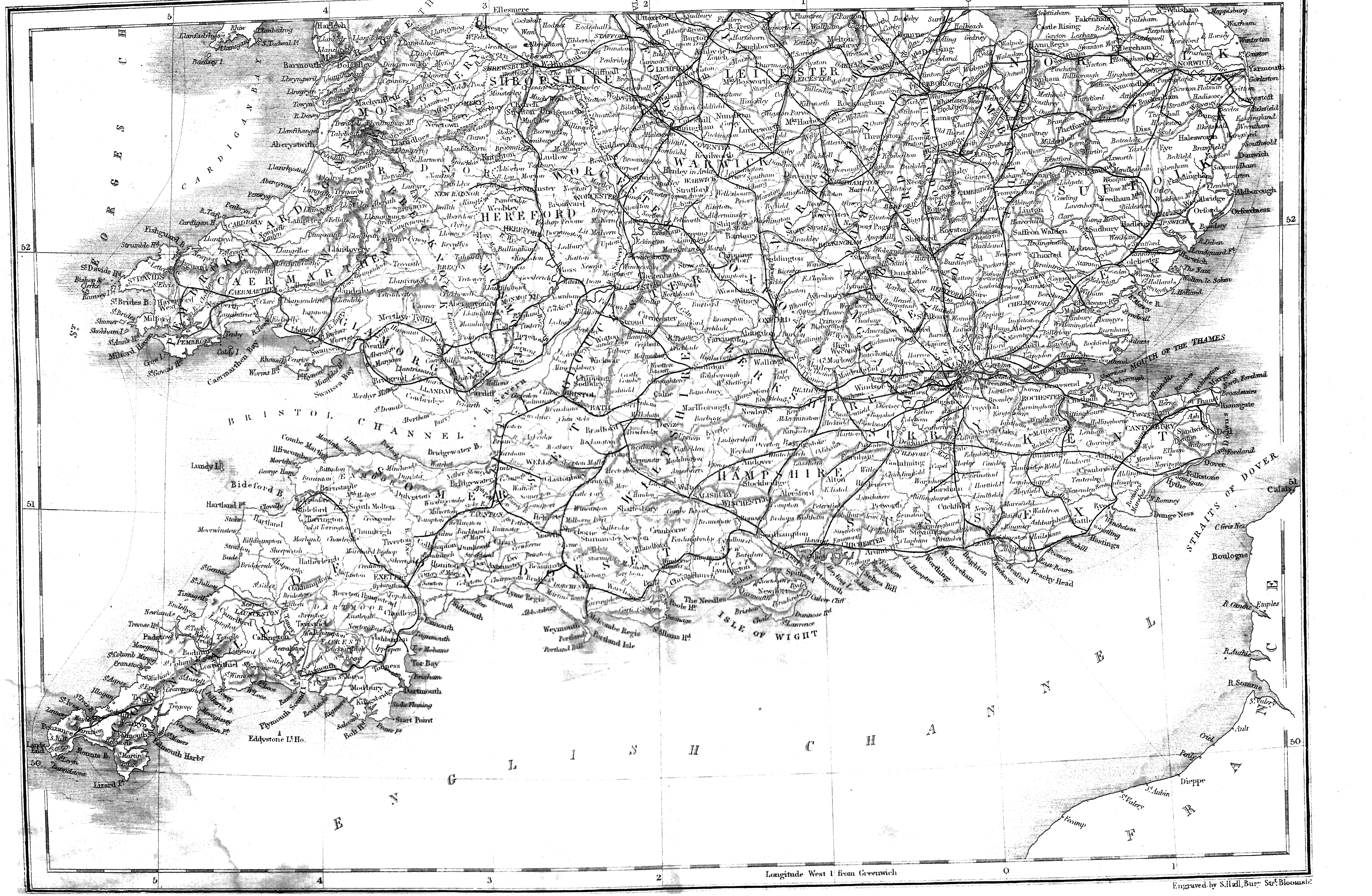


10 5 0 5 10 15 20 feet.

Engd by

Published by A.&C.Black, Edinburgh.


ENGLAND AND WALES.
English Miles.
NORTH SEA
IRISH SEA
IRELAND
SCOTLAND
ISLE OF MAN
CANTIRE
ARRAN
JURA
YORKSHIRE
WESTMORLAND
DURHAM
LINCOLN
Edinburgh
Glasgow
Carlisle
Newcastle
Liverpool
Belfast
Douglas
Flamborough Hd
Spurn Head
The Wash
Firth of Forth
Solway Firth



Engraved by S.Hall, Bury St. Bloomsb.